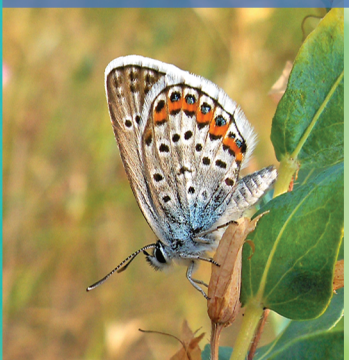
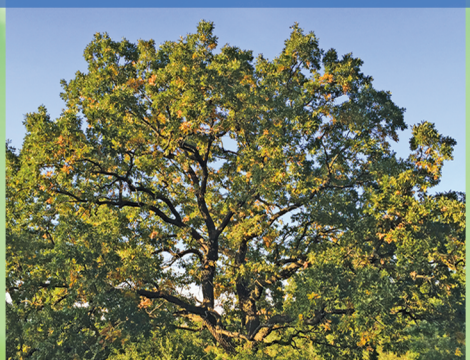
IX-TH INTERNATIONAL CONFERENCE OF ZOOLOGISTS

"SUSTAINABLE USE, PROTECTION OF ANIMAL WORLD AND FOREST MANAGEMENT IN THE CONTEXT OF CLIMATE CHANGE"

dedicated to the 70th anniversary from the creation of the first research institutions and 55th of the inauguration and foundation of the Academy of Sciences of Moldova

12-13 OCTOBER 2016





ACADEMY OF SCIENCES OF MOLDOVA
INSTITUTE OF ZOOLOGY

IX-th International Conference of Zoologists

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The materials of IX-th International Conference of Zoologists **"Sustainable use, protection of animal world and forest management in the context of climate change", dedicated to the 70th anniversary from the creation of the first research institutions and 55th of the inauguration and foundation of the Academy of Sciences of Moldova,** organized by the Institute of Zoology of the Academy of Sciences of Moldova in partnership with the Ministry of Environment of the Republic of Moldova, European Union, World Bank, Global Environmental Facility, United Nations Development Program, International Union for Conservation of Nature, World Wildlife Fund are a generalization of the latest scientific researches in the country and abroad concerning the diversity of aquatic and terrestrial animal communities, taxonomy, systematics and evolution of animals, structure and dynamics of animal populations in natural and anthropized ecosystems, population functioning and role of animals in maintaining the ecological equilibrium in the context of climate change, biological control of pests, invasive species, their ecological and social-economic impact, molecular and genetic methods in systematics, phylogeny, phylogeography and animal ecology, protection of rare, endangered and vulnerable animal species under the conditions of intense anthropogenic pressure, status and trends of forest resources evolution in the context of climate change, forest governance and law enforcement (FLEG).

The proceedings are destined for zoologists, ecologists, ethologists and for professionals in the field of protection and sustainable use of natural patrimony.

The reviewed materials are approved and recommended for editing by the Scientific Council of Institute of Zoology of A.S.M.

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CONTENT

PLENARY COMMUNICATIONS

REPUBLIC OF MOLDOVA: FLEG PROCESS AND CLIMATE CHANGE

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Illegal logging and associated trade and corruption made FLEG – forest law enforcement and governance, become an inter-state initiative meant to address problems that forest ecosystems are facing nowadays. In 2005, representatives of 44 governments from Europe and Northern Asia signed the St. Petersburg Declaration, thus committing themselves to address illegal logging and forest governance. In 2008, the European Commission in partnership with the World Bank, WWF and IUCN teamed up to implement the first Forest Law Enforcement and Governance (FLEG) Program in Armenia, Azerbaijan, Belarus, Georgia, Moldova, Russia and Ukraine (the ENPI FLEG program) – these countries have all together more than 20% of the world's forests.

Moldova joined the FLEG process in 2009 and cooperation with the forestry authorities (i.e. Agency Moldsilva with its 25 forestry enterprises), local public authorities, and NGOs was set based on principles of sustainable forest development. The results of the 1st phase (2009-2012) of the program were analytical studies of wood consumption and illegal logging, new proposed visions to improve legal and normative frame, circa 2500 ha of community land under forest management planning work, and an ample awareness campaign. All this boosted the Forest Institutional Reform Strategy of Moldova (FIRSM), a document elaborated under FLEG data and submitted to the Government in 2012. Phase 2nd (2014-2016) of the program stayed on the established partnership with Moldsilva and its entities, several studies carried out (e.g. forest ecosystem services forest dependency, revenue loss from unsustainable use), a comparative legal analysis conducted, a dialogue and communication platform with the large public supported by a number of activities, and more focus put on working with local public authorities (e.g. circa 5000 ha of community forest land covered with forest management plans).

For Moldova, with its fewer forests concentrated mainly in the central region (circa 13,7% of the territory covered with forest vegetation, but forest ecosystems may represent some 8%, the rest being plantations) and water shortage (e.g. more frequent droughts over the last decades), the climate change is a true challenge. Climatic prognosis for the next 20-80 years forecast an increase in annual temperature as well as a decrease in levels of precipitation. According to "Moldova: Forest Policy Note", significant changes will take place up to 2099, when large areas of tree dying out will expand from one region to others, but strongly aggravating towards South.

Changes in environment may cause other effects on forest vegetation, from species composition and invasive exotics penetrating across forest habitats to a decrease in biologic potential of existing forest ecosystems to offer indispensable services and products.

It is extremely important for the Moldovan forestry authorities to take all these into consideration, especially when strategic plans are built and decisions to rationally use existing forests are made. International practices, especially of neighboring countries (i.e. Romania and Ukraine) may offer good lessons, and trans-boundary cooperation with these countries can bring governments and nations to contribute to a better environment and sustainable development.

Although FLEG program will finalize by the end of 2016, its results may give life to other incentives and projects. Thus, the World Bank is now working on a Climate Change and Afforestation investment project to help several sector of national economy better adapt to the climate change. WWF will probably continue its wood traceability cooperation with Agency Modlsilva, spanning also on to other forest owners. IUCN is trying to foster FLR (Forest Landscape Restoration) initiative by involving more local communities.

MAJOR MEAT PARASITES IN ROMANIA- SPECIES, STRAINS, AND GENOTYPES

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Toxoplasma gondii, Trichinella spp., *Echinococcus spp.* and *T. solium* and *T. saginata* larvae have a high impact on the health of human population worldwide, by consumption of contaminated food or by contact with definitive hosts.

T. gondii is prevalent in most areas of the world, in animals and humans. In the last 10 years, sero-epidemiological studies on *T. gondii* infection revealed a high seroprevalence of specific antibodies in Romania (Junie et al., 2002; Barabás-Hajdu et al., 2007; Stirbu-Teofănescu et al., 2007,2008; Militaru et al., 2008; Olariu et al., 2008; Cozma et al., 2007, 2008, 2009; Coroiu et al., 2009; Iovu/Pastiu et al., 2009, 2012, 2013; Györke/ Titilincu et al., 2008, 2011; Chitimia et al., 2011; Dărăbuş et al., 2011; Hotea et al., 2012; Dubey et al., 2014). First isolation and genetic characterization of a *T.gondii* strain from a symptomatic human case of congenital toxoplasmosis in Romania revealed the type II genotype (Costache et al., 2013).

Trichinellosis is a zoonosis acquired by ingesting raw meat with encysted larvae of *Trichinella*. Romania represents the country with the most extensive *Trichinella* infection in the world. Currently, two of the species are present: usually, *T. spiralis* in domestic animals and *T. britovi* in wild animals (Blaga et al., 2009). Simple species identification of *Trichinella* isolates has been performed by amplification and sequencing of the 5S ribosomal DNA intergenic spacer region (De Bruyne et al., 2005).

E. granulosus causes cystic echinococcosis. The high prevalence of echinococcosis/hydatidosis in animals and humans, places Romania on the top at European and global level. *E. multiloculari* causes alveolar echinococcosis. The presence of *E. multilocularis* in Romania has been described in rodents and humans cases (Panaitescu and Pop 1999; Savlovschi, 2000; Sikó, 1992, 1993; Sikó et al. 1995), but these cases were not confirmed by specific diagnosis tests. In 2010 and 2011, respectively, *E. multilocularis* was confirmed using molecular biology methods in red foxes and wild rodents (Sikó Barabási et al., 2010a; 2010b; Sikó Barabási et al., 2011). Comparison of nucleotides sequences, mostly fragments of mitochondrial DNA (cox1 and NADH1), was useful in genotypes identification (Bowles, Blair and McManus, 1992; Bowles and McManus,

1993a). In Romania, the first studies regarding animal and human cystic echinococcosis identified only G1, G2 and G7 genotypes (Bart et al., 2006). Other research in domestic and wild ruminants reported the G1 genotype as dominant, from 41.6% (Bart et al.2006) up to 100% (Casulli et al. 2012; Mitrea et al. 2012). First detection of G1 genotype in red deer was performed by PCR and PCR-RFLP techniques (Onac et al. 2013). In wild boars, G1 (45.5%) and G7 genotypes (39.4%) were identified (Onac et al. 2013).

Muscular cysticercosis caused by *T. solium* (swine) and *T. saginata* (cattle) larvae is a zoonosis of public health importance. A retrospective epidemiological study was performed during the period 2009-2013, by assessing report/surveillance systems and the management of infected animals, by analyzing the temporal and spatial distribution of muscular cysticercosis in Romania (Oleleu et al.,2015).

In terms of spatial spread, outbreaks in porcine cysticercosis were discovered in 7 counties (16.66%) of the 42 existing in Romania; the prevalence of positive cases, nationwide, can be characterized as low infestation, with an average value of 0.45%. During the studied period, there were a total of 10 disease outbreaks. In terms of temporal spread, cases of disease had been recorded every year.

In the same period, a total of 471 cases with suspected muscle cysticercosis have been reported in cattle, with a total of 13 cases confirmed. In terms of spatial spread, outbreaks were found in 3 counties (7.14%) of the 42. The data obtained allow us to observe trends of evolution in *T. saginata* larvae infestation in the northern region of Romania, where 12 cases were detected out of 13.

In terms of temporal spread, it was found that cases of animals diagnosed with bovine cysticercosis were reported in two years out of five, in 2009 and 2010, respectively (Oleleu et al., 2015).

In Romania, the development of serological surveillance and molecular diagnostic in these parasitic zoonoses is required.

BIODIVERSITY ADAPTATIONS TO THE CLIMATE CHANGES

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In December 2015, the world celebrated the international climate change agreement reached at the end of United Nations Climate Change Conference (COP21) held in Paris. Critics believe that the Paris Accord does not go far enough to protect the planet. Nevertheless, the COP21 agreement is widely considered to be the turning point for the world as it is the most far-reaching climate commitment made so far by 195-member states of the United Nations.

Against this backdrop, the academic community and other stakeholders from around the world were get-together in Karlsruhe, Germany from the 19th to 21st of October 2016 to examine the pivotal role of education and training in creating a climate-friendly world. The conference provided a global platform to exchange views on integrating climate change and environmental sustainability at all levels of education. During the three-day event, the delegates shared their unique approaches and innovative ideas for preparing students and learners to become responsible leaders and stewards of our planet and transform the world's fossil fuel-driven economy.

This year's (2016) global gathering of committed and like-minded delegates from across the globe was an opportunity to deliberate on how education can be reshaped to address the 21st century challenges. Further to sharing knowledge on education for sustainability, the upcoming event also provides an excellent networking opportunity with peers and experts in Europe and beyond.

At the break of day of the hominid species (in Pleistocen), the biodiversity faced with fluctuations and high concentrations of CO2 in atmosphere, with climatic and precipitation variations, supporting important evolutionary changes and adopting new strategies of adaptations to the new natural conditions. But those climatic changes developed a longer period of time, enough to allow to the biodiversity. to adapt or migrate and the land was not so much fragmented as today; there was not the actual pressure and impact of human activities. Habitat degradation and fragmentation pushed many species to smaller and smaller areas from their former range.

It was proved that restricted species distribution is reflecting in reducing their genetic variability. The interglaciary warming periods affected much less the ecosystems and generally biodiversity than the alarming climate changes recently appeared. Up

to 2100 (with today rhythm of the global mean temperature rising of the green-house effect) the temperature will be with 1.4°C – 5.8°C higher. **The impact** of these climate changes will be:

- increase of the global mean sea level;
- deep modifications of the rainfall quantities;
- increasing risks to human population, because of new (unknown) disease vectors.

Understanding the global biodiversity spoliation because of the climate changes, the international forums in the field had concluded these changes will be most important factors which will determine significant loss of biodiversity up to the end of 21st century. (U.N.). At the same time, optimistic signals on the support and adaptations capacity of biodiversity to the impact of climatic phenomenon would be, if they were producing slowly, in a longer period of time. In relation between climate changes and biodiversity, this one can resist (at least temporary) by:

- physiological, morphological and ethological behaviours;
- favourable mutations will be encouraged;
- suitable adaptations to use the new habitat resources;
- changes of the life cycles;
- new morphological characters;
- increasing resistance to the unfavourable factor pressure, etc.

Adaptations are at the individual, populational and especially at the ecosystem level. Inside and between species' relations, the biodiversity can adopt suitable strategies to use the ecosystem's resources by:

- sustainable management to protect the coastline areas (mangroove forests and pioneer plant associations);
- preservation of the plain and coastline wetlands to reduce the flooding effects;
- preservation of the higher altitude wetlands, as a source of the rivers' flow and the fresh/drinking water's quality.

Under the climate changes, all species will be drastically tested on their **capacity to adapt** and finding genetic resources to the populational level will be the basic premise to generate new species.It is possible to foresee coming into being at the global and national levels of new species, with surprising adaptive capacities, to resist to the unusual thermic variations or to the high aridity and to reduced precipitations.

Between measures to help biodiversity adaptations we can mention:

- Maintaining and restoration of forests (risk of deforestation) for slopes stabilization and river's flow regularization.
- Practicing agro-foresting systems to diminish the climate change risks.
- Conservation of the agro-biodiversity's genetic fund to ensure the gene-flow of the cereal and zootechnical species, with high resistance and adapted to the climate changes.
- Reducing agricultural activities in the affected areas and adopting suitable measures to protect natural and deminatural habitats close to the agricultural areas.
- Identification of the compensatory measures, necessary to survive the affected population/species;

- Reduce the impact of the industrial activities on the phreatic waters and air quality, isolating them with forestry curtains.ted areas, restoration of those degraded and their extension to the favourable areas.

So that, the **flexibility** and **predictions** play an important role in alerting scientists and decision makers to potential biodiversity's future risks. Predictions provide a means to bolster attribution of biological modifications to climate change and can support the development of proactive strategies to reduce climate change impacts on biodiversity.

Why alert? Because the biodiversity services and products are at the base of the human species outliving.

ACTUAL STATE OF SHREW SPECIES (INSECTIVORA: SORICIDAE) IN THE REPUBLIC OF MOLDOVA

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Although the shrews are the smallest mammals of the world fauna, they have an important role in natural environment and in human economy, being important link within the animal trophic chains. Five shrew species inhabit in Moldova: common shrew (*Sorex araneus*), pygmy shrew (*S. minutus*), bicolored white-toothed shrew (*Crocidura leucodon*), lesser shrew (*C. suaveolens*) and Mediterranean water shrew (*Neomys anomalus*). The water shrew (*Neomys fodiens*) was mentioned for the territory of Moldova by several researchers, but the detailed studies accomplished in the past century (Averin, 1969; Lozan, 1975, 1979) and in the last 15 years didn't reveal the presence of this species even in the northern part of the republic. The presence of the species was mentioned in pellets of some predatory birds (Zubcov, 1983).

During the last 60 years considerable modification of shrew communities in various types of ecosystems on the whole territory of Moldova were registered.

In the 1950-60's the dominant species among shrews in natural ecosystems of the republic was *S. araneus*, followed by *N. anomalus* that was very abundant in wet habitats (up to 25-30% in lower course of Prut river). We have to mention that in 50's-60's of the past century the lower Prut area occupied large surfaces with many floating reed islets, covered with dense herbaceous vegetation and abundant litter. Here the shrew species, especially the most higrophylous ones (*S. araneus, S. minutus, N. anomalus*) could find favourable trophic and shelter conditions, therefore they were the dominant mammals in these biotopes. The pigmy and lesser shrews were rather spread all over the studied territory, but their abundance was lower. The bicolour shrew was rather rare and together with *C. suaveolens* was recorded in more arid biotopes, such as fields, pastures, abandoned lands, slopes with herbaceous or bush vegetation. The common, pigmy and Mediterranean water shrews have been recorded in various types of forest ecosystems, as well as in paludous and riparian biotopes with characteristic significance. Shrew species were also recorded in pellets of predatory birds, but in very low quantity: *S. araneus* – between 0.6% and 2.4% from all the vertebrate prey, *S. minutus* – between 0 and 1.6%, *C. leucodon* – between 0.02% and 1.6%, *C. suaveolens* – between 0.3% and 1.9%, *N. anomalusI* – about 0.3% - 0.6% and N. Fodiens – about 0.15% - 0.3% (Ganea, Zubcov, 1975; Zubcov, 1983).

In 1990's the changes of social and economic conditions lead to the changes of ecosystem structure and to the modification of whole landscape of the Republic of Mol-

dova. Vast single-crop agricultural fields from the agrarian complex of 70-80's that occupied large territories were divided in parcels cultivated with various annual, biannual and perennial cultures. Many lands were abandoned and uncultivated, the mosaicity of the territory increased. The process of natural habitat destruction (forest cutting, increasing of recreational activity, waste deposited outside localities, water habitat pollution etc.) was rather intense. In such stressful conditions the shrew species density decreased drastically by comparing with other mammal groups. In this period the common shrew showed high degree of adaptability and the largest limits of ecological valence. Thus, it had the highest abundance among soricid mammals and constituted almost 80% from the shrew population, being a constant species in many types of natural and anthropized ecosystems. *S. minutus* and *N. anomalus* were characteristic in wet habitats and near water basins in natural reserves and protected areas, while in other habitats they were accidental or accessorial species. Their total abundance was rather low: the pigmy shrew constituted 5%, the Mediterranean water shrew – about 9%, the lesser white-toothed shrew – about 12%, while the white toothed shrew – only 1-2%. The last species was very rare in the past century and since the 80's its number decreased more, so it was included in the Red Book of Moldova, 2nd edition as critically endangered. It can be also observed the strong decreasing of Mediterranean water shrew by more than three times in comparison with the 70's, conditioned by intense drying of lower Prut and Nistru swamp ecosystems in the 80's and by intense pollution of surface waters in 90's.

At the beginning of new century many abandoned lands reverted to their more or less natural state as natural biotopes, such as pastures, meadows, grazing lands etc. At the same time, the processes of anthropization, urbanization and degradation of the natural ecosystems occur all over the territory of the republic. In this context the modification of the shrew community's structure continued. The common shrew remain the dominant species in the population, but its abundance decreased (to 43%) by comparing with the previous period. It is more tolerant to the environment conditions and to anthropogenic activity in comparison to other shrew species. The pigmy shrew had the abundance of above 30%. The density of bicolour white-toothed shrew increased up to 8%, while the abundance of *N. anomalus* decreased drastically to only 3%.

In the last decade the common shrew is the dominant species and was recorded in the majority of studied natural and anthropogenic biotopes (F=94%). The frequency of pigmy shrew was also rather high – 88%, but it is more rare. The density of bicolor white-toothed shrew increased and its frequency was rather high with the value of 9.7% while in its preferred habitats the frequency of the species reaches 40%. The density of bicolor white-toothed shrew increased up to 8.8% and its frequency was rather high with the value of 9.7% while in its preferred habitats the frequency of the species reaches 42%. The lesser shrew was more frequent (17.8%) and abundant. The Mediterranean water shrew was the rarest shrew among other species after 2000. Its frequency was very low (below 5%), it being registered only near aquatic basins of natural reserves, and the maximum abundance of 7.8%.

In the last years of study the structure of shrew communities on the territory of Moldova shows significant changes. In the majority of the study periods *S. araneus* is the dominant species, except 2004 and 2008, when its abundance is below 30%. The abundance of pigmy shrew is the highest in 2004 (more than 45%), than is maintaining between 20% and 25% and decrease to 10% in 2009. The evolution of *C. leucodon* is very interesting: from rare species and 15% abundance it increases to 36% in the last years, being together with the common shrew the dominant species in the studied ecosystems. The lesser white-toothed shrew abundance also increased to 2008, when it was the dominant species. Its frequency constituted 40% in natural ecosystems and more than 85% in urban environment. *N. anomalus* abundance decreased during the last years, in some years it wasn't recorded at all and when registered it constituted only about 7% from all the shrews as rare or accidental species. Its abundance in the republic ecosystems decreased drastically in the last 20 years and it becomes a very rare and critically endangered species. This fact is caused by the degradation of wet habitats and of water basins pollution. Therefore, it was included in the third edition of the Red Book of Moldova, as critically endangered species. The water shrew (*N. fodiens*) wasn't recorded in the last 15 years of our study, although it was mentioned for Pădurea Domnească reserve.

We have to mention the high abundance of bicolour white-toothed shrew in the last several years. It was recorded not only in natural and wet biotopes, but also in more arid ones, in agrocenoses, in abandoned lands and even in urban ecosystems. It was still included in the third edition of the Red Book of Moldova, but with the status of vulnerable species.

The work was performed within the fundamental project 15.187.0211F at the Institute of Zoology of A.S.M.

PRESENT SITUATION AND CONSERVATION PERSPECTIVES OF HERPETOFAUNA IN THE REPUBLIC OF MOLDOVA

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Stability and development of herpetofauna communities in the current conditions are determined not only by natural factors, but also largely by anthropogenic ones. Communities of amphibians and reptiles, historically formed in Nistru – Prut interfluve space, are representatives of three biogeographic regions and constitute 16.5% and 9.7% of Europe's herpetofauna complex. Most of the local populations are located at the periphery of species spreading areas and are characterized by an accentuated fragmentation of distribution, having at the same time a high degree of vulnerability. Endangered species of amphibians and reptiles constitute --- and 64% (compared to the European level these indices are 22.9% and 19.4%). Our investigations and analysis of previous publications shows that in the last 50 years the areas of many amphibians and reptiles species have been reduced considerably, while some have extended their spreading. In the current conditions of the Republic of Moldova the leading role in preserving the diversity of herpetofauna have the natural ecosystems, but they are also directly or indirectly influenced by many factors of anthropogenic origin or climatic ones, causing changes in the structure and functioning of historically formed communities. These changes are primarily related to the transformation, reduction and fragmentation of natural habitats and are characterized by the appearance of areas of the mosaic type and of isolated micropopulations in the species more susceptible to environmental changes. For example, the area of four-lined snake (*Elaphe quatuorlineata*, Lacepede, 1989) in recent years has considerably reduced, currently consisting of several micropopulations that occupy 10-100 ha land situated at distances of 100-200 km. Such spread is also particular for Caspian whipsnake (*Coluber caspius*, Gmelin 1789) and common viper (*Vipera berus*, Linnaeus, 1758). The process of these changes in the last 20 years has been accelerated by such factors as: removal of some land from the complex of natural areas and their use for the construction of villas, without respecting ecological principles; overgrazing of steppe sectors and of forest ecotones, where the highest diversity of reptiles is concentrated. Draining and sewerage of wet meadows, formation of new agrocoenoses has led to the reducing of reptiles and amphibians diversity (in some habitats out of 5-10 species remained only 1-2), and in some places to their complete disappearance. As a result of reckless social and economic reforms in recent years a number of anthropogenic factors has appeared, which negatively (in some cases positively) influence on animal populations.

Considering the current state of herpetofauna complex, the character and influence of various factors on of amphibians and reptiles populations, there were developed a number of measures that will ensure the preservation of their diversity in terms of contemporary agricultural landscape. The main directions in the field of conservation and monitoring are environmental information and education of people, improving scientific basis for conservation, improvement of administrative legislative and control of biodiversity conservation. On the other hand, the application of some practical measures (protection of existing natural habitats, creating the ecological network and underground crossings, reproduction of endangered species in conditions of captivity, establishment of new protected areas, ecological education etc.) will help maintain the specific diversity of herpetofauna complex and ceasing if its degradation. In order to preserve rare species is necessary to maintain the natural appearance of some important areas in this regard. The first step in this direction is to protect, restore and correct approach to managing sectors potential for maintaining the diversity of reptiles and amphibians.

The work was performed within the fundamental project 15.187.0211F at the Institute of Zoology of A.S.M.

Section I
TERRESTRIAL VERTEBRATE AND PALEOZOOLOGY

WINTERING GROUP OF MUTE SWANS (CYGNUS OLOR) IN BREST AND ITS INFLUENCE IN THE MAINTENANCE OF BREEDING POPULATION IN SOUTH-WESTERN PART OF BELARUS REGION

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The first record of wintering swans in Belarus was in 1961-1966 (Lesnaya river, Brest region). Mute Swans started to winter in the city of Brest in 1981. The numbers of wintering group varied from 60 (2003) to 224 (2011) birds in dependence of weather conditions during winter. We studied wintering group in Brest since 2003. In total 542 Mute Swans were ringed with metal rings during 2003-2016.

To determine the degree of influence of Brest wintering group on the breeding population of Mute Swans in the region were used data of recoveries of rings. These data allowed to define the relationship of nesting and wintering birds.

For study of breeding population of Mute Swans the permanent plot 25x25 km was selected in the vicinity of Brest. About 9-15 breeding pairs were recorded in this area annually.

During 2005-2015 we found that 32 pairs from 41 (about 80%) had ringed birds wintering in Brest or observed in Brest after ringing. Another 10% (4 pairs) pairs were also ringed, but it was impossible to read the inscription.

Furthermore, most of the birds have been read are 65% males. Approximately the same percentage of males observed wintering around 70% of all ringed birds. Main part of birds with rings reading during breeding period were also males (65%).

Thus, the local group of breeding Mute Swans is highly dependent on wintering birds. Mute Swan males are more conservative than the females in the choice of wintering grounds and nesting sites, which causes a higher percentage of males among ringed birds in different seasons.

CONTRIBUTION OF CRYOBIOLOGY IN THE SOLUTION OF PROBLEMS OF PRESERVATION OF ANIMAL BIODIVERSITY

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Flora and fauna are an open biological system that continuously changes. These changes in the environment over millions of years have had and continue to have an impact on the genomes of organisms as the result their adaptive capabilities are increased. Due to this, living organisms have occupied almost all the space of our planet. However, in recent years started to rise sharply permissive human impact on the environment. In the air and water, soil and living organisms are all a greater number of toxic substances, exhaust gases, waste products of various industries, as well as of human life. Growing environmental pollution and unsustainable use of biological resources and sources of raw materials adversely affects flora and fauna. These circumstances point to the fact that the Earth is not an environmental crisis, and the initial stage of anthropological catastrophe. Such a high rate of death of living organisms in recent years has led to the formation of scientists, dealing with this problem with ideas about the possible occurrence of a chain reaction of death of all living beings on the globe. Therefore, particular importance attaches to the problems of preservation of the gene pool of all existing organisms, without division into useful and harmful types. Extensive work on the creation of sanctuaries, zoos and various farms on the reproduction, maintenance, and the increase in the number of living organisms. Create special ciyobanks, which contain genetic resources. The international community developed an environmental Convention. To change this situation is needed, along with prevention of environmental pollution must be much greater attention paid to environmental protection. Thus, special attention is given to techniques of cryopreservation. Still a high percentage of cell death in the preservation process, which indicates the loss of part of the gene pool of a population and the existence of selective effects. In addition, more research is needed to study the effect of the method of cryopreservation on DNA, as according to some researchers, in this case, the DNA content does not change, while the possible qualitative changes in the structure of these macromolecules, accompanied by their fragmentation. Proceeding from the above, it seems advisable to conduct multidisciplinary research on: fundamental studies of the mechanisms of triprolidine and cryoprotection of biological objects; the creation of new methods to improve the preservation of the functional activity of cells with an intact genome; the development of new methods of storage of biological objects at lower costs for their content.

IMPORTANCE OF PRESERVING THE GENE POOL ZOOS

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Zoos is a promising base for research and data collection on reproductive characteristics and biology of rare species, for the implementation of the obtained knowledge, the use of stored genetic material. They represent unique possibility of studying the representatives of a rare species that can be underestimated. Significant is the fact that such research can be carried out in stationary and field conditions and without equipment expensive expeditions. Due to the fact that in zoos the species, as a rule, not one, but several individuals, it becomes apparent that they occupy one of leading places, both in the number and diversity of the preserved gene pool of rare species. Therefore, the need for the establishment of genetic cryobanks of rare and endangered species on the basis of Zoological parks and nurseries with time becomes more obvious. However, cryobanks zoos are being considered as an integral part of a network of zoos and conservation programmes of rare animals in captivity. It is a natural consequence of the very nature of cryobanks of rare species, and of the challenges zoos, certain global Strategy for the protection of Animals zoos. In the world there are now about ten of cryobanks in zoos, mainly in the United States. Significant efforts and some progress in the solution of this problem is achieved by members of the Institute of cell Biophysics, Russian Academy of Sciences and the Moscow zoo. However, in Moldova and all over the world work in this direction cannot be considered deployed. The problem is at the level of awareness that zoos occupy a leading place in the world in the number and variety of persistent gene pool of rare species. For breeding animals in zoos is increasingly used methods of artificial breeding, specifically artificial insemination of females. This method is a biotechnological and allows performing genotypic selection of individuals and use the genetic material producers to fertilize many females compared to animals in natural conditions. Improving the efficiency of artificial reproduction of rare species of animals is possible with the use of cryopreserved semen. Despite some of the problems of cryopreservation however, only by this method can be implemented long-term storage of reproductive material and use it as needed. For endangered species, being tribal and a red book that allows you to control genetic processes in populations *ex-situ*. Cryobanks containing samples of sex products and tissues of animals zoos can be used for molecular biological, biochemical and genetic studies, the study of animal diseases. In addition, they represent a component of the management of genetic structures of artificial populations, including through methods of artificial insemination using cryopreserved material.

BIOTECHNOLOGY OF REPRODUCTION ANIMALS

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In the conditions of constant reduction of number of cattle, which is accompanied by increase in the number of cows in the herd and simultaneous increase in plume cattle in our country becomes a little more extensive. This has led to a sharp reduction in livestock production. Therefore, along with the adoption of a complex of organizational, economic and technological measures necessary to increase the intensity of use of the genetic potential of highly productive producers. To improve the efficiency of large-scale selection, which provides a permanent increase in milk yields need to increase the intensity of selection of the best bulls on quality of posterity. Along with this, it is necessary to intensify the process of structural changes of species composition of animals that meet the increasing requirements of the economy. Given the situation, it becomes apparent that the use of traditional methods of play can not solve the problems the livestock problems. In these conditions the special urgency of the activities aimed at improving the organization of the reproduction on the basis of modern biotechnological methods, which have already been approved in cattle and can be used in the reproduction of other species. Primarily these include biotechnological method embryo transfer, which is based on the principles of purposeful regulation of reproductive functions. In this sense, it should be noted that scientists have developed a new technology of transplantation of embryos, allowing for the basic parameters (11-12 ovulation and 55-60 quality embryos per donor, 55 calves per 100 embriodered), to be at par with the best world analogues. Hence, in breeding programs the use of the method of embryotransfer allows to intensifythe breeding progress by use of the genetic potential, which is a reserve gene pool of cattle. Transplantation method in the practice of pastoralism is also used for rapid recovery of the number and wide distribution of rare and endangered species, the accelerated establishment of herds of cows recordist, create a Bank of cryopreserved embryos and their subsequent transfer in herds. Obviously the advantage of this method for imports and exports of agricultural animals.. However, it should be noted that the method of embryotransfer effective at the perfect observance of the hygienic norms of the maintenance, freeding and maintenance of animals, when all process elements are performed by highly qualified specialists in healthy animals. The main prospect of the development of the method of transplantation should be the development of new methods allowing obtaining the maximum number of calves from the animals with the desirable genotype.

CONTRIBUTIONS ON THE ESTABLISHING OF THE OPTIMAL STOCKING PARAMETERS OF THE HATCHING EGGS

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Egg storage is the time between oviposition (laying) and the start of the incubation process for hatching eggs. Optimal hatching results and chick quality can be achieved if eggs are set after an initial adaptation period of about 1 to 2 day(s). This allows carbon dioxide to be released from the egg, which increases albumen pH from 7.6 at oviposition to pH8.8 - 9.3. Yolk pH remains virtually constant around pH6.5, so that the embryo, situated on the yolk, is exposed to a pH-gradient. This optimises early embryonic development.

It is common practice for hatching eggs to be stored for several days before starting incubation. If temperature (18-20°C; 64.5-70 °F) and humidity (75%) in storage rooms are controlled properly, eggs can be stored for one week without significantly reducing hatchability or chick quality. Longer periods of storage however do affect the vitality of the embryo.

Causing increased early and late embryonic mortality, a delay in hatch and reduced chick quality (Fasenko, 2007; Dymond, 2013). To overcome this, new approaches to egg storage management are being trialled among hatchery managers.

We intended in the current paper to establish the stocking parameters of the hatching eggs provided by the parents of the "COBB-500" commercial broiler hybrids. These parameters were established on a 12 days.

The researches have been set up on 2 (two) groups of eggs, respectively a control group (Lc) and another group, called experimental (Lexp.).

On the Lc group, the studied eggs' stocking conditions were those used m the main part of the incubation stations in Romania; so, the stocking temperature of the eggs was of + 14-+16°C and the relative air humidity was of 65 - 70%.

On the experimental group (Lexp.) the sticking temperature of the eggs was reduced till +12 - +14°C but the relative humidity ot the air maintained its values, ot 65 - 70%.

Eggs turning started from the 4^{h} stocking day, in both experimental groups, three times each day.

Basing on the experimentally results we obtained, straightly concerning the hatching proportion, the hachability percentage of the eggs and the quality of the day old chickens, we conclude the egg stocking thchnology we used still requires some new experments on order to confirm the best results.

DIVERSITY OF HIBERNATING BAT SPECIES IN WINTER 2015-2016 IN SAHARNA ABANDONED MINES

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The bat species occupy a specific ecological niche due to their ability for flight, for hibernating and for using as trophic resources insects and other invertebrates with crepuscular and nocturnal life mode. In the Republic of Moldova the bats hibernate about 4-5 months during the cold period of the year. The hibernation roosts can be of natural and antrhopogenic origin. The abandoned stone quarries from Saharna are situated on the right bank of Nistru river and represent a complex of mines connected with tunnels, where several bat species hibernate. The air temperature in summer period varies from +18^{0}C and +13^{0}C and in cold period from +2,5^{0}C to +7^{0}C, the humidity reaches up to 80%.

The studies were performed at the end of January 2016. At the entrance the air temperature was of +9°C, the humidity – of 44%. At about 20m from the entrance the temperature was +6,3°C, the humidity – of 43%. About 4 km of underground passages were studied. The bat species were identified without removing from the shelters, to not disturb the hibernation process.

In the study period 336 individuals from 8 species have been registered: *Rhinolophus hipposideros, Barbastella barbastellus, Myotis daubentoni, M. dasycneme, M. mystacinus, M. blythii, Plecotus austriacus* and *Eptesicus serotinus* (fig. 1). The dominant species was *E.serotinus* with 55.36% and constituted more than half of hibernating community. In the previous years of study the Serotine bat was also dominant and constituted between 40% and 65% of bat community. The pond bat constituted 13.1%, followed by lesser horseshoe bat (9.52%), Barbastelle bat (7.44%), grey long-eared bat (7.15%) and *M. blythii* with 5.65%. The least numerous were *M. dasycneme* and *M. mystacinus* with 0.89% each. During the study the brown long-eared bat wasn't recorded, while in the past year it constituted 0.47%. *P. austriacus* was more abundant (7.44%) by comparison to the previous year (2.35%).

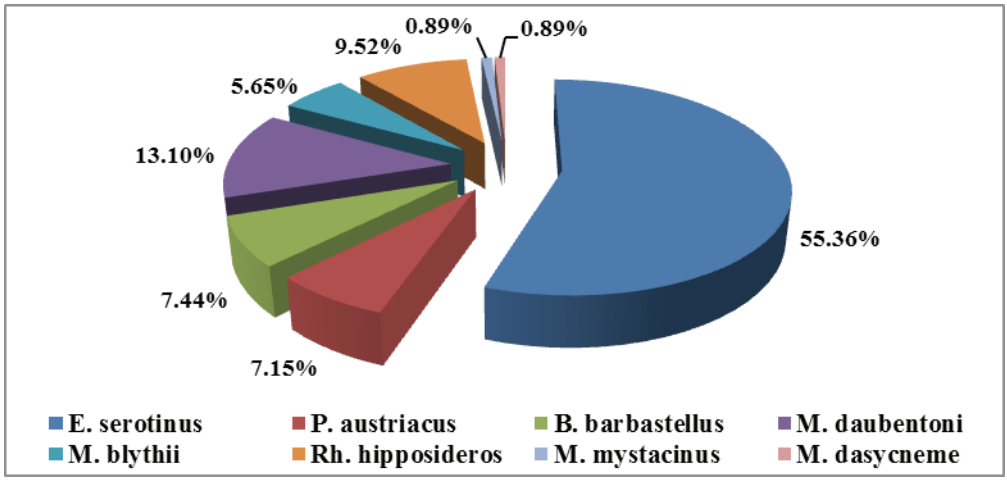

Figure 1. Structure of bat community in Saharna quarries in winter 2016

The first individuals, belonging to *E. serotinus* and *P. austriacus* were observed at 3-5 m from the entrance. The *Plecotus* species usually hibernate near the entrances of underground shelters, up to 8-10 m, while the serotine bat can be found near the entrances, as well as deeper in the underground. The first individuals of *B. barbastellus* were found at about 40 m from the entrance, where the air temperature was of +5,5°C and the humidity – of 44%. The first individuals of *M. daubentoni* were found at about 50m from the entrance, where the air temperature was of +5°C and the humidity – of 45%. The Serotine bat individuals were found in solitarily and small groups, ranging from 2 to 12 individuals. Other species were found exclusively solitarily.

It must be mentioned the increase of *B. barbastellus* species with approximately 5% in comparison with the previous studies. It is a very rare species of our fauna, included in the Red Book of the Republic of Moldova as critically endangered species, and Saharna site represent the only known hibernation place of this species in R. Moldova. Also, in the third edition of the Red Book (2015) are included the species *Rh. hipposideros, M. dasycneme* as endangered species, and *M. daubentoni, M. mystacinus, M. blythii* and *P. austriacus* as vulnerable species.

The abandoned stone quarries from Saharna represent an important bat hibernation roost, where hundreds of individuals from about 10 species, including rare and endangered species, spent the winter. The monitoring of this site will continue.

The work was performed within the fundamental project 15.187.0211F at the Institute of Zoology of A.S.M.

DIVERSITY OF SMALL MAMMALS IN ANTROPIZED FOREST ECOSYSTEMS OF CHISINAU CITY, REPUBLIC OF MOLDOVA

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At present the processes of anthropization and degradation of natural ecosystems occur intensely throughout the world. In the last decades a high growth of urban areas and, consequently, an increase in urban population density is registered. Urbanization, in the scale of landscapes, has occurred only during the last 100-200 years. From evolutionary point of view the cities represent new type of biota, with a complex of permanently changing ecological conditions, characterized by high levels of anthropogenic pressure. The city area and the adjacent territories subjected to disturbances are constantly expanding. Among these disturbances there can be mentioned urban expansion, road construction, tourism development which also causes the formation of many recreational areas in forest ecosystems within and around the cities. The mentioned anthropic modifications along with climate change phenomena recorded in the last years all over the world lead to changes in faunal community structure and generate some new strategies of adaptation of animal species to new environmental conditions.

The studies have been conducted in 2008-2013 in anthropic forest ecosystems of Chisinau city: forests, forest edge, forest belts, recreational parks. During the study period 5283 trap/nights were processed and 1008 individuals from 13 species were registered.

The analysis of small mammal activity showed that the highest trappability index was in shelter belts (24.91%), followed by parks (19.33%), forest edge (18.75) and forest (16.24%). According to relative abundance of the species in communities the most abundant were the *Apodemus* species: *A. sylvaticus* with 27.68%, followed *by A. flavicollis* with 24.6%, *A. agrarius* with 18.55 and *A.uralensis* with 5.36%. The bank vole had the abundance of 7.14%, *Microtus* sp. – 11.8%, *Mus spicilegus* – 3.17%, *M. musculus* – 0.59%, registered only near recreational sectors. Among shrews 4 species have been recorded in low proportion *Crocidura* sp. (0.7%) and *Sorex* sp. (0.5%), dominant being *C. suaveolens*.

In general, in optimal conditions the sex ratio slightly oscillates around 1:1 value in the majority of the species, with the prevalence of males in spring and increasing of female's number toward autumn. As to the age structure, at the beginning of spring the rodent populations are formed only by adult individuals, the majority being involved in reproduction process.

The work was performed within the fundamental project 15.187.0211F.

IMPORTANCE OF SMALL MAMMALS (RODENTIA, INSECTIVORA) AS RESERVOIRS OF PATOGEN AGENTS OF ZOOANTHROPONOSIS IN THE REPUBLIC OF MOLDOVA

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Small mammals are the main reservoirs of a range of pathogens that can cause diseases in humans, some extremely dangerous as tularemia, leptospirosis, Q fever, Crimean Congo haemorrhagic fever etc. The diversity of small mammal communities from orders Insectivora and Rodentia, their extensive spread in various natural and anthropogenic ecosystems contributes to maintaining and activation of existing natural and anthropogenic outbreaks, potentially widening the spread area of pathogen agents. Scientific studies of small mammals' communities from faunistic and medical point of view are necessary in order to obtain updated epidemiological and ecological information for reasoning the complex measures to control zooanthroponosis diseases.

The studies have been performed in 2011-2015 in various types of ecosystems from different zones of Moldova territory. In the northern zone the studies were performed in Ocnita, Briceni, Glodeni and Șoldănești districts; in the center – Chișinău city, districts of Ungheni, Hîncești, Orhei and Anenii Noi; in the southern zone – Ștefan Vodă, Cahul, Taraclia and Ceadîr Lunga districts, within the scientific reserves"Codrii", "Plaiul Fagului", "Pădurea Domnească" and "Prutul de Jos", as well as in anthropized ecosystems. The material in the field was collected using snap traps.

In sentinel points of annual and multiannual surveys there were processed on the whole 23417 trap/days and 5243 small mammals have been caught in spring, summer and autumn periods. Small mammals were investigated by microbiological methods for the presence of tularemia, leptospirosis, Crimean Congo haemorrhagic fever and yersinosis pathogen agents in the laboratory of Centre of surveillance and control of transmissible diseases and biological safety of the National Center for Public Health.

In the study period 22 species of small mammals have been caught and identified, of which 17 species belong to order Rodentia and 5 to Insectivora. The most frequent and wide spread were the species *Clethrionomys glareolus*, *Apodemus sylvaticus*,

A.agrarius, *A.uralensis, Mus spicilegus, M.musculus* and *Microtus sp.* that have been registered in all the studied areas and in the most of ecosystems. The mean multiannual capture rate of small mammals was of 22.4%, varying from 14.7% (in 2012) to 31.2% (in 2014).

The obtained laboratory results showed the presence of *Yersinia enterocolitica* antigen in species *A.sylvaticus*, *A.agrarius*, *Rattus norvegicus* and *Microtus sp.*, captured from forest, paludous and agricultural biotopes in Glodeni, Ungheni and Cahul districts. Positive results were established in 0.8% from the total number of investigated small mammals.

Specific antibodies to Leptospirosis were identified only in small mammals caught in the North (Briceni, Glodeni, Ocnița) in most of investigated biotopes. Positive results were found in 1.2% of small mammals investigated, of which 71.9% are attributed to Briceni district. A high diversity of species affected by leptospira was recorded (*C.glareolus, A.flavicollis, A.agrarius, A.sylvaticus, A.uralensis, M.spicilegus, M.musculus, Arvicola terrestris*, *Sorex araneus*), which ensure the natural and anthropogenic outbreaks maintainance, where their annual activation is registered, but also conditions for formation of new outbreaks and increasing the risk of disease spread among human population.

The antigen of Crimean Congo hemorrhagic fever virus (FHCC) was determined in 15.1% of investigated small mammals, being affected the species *A.uralensis, A.sylvaticus, A.agrarius, C. glareolus* and *Microtus* sp. FHCC area of spreading included territories all across the country: North (Glodeni, Soldanesti), Centre (Orhei) and South (Ceadîr Lunga and Taraclia). Increased circulation of FHCC virus in nature was recorded in forest biotopes, forest edge, forest belts and rest camps located in the forest – places permanently frequented by humans. Examination of small mammals to detect causative agent of tularemia did not show positive results during the study period.

According to national statistics data during 2011-2015 87 cases of yersiniosis, 37 cases of leptospirosis and two cases of tularemia in the human population have been reported.

Thus, the circulation of mentioned causative agents in natural and anthropogenic ecosystems is favored by 11 species (*C.glareolus, Microtus sp., A.sylvaticus, A.agrarius, A. uralensis, A.flavicollis, M.spicilegus, M.musculus, R.norvegicus, Ar.terrestris*, *S.araneus*) of 22 identified during 2011-2015 in Moldova. *A. sylvaticus* and *A.agrarius* species present in almost all the investigated biotopes participate in the formation of mixed infection outbreaks and the occurrence of people in their area increases the risk of concomitant contracting several zooantroponosis diseases.

Continuous monitoring of small mammals populations allow the determination of high risk territories, quantify the level of risk to public health by developing recommendations for the population in general, for risk groups (farmers, zootechnicians, foresters etc.) in order to prevent the emergence and spread of zooantroponosis diseases.

CLADISTICS ASSESSMENT OF THE PHYLOGENETIC RELATIONSHIPS WITHIN SYLVIOIDEA SUPERFAMILY (AVES: PASSERI) - DRAWING A COMPREHENSIVE SUPERTREE

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A general trend of biology has been and still is the reconstruction of the organisms' evolutionary history (expressed as phylogenetic trees) and to illustrate the speciation process. In birds' phylogeny, the taxonomic uncertainties still persist, mainly determined by the experimental design. Sylvioidea superfamily includes Old World warblers, Old World babblers, swallows, larks etc., numbering about 1300 species divided in 221 genera. The first comprehensive study of the entire superfamily was conducted by Alström et al. (2006), based on a nuclear and a mitochondrial marker. They highlighted 10 main clades with high support, elevated afterwards to family level. In contrast to the large number of phylogenetic studies which aimed Sylvioidea superfamily, the taxonomic uncertainties still persist. These taxonomic uncertainties could be avoided by constructing a phylogenetic supertree that includes all component species (an ideal case) or as close as possible to this number.

In this study we aimed to construct and explore a comprehensive Sylvioidea phylogenetic supertree. In order to construct and explore a comprehensive phylogenetic supertree a large ingroup dataset consisting in 1858 cytochrome b sequences available on GenBank – NCBI was compiled. While the implications of a large data set are still uncertain, several datasets were assembled. The first one, called "superTaxa", was represented by a large dataset consisting of 1898 cytochrome b sequences from ingroup and outgroup. The second one, called "fewTaxa", was a typical dataset, in terms of size, for a phylogenetic study comprising 192 sequences, from which 152 were from ingroup (one or two species per family) and the previously declared outgroup. Also, another 20 datasets, called "familyTaxa", for each family consisting of component species, except 4 monotypic families and family Scotocercidae with an uncertain status. Evolutionary relationships reconstruction within Sylvioidea superfamily was performed under a Maximum Likelihood (ML) framework using RAxML v.8.2.6 run through the CIPRES Science Gateway V.3.3.

DISTRIBUTION AND CONSERVATION STATUS OF COMMON HAMSTER (*CRICETUS CRICETUS* L., 1758) IN ROMANIA AND REPUBLIC OF MOLDOVA

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Although the distribution range of the Common Hamster in Romania has been covered in several papers (Hamar et al. 1959, Murariu 1998, Hegyeli et al. 2015), the present knowledge on its distribution from literature is unsatisfying, being based on incomplete historical date, only recently reports, or areas drawn without being based on real points of distribution. Generally, the Common Hamster distribution is considered to cover a large part of the country, from lowland up to 700 m altitude with a special case in Dobruja, where the species has not been reported for over a century and is considered absent, although it is reported further south in Bulgaria. In the Republic of Moldova rather complete information on common hamster distribution range, biology and ecology can be found in some papers from the past century (Lozan, 1966, 1971; Averin et al., 1979). New data on common hamster are published only after 2000, where some general information is presented (Munteanu 2004). The species is considered widely spread all over the republic territory, due to pronounced anthropization degree of all the ecosystems, including natural ones. It is absent only in deep compact forest stands from Codri forest in the central part. It is more abundant in steppe areas of Bălți in the north and of Bugeac in the south.

The aim of this study was to establish the current distribution range of the common hamster in Romania and Republic of Moldova, with a glimpse on the conservation status.

We reviewed distribution records from all the available bibliographical references, and the mammal collections of several institutions (National Museum of Natural History Grigore Antipa, Research and Development Institute of Plant Protection – ICDPP, Faculty of Biology from Bucharest University), adding personal observations of the authors and verified citizen science records. All of these records were plotted with a 10x10 km UTM grid and were used to create a comprehensive distribution map including both historical and recent records. To be able to compare this area with the

ones published in the past, we digitized distribution maps available from reference literature and crossed paths with a UTM grid of 10 x 10 km, resulting in a number of squares for each of them.

References about the distribution of Common Hamster in Romania were identified in 40 bibliographical sources, totaling together with the other sources examined, a number of 104 localities, distribution covering 91 squares UTM 10 x 10 km, from all periods and all over Romania. Thus the distribution of the Common Hamster overlaps with 57 landscape units, intersected with UTM grid squares gives the probability of coverage for this species in 814 squares UTM 10 x 10 km. Although the apparent surface area is considerably smaller than previously mapped areas in the literature, this can be explained rather by the lack of accuracy in plotting areas in the past than on its decline. The bibliographical sources and field studies in R.Moldova indicate 34 localities of common hamster distribution, mostly in the central, northern and western parts of the republic.

We consider that the distribution of the Common Hamster in Romania did not change significantly in the last decades, as other authors also noticed, but regarding the population size, we expect that it declined as in many parts of Europe. In the Republic of Moldova the population of common hamster is actually strongly fragmented, with mosaic spreading in open type habitats and at ecotone areas. There is observed the spatial and numerical decreasing of common hamster population all over the territory. The common hamster is a protected species in Romania and Europe, being a Natura 2000 species, included in Annex IV of EU Habitats and Species Directive, Bern Convention (Appendix II), and listed as Vulnerable in the Romanian red list of vertebrates (Murariu 2005). It is included in the Red Book of the Republic of Moldova, 3rd edition (2015) as vulnerable species. Recent studies on monitoring this species concluded that the conservation status is favorable (Mihăilescu et al. 2015), but there is no action plan at governmental level regarding the conservation measures that are needed for this species.

The work was performed within the fundamental project 15.187.0211F and within inter-academic exchanges between Romania and Republic of Moldova.

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INFLUENCE OF THE ECOLOGICAL FACTORS ON COLORATION OF THE GREEN FROGS (AMPHIBIA, RANIDAE) IN ECOSYSTEMS OF MOLDOVA

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Coloration of the green frogs (*Rana ridibunda, R. lessonae, R. esculenta*) is a phenotypic feature as the result of a long evolutionary process (Arnold et al., 1986). The major importance of coloration for amphibians consists in the role of thermoregulation, blinding enemies and not least the attraction of sexual partners (Dediu, 2007; Cozari, 2010; Gherasim, 2014).

In order to study the polymorphism of the green frogs the original methodology has been applied, which comprises carrying out the series of successive images of the specimens in a short period of time on the whole surface of the habitat. Photos of all individuals in every aquatic habitat during active periods of life cycle and subsequent analysis for each species and specimen in part allowed us to get an overview of chromatic forms in the examined population.

In evaluating data on the color of the green frogs was established that, with reference to the background color (ranging from gray to olive green), stains, lines and points of other colors, can be distinguished 12 types of morphs of dorsal coloration.

Coloration is the result of interaction of genome with external factors; it has an adaptive character to focus on ensuring efficient vital needs for the species, which differs in different living conditions, but also in various phases of the annual cycle of green frogs.

Thus, in late March, when the air temperature record values of +10°C and the water temperature was between +5° + 7°C (during spring) and green frogs specimens are coming out of hibernation, field and the lab work were established background color ranges from gray to grayish olive green with dark metallic sheen. In such environmental conditions among the populations examined were identified three basic morphs: *Maculata (M), Striata (S)* and *Bursni (B).* As a result, these phenotypes are formed as a combination of the *maculata – striata (MS), maculata – hemistriata (MhS), hemimaculata (hM), hemistriata (hS)* and *bursni (B).*

Types of morphs identified for green frogs are not only an example of interaction between amphibians and environmental factors, in addition they also embody areas where they live in conformity both with the vegetation cover on land and dried aquatic flora from aquatic environment.

While atmospheric values continue to rise, the air temperature reaching 30 + 35^{0}C and water 24 + 26^{0}C (summer) we have recorded a change in background color, in most cases it was light green. This background color variation is due not only to temperature change, but also because of bright substrate; where the dark color switch to the green.

In the summer most frequent were the following four basic morphs: *Maculata (M), Striata (S), Bursni (B)* and *Punctata (P)*. As with the basic morphs of the spring, these phenotypes form other combinations, such as: *maculata striata (MS), maculata hemistriata (MhS), hemimaculata (hM), hemimaculata hemistriata (hMhS), striata hemipunctata (ShP), punctata (P)* and *hemipunctata (hP)*.

Unlike the specific combined morph distribution that were registered during the spring-summer, towards fall as the temperature of air and water decreases, humidity changes, disappear optimum conditions for living. Among green frogs have been recorded a greater number of combined morphs: *maculata (M), maculata striata (MS), maculata hemistriata (MhS), hemimaculata hemistriata (hMhS), punctata (P), punctata hemistriata (PhS), hemipunctata (hP), bursni (B), bursni striata (BS), striata (S)* and *hemistriata (hS)*. This demonstrates that in less favorable conditions of life amphibians are stronger dispersed throughout terrestrial and aquatic habitats and number of morphs obviously increases.

The background dorsal color of green frogs is darker during spring and autumn, in addition to camouflage function, in particular this provides thermoregulation. Thanks to dark color, thermoregulation is provided by better level of absorption of solar energy that provides the appropriate functioning of physiological processes of specimens.

In summer, when living conditions are favorable, the role of coloration is focused specifically on camouflage.

Unlike chromatic forms of adult frogs, the young specimens are characterized by the dark color of background. Specificity of the dark color is explained by the vital needs for absorbing solar energy from the period of embryonic development, larval and juvenile stage.

Since the embryonic and larval development of frog are only conducted in the aquatic environment and their specimens are prone to a higher risk of bearing the consequences of less favorable external factors and aquatic predators, dark chromatic provides the main functions of thermoregulation and protection.

After analysis of determined morphs, we can conclude that the phenological changes is a continuous processes with adaptive capacity and operational response to environmental factors; morphs concerned homochromia show adaptations to the substrate, and this can protect from predators (waterfowl, some mammals and others) and ensure their thermoregulation.

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TAXONOMY AND SYSTEMATIC POSITION OF THE INDIGENOUS HOLOCENE RED DEER (*CERVUS ELAPHUS*, CERVIDAE, MAMMALIA) FROM MOLDOVA

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The now extinct aboriginal population of red deer from the Prut-Dniester interfluve area remains poorly known and its systematic position was discussed in literature quite superficially. The extinction of *Cervus elaphus* took place in the early years of 19th century due to an excessive anthropogenic pressure. Uspenskii (1979) considers that red deer population disappeared in the area between Dniester and Prut by the 1840s, however, apparently, red deer disappeared in the area under discussion much earlier. In his description of Bessarabia, Svinyin (1817) already does not mention red deer in the composition of local fauna and reports a massive deforestation of the region that could be one of the reasons of the local red deer population extinction. The attempts to reintroduce red deer in the forests of Codrii Hills were repeatedly undertaken starting from 1954. The first introduced individuals come from the biosphere reserve Askania Nova and represented hybrids that resulted from multiple random interbreeding between two subspecies of red deer (*C. elaphus elaphus* and *C. elaphus maral*) and Siberian wapiti (*C. canadensis sibiricus*) (Sokolov, 1959; Uspenskii, 1979). Uspenskii (1979) applies a controversial term "reacclimatization" for wapiti/red deer hybrids introduction in the Moldavian forests. The literal meaning of this term is inappropriate, since it supposes a repeated acclimatization of an untypical for Moldavian fauna species. The introduced later in the Codrii forests sika deer (apparently, subspecies *Cervus nippon hortulorum*) also was involved in the intraspecific hybridization (personal communication of A. Munteanu). From the zoological point of view, the created population of hybrid deer has no scientific value and represents a sad example of species genetic pollution and destruction (Geist, 1998; Hartl et al., 2003).

The discussions on taxonomy of red deer from South-Eastern Europe have a long story. Lydekker (1898) included the red deer from Eastern Carpathians in the Caspian subspecies *Cervus elaphus maral* Ogilby 1840, taking in account its large massive antlers with low number of tines and poor development of distal antler crown. Botezat (1903) proposed two subspecies names *C. vulgaris montanus* and *C. vulgaris campestris* for the red deer forms of Eastern Carpathian Area. The applied by Botezat (1903) species name *C. vulgaris* is a junior synonym of *C. elaphus* (Grubb, 2000). Lydekker

(1915) presumed that *C. vulgaris montanus* could be a junior synonym of *C. elaphus maral* and assumed that both Carpathian red deer forms described by Botezat may represent recently immigrated dwarfed forms of *C. elaphus maral*. Botezat's (1903) subspecies *campestris* and *montanus* were regarded by the subsequent authors as synonyms (Heptner & Zalkin, 1947; Grubb, 2000). Heptner & Zalkin (1947) and Grubb (2000) rejected the subspecies name *campestris* as *nomen nudum* and *nomen preoccupatum* by *Cervus campestris* Cuvier 1817 (junior synonym of *Odocoileus virginianus*). Grubb (2000) also rejected the subspecies name *montanus* Botezat 1903 as *nomen nudum* preoccupated by *Cervus macrotus montanus* Caton 1881 (junior synonym of *Odocoileus hemionus*). However, Heptner & Zalkin (1947) regarded *C. elaphus montanus* as a valid subspecies that represents a transitional form between European *C. elaphus elaphus* and Caucasian *C. elaphus maral*: it is characterized by an underdeveloped neck mane, a missing black stripe bordering rump patch, a generally grayish color of pelage, poorly developed distal crown in antlers, and comparatively larger body size. Tatarinov (1956) created a new subspecies *C. elaphus carpathicus* for the red deer from Ukrainian Carpathians. Heptner et al. (1988) regarded Tatarinov's subspecies as a junior synonym of *campestris* and *montanus* and *nomen nudum*. Flerov (1952) and Sokolov (1959) placed the Carpathian red deer in the subspecies *C. elaphus elaphus* Linnaeus 1758 since, according to the cited authors, the antler morphology, pelage color, and body size are individually variable characters. Almaşan et al. (1977) referred the Carpathian red deer to the Central European subspecies *C. elaphus hippelaphus* Erxleben 1777. Banwell (1997) proposed another new subspecies name *C. elaphus pannoniensis* for red deer from Hungary, Romania and the Balkan Peninsula. Banwell (1997, 1998) described a set of specific morphological characters that distinguish the so-called "maraloid" Pannonian red deer from Western European red deer; however, he failed to provide diagnostic characters distinguishing *C. elaphus pannoniensis* from *C. elaphus maral*. In our opinion, *C. elaphus pannoniensis* is a junior synonym of *C. elaphus maral* (Croitor & Cojocaru, 2016). Subfossil and Late Pleistocene red deer remains from Bulgaria (Spassov et al., 2015) and Eastern Romania (Saraiman & Ţarălungă, 1978; Croitor & Cojocaru, 2016) are characterized by comparatively larger body size and large heavy antlers with poor development of the second basal tine (bez tine) and of the distal antler crown, showing a great morphological affinity with *C. elaphus maral*. Therefore, the available archaeozoological and paleontological data support the old viewpoint of Lydekker (1898) who included Carpathian red deer in the subspecies *C. elaphus maral*. The origin of the indigenous Carpathian red deer is linked to the Balkan-Anatolian-Caucasian glacial refugium and Moldova is regarded as a part of this glacial refugium (Sommer et al., 2008; Skog et al., 2009; Meiri et al., 2013).

CENSUS OF BREEDING DIURNAL BIRDS OF PREY ON THE TERRITORY OF THE REPUBLIC MOLDOVA

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In an environment that is in constant motion adaptive capacity is one of the primordial characteristics of living organisms. Many researchers have studied this issue, but nowadays the given research direction remains actual.

Currently, in Moldova the following species of breeding prey birds can be encountered: European honey buzzard *(Pernis apivorus)*, Short-toed snake eagle *(Circaetus gallicus)*, Black kite *(Milvus migrans)*, Western marsh harrier *(Circus aeroginosus)*, Montagu's harrier *(Circus pygargus)*, Northern goshawk *(Accipiter gentilis)*, Eurasian sparrowhawk *(Acipiter nisus)*, Common buzzard *(Buteo buteo)*, Lesser spotted eagle *(Aquila pomarina)*, Common kestrel *(Falco tinunculus)* , Red-footed falcon *(Falco vespertinus)*, Eurasian hobby *(Falco subbuteo)*, Saker falcon *(Falco cherrug)*, White-tailed eagle *(Haliaeetus albicilla)*, Booted eagle *(Aquila pennata),* Long-legged buzzard *(Buteo rufinus)*. From the above list some species *Accipiter gentilis*, *Acipiter nisus*, *Buteo buteo* and *Falco tinunculus* are more common, others, such as *Falco cherrug* , *Haliaeetus albicilla* , *Aquila pennata* are very rare and can be even absent from republic's fauna for several years.

For data collection were used two classic methods: transects and observation from fixed point. These data were used differentially depending on data that we wanted to collect, period and not least of habitat. Transect method consists in selection of certain route in an area previously established. This method was used to identify the nests. The fixed point observation method involves choosing a certain point in a certain area where observations will be made. This method was used to identify nesting pairs.

During cold period of 2012-2015 were checked approximately 5,000 hectares of forest and 20,000 ha around the open land in different parts of the country, in order to identify nests of prey birds. These periods were chosen because the visibility in closed and semi-open land is higher. Later, during nesting season (April-June) the nests were checked again to determine their occupancy. In total they were identified and recorded using GPS 76 nests and at the second checking during nesting season it was detected that 39 out of 76 nests were occupied by various species of Falconiformes prey birds.

As result of the study 11 species of diurnal prey birds were registered at breeding on the territory of the republic (tab. 1).

Table 1. Prey bird species found at breeding in the republic during 2012-2015

Species	No of occupied nests
Falco tinnunculus Common kestrel	10
Falco cherrug Saker falcon	3
Falco subbuteo Eurasian hobby	9
Buteo buteo Common buzzard	7
Buteo rufinus Long-legged buzzard	2
Accipiter gentilis Northern goshawk	3
Accipiter nisus Eurasian sparrowhawk	1
Haliaeetus albicilla White-tailed eagle	2
Pernis apivorus European honey buzzard	2
Aquila pennata Booted eagle	1
Milvus migrans Black kite	1

The nests of *Falco tinnunculus, Falco cherrug, Falco subbuteo* and one nest of *Buteo rufinus* were found on electric poles, while the nest of other species were foung on trees at high altitude, most of them being located in woods on old oak and ash trees.

The most common and widespread were the Common kestrel, Eurasian hobby and Common buzzard. We have to mention the high occurrence of Eurasian hobby in the last years, although the existing data show that it is a very rare species, that wasn't recorded at breeding for many years. Among other rare species can be mentioned Saker falcon, White-tailed eagle, European honey buzzard, Booted eagle, included in the Red Book of Moldova (2015). It must be mentioned the presence of Long-legged buzzard in the southern and northern parts of the republic, which was recorded for the first time in 2012 (Ajder, Baltag….)

The causes of change in the number of prey birds is due primarily to reducing of food base, accompanied by decreasing of suitable nesting places, because of the forest cutting, especially of old trees for commercial purpose, instead of sanitary cleaning of unhealthy or damaged trees. Another factor is the conventional farming practices with applications of pesticides, land processing with agricultural heavy technique, poaching, disturbance during breeding period etc.

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FAUNA OF MOLLUSKS IN BADENIAN DEPOSITS FROM PÂRLAGELE (MEHEDINȚI PLATEAU GEOPARK, ROMANIA)

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This study is focused on data issued from the research on fauna of molluscs in the Badenian deposits from Pârlagele. Pârlagele locality is located 12 km northeast from Drobeta Turnu Severin, Mehedinţi District, being part of the Mehedinţi Plateau Geopark.

In the Badenian deposits at Neagonea Valley, near Pârlagele, Stancu & Ţicleanu (1974) identified and the fallow species of gastropods: *Odostomia* sp., *Spiratella andrussowi andrussowi* (Kittl) and *S.* cf. *koeneni* (Kittl). Far later, 10 mollusc species originating from deposits cropping out on the left slope of the Neagonea Valley, near Pârlagele locality were identified by Diaconu & Meilescu (2011). Diaconu (2015) presents the results of research on marine fauna from the Badenian deposits in the Neagonea Valley (Pârlagele).

From geological point of view, the studied area represents the westernmost side of the Dacian Basin and involves among other various lithologies, marl tuffite clay with numerous foraminifers, equivalent "*marls with globigerinae*" from Muntenia (Marinescu, 1978). In this area, at Bâlvăneşti, near the contact with the metamorphic rocks the Badenian is cropping out. It concerns clays and fossil-bearing sandy clays. Locally, in the Bâlvăneşti sector, above them there is very fossil-bearing gravel, sand and marl clay. They also include a layer of volcanic tuffite. To the north, sands and marl clays reach big thickness, replacing the gravel.

The material presented here was collected for improving the paleontological collection of the Iron Gates Region Museum in Drobeta Turnu Severin. The species were assigned based on measurements and morphology, than compared with the specimens described and figured in paleontological references.

In the assemblage from Pârlagele are present also molluscs with primitive characters (e.g. *Cerithium*). A wide variety of molluscs of the genera *Pecten*, *Chlamys*, *Ostrea*, *Cardita*, *Turritella*, *Conus*, and corals indicate a subtropical marine basin. In the sub-littoral realm of subtropical basins up to 70 m depth one can meet *Turritella* and *Cerithium*. *Turritella* is a representative of Indo-Pacific marine species that prefer shallower waters (1-27 m). Most species live at depths of 7 to 10 m and temperatures above 21 °C. In the assemblage of bivalves from Pârlagele one can noticet epi-faunal representatives. Most of them actually live in the coastal realm and have a maximum

development up to 300 m in depth (*Pecten*, *Chlamys*). In the juvenile stage, *Chlamys* is living as fixed organism on bedrock, and in adulthood becomes free. Among the carnivorous gastropods, *Conus* is a sifonostomate species, which lives only in seas with normal salinity in coastal-tropical zones (1 to 80 m depth), in rich oxygen water, in association with other mollusks, on the coral reefs.

Conclusions. In the outcrop from Pârlagele was collected a very taxonomically diverse Badenian invertebrate fauna, including mainly mollusks and corals. The mollusks species reported are: *Ostrea (Ostrea) digitalina* Dubois, *Cardita jouanneti* Basterot, *Pecten revolutus* Michelotti, *P.* cf. *hornensis* Deperet & Roman, *Chlamys elegans* Andrzejowski, *Pectunculus (Glycymeris) pilosus* Linné, *Tellina donacina* Linné, *Corbula carinata* Dujardin, *Laevicardium herculeus* Dollfus Cotter et Gomez, *Cerithium europaeum* Mayer, *Conus ponderosus* Brocchi,

Turritella sp. The fauna of Neagonea River hydrographic basin and adjacent areas has affinities with the Badenian fauna from Bahna and Topliţa areas, but lesser to the one in eastern Oltenia (Jiu and Olteţ) or one from Buituri. Among the collected and studied taxa, mention three species that were not reported so far in this area: *Corbula carinata, Pecten revolutus* and *Laevicardium herculeus.* The paleoecological conditions in the Neagonea River basin show the existence of a coastal marine environment with normal salinity waters, in subtropical climate.

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SPECIES DIVERSITY AND LOCATION OF BATS (MAMMALIA: CHIROPTERA) IN CRICOVA STONE QUARRIES

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The studies were conducted from August 2014 to April 2015 in abandoned stone quarries of Cricova town, in order to determine the species diversity of bats. The mines represent a limestone complex of hand and machine processing. The microclimate formed in the quarry is favorable for the development of many bat species. The depth of mines is of 200-300 meters and the total length of the galleries reaches two kilometers. Temperature throughout the year oscilates aroud 8°C and the humidity is of 45%.

During the study of the quarry species studiy was carried out by collection and examination of animals and their identification according to the field guide, also using ultrasonic detectors that register echolocation signals.

The number of bats in this quarry is small and the distribution is uneven throughout the year. Most of bat individuals were found in the period from November to March, while during the summer months have been found just a few individuals (fig.1).

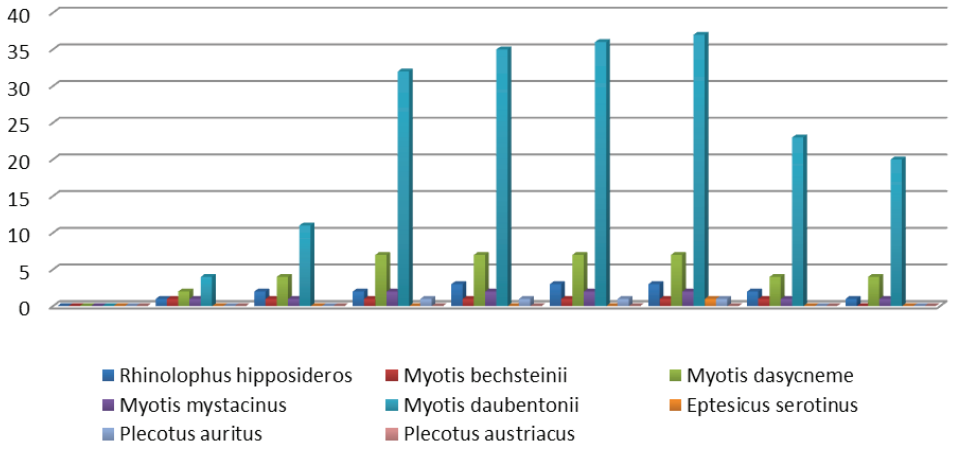

Figure 1. The number of bats in the Cricova stone quarries (August 2015 - April 2016)

The maximum number of bats for the entire period of observation found in the period from January to February was of 51 individuals. To determine the preferred temperature, humidity and air flow circulating in a quarry, on the map were marked the places, where the object of study was recorded (fig. 2).

Rhinolophus hipposideros – red dots
Myotis bechteinii – blue dots
Myotis dasycneme – green dots
Myotis mystacinus – yellow dots
Myotis daubentonii – dark blue dots

Figure 2. Zone of evaluation and determination of bats' location in Cricova stone quarries

Therefore, the lesser horseshoe bat (*Rhinolophus hipposideros*) prefer quiet places, withour air flow and temperature fluctuations and with the warm and stable conditions, while some species were found at the entrance to the mines.

In general, the dominant species in the mines is Daubenton's bat (*Myotis daubentonii*), followed by the pond bat (*M. dasycneme*), lesser horseshoe bat (*Rh. hipposideros*), bechstein's bat (*M. bechsteinii*) and the whiskered bat (*M. mystacinus*). Such species composition can be explained by the close proximity of water resources, which is the main factor for the life of these species. Brown long-eared bat (*Plecotus auritus*), Grey long-eared bat (*P. austriacus*) and serotine bat (*Eptesicus serotinus*) were detected extremely rare.

The uneven distribution of bats suggests favorable conditions for the winter, but in the warm season, bats are moving into places richer in food resources. Thus, in Cricova mines the number of bats is low and for the most part these are solitary individuals but, despite this, here can be found a great diversity of chiropteran species in the central zone of the Republic of Moldova.

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TRENDS OF FAUNA CHANGING IN THE HOLOCENE IN WESTERN SIBERIA

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Based on the analysis of dynamics of the fauna of Western Siberia during the Holocene can be given a classification and periodization of the main faunal trends that definitely are related to periodic climate change processes at the different levels:

I. Global trends (the reasons are global warming, glacier retreat to the North and disappearance of Impounded Lake:

1. Early Holocene (disjunctive) trend (the reason is forming belt of taiga forests divided part of species into "tundra" and "steppe" species, subspecies etc.).

Some species of open habitats developed disjunctive ranges as a result of distinguishing the effects arising forest zone. Some of these species is occupied tundra and forest tundra, and the other one - the forest-steppe. Currently these species are represented in these areas as separate subspecies, such as, *Microtus gregalis maior* or *Lagopus lagopus lagopus* in the north of Western Siberia, and *Microtus gregalis gregalis*, *Lagopus lagopus pallasi* in the south of it. Also it can be isolated populations such as populations of *Carabus sibiricus* and *Chrysolina exanthematica gemmifera*.

2. The European trend (leaded the formation of the western areas of Palearctic species). It began in the ancient Holocene (~12-10 thousand years ago) as a result of the movement of European species to the east by the south part of Western Siberia. To date, it continues to species movement from west to east: *Erinaceus roumanicus, Nyctalus nuctula, Microtus rossiaemeridionalis, Turdus merula, Parus caeruleus, Chloris chloris, Accanthis cannabina, Lissotriton vulgaris, Cottus gobio, Alburnus alburnus* and other.

3. Siberian trend (leaded the formation of the eastern areas of Palearctic species). It began in the middle Holocene (the Atlantic period, ~5-7 thousand years ago) as a result of the movement of Siberian species to the west by the central and northern part of Western Siberia. As an example distribution such species as *Sorex roboratus, Corvus orientalis, Losustella certhiola, Phulloscopus proregulus, Ph.fuscatus, Muscicapa sibirica, M.daurica, Zoothera sibirica, Uragus sibiricus, Ocyris spodocephalus, Rana amurensis*, *Tamias sibiricus, Martes zibellina, Mustela sibirica* and other.

II. Fluctuating trends (the reason is periodic regional climate change):

a. Super long-term (thousand-year) periods (1000-1200-year, 1800-2000 and 5000-year cycles); b. Long-term (hundred-year) periods (80-111-year and 500-year cycles); c. Medium-term (brikner's period) periods (30-50 years and an average of 35 years (Climatology, 1989); at this time there is rotation of latitudinal and meridional transfer of air masses and the shift Voeikov axis - from the end of the 19 century after 34 and 36 years); d. short-term (ten-year) periods (≈ 11-year cycles by Chizhevsky, that associated

with solar activity and equal 10 or 12 years); e. annual (seasonal) periods (associated with the seasonal cycles of weather and cycles of vegetation).

4. Central Asian trend (the reason is a periodic change of continentality of regional climate - change of temperature and humidity) presented by such species as: *Haemiechinus auritus, Spermophillus pygmaeus, Sicista subtilis, Aquila heliaca, A.nipalensis, Hieraaetus pennatus, Falco naumanni, Otis tarda, Glareola nordmanni, Upupa epops, Oenanthe isabellina, Gloydius halys, Bufo viridis, Mantis religiosa, Phaneroptera falcata, Argiope bruennichi*, *Lycosa singoriensis*, *Saga pedo*, *Latrodectus tredecimguttatus*, *Pelecanus crispus, P.onocrotalus, Egretta alba, Botaurus stellaris, Ixobrychus minutus, Plegadis falcinellus, Aythya nyroca, Himantopus himantopus, Recurvirostra avocetta, Larus ichthyaetus, Sterna caspia* and other.

5. Mongolian Chinese trend (the reason is the periodic increasing of temperature and decreasing of humidity) is shown as a distribution such species as *Spermophilus erythrogenys, Myospalax myospalax, Ellobius talpinus, Tadorna ferruginea, Otus scops, Parus palustris, Parus cyanus, Carpodacus erythrinus, C. auratus (gibelio), Perccottus glleni, Misgurnus nikolskyi, Pterostichus ehnbergi, P. burjaticus, Nebria subdilatata, Pterostichus drescheri* and other.

6. Mediterranean trend (the reason is the periodic temperature and humidity increasing) represented by some species as *Netta rufina, Streptopelia decaocto, Alcedo atthis, Lanius excubitor, Phoenicurus ochruros* and other.

3. Arctic trend (the reason is a periodic change of continentality of regional climate - change of temperature and humidity), for example, movement of the northern species to the south during the winter (*Alopex lagopus, Gulo gulo, Lagopus muta, Nyctea scandiaca, Bombycilla garrulus, Nucifraga caryocatactes, Pyrrhula pyrchulla, Pinocola enucleator, Loxia leucoptera* etc.), when they are reached not only sub-taiga, but also forest-steppe zone.

III. Anthropogenic trend (the reason is the landscape changing as a result of human activity, special or accidental introduction of alien species, species elimination or their habitats degradation). Some species as *Mus musculus, Rattus nirvegicus, Columba livia, Passer domesticus u P.montanus, Ondatra zibetica, Nyctereutes procyonoides, Mustela vison, Costatella integra, Borysthenia naticina, Viviparus viviparus, Pomacea canaliculata, Melanoides tuberculatus* etc. came to region. At the same time another one as *Mustela lutreola, Numenius tenuirostris, Ocyris aureolus* etc. were extinct.

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PROSPECTS FOR CONSERVATION AND RISKS OF LOSS OF RARE SPECIES IN PROTECTED AREAS OF A STEPPE ZONE OF UKRAINE

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A steppe biome of Ukraine occupies about 30 million hectares. Specially protected forbidden steppe areas are about 45 thousand hectares, 11,054 hectares of which are concentrated in the oldest on the planet steppe reserve "Askania-Nova", with the status of "Biosphere Reserve" since 1985. Long-term studies of reserved succession in the steppe reserves of Ukraine enable to assess the results of an influence of the protected regime on conservation of the specific animal diversity in different types of nature using. On the present territory of the Biosphere Reserve "Askania Nova" the protected regime is introduced since 1898. Numerous studies show that a mechanism of reserved succession in the steppes comes after the stopping of grazing pressure, and as is known to be accompanied by accumulation of the steppe litter, mesophytisation processes, composition change and increasing of grass height, that distinctly negative impacts on the population status of the steppe species making up the trophic chains. The consistent expansion of the protected area and strengthening of the regime from the beginning of 70-ies of XX century at the virgin lands of the Biosphere Reserve "Askania Nova" entailed reduction of little souslik population (*Spermophilus pygmaeus* Pallas, 1778), which from the large species became extremely rare. The species became extinct completely at the other protected areas or its state is critical. At the same time it is observed the disappearance of other steppe species of rodents: great jerboa (*Allactaga major* Kerr, 1792), hamster (*Cricetus sricetus* Linnaeus, 1758), sagebrush vole (*Lagurus lagurus* Pallas, 1773). Disappearance of the souslik catastrophically affected species such as a steppe eagle (Aquila rapax Temminck, 1828), its last reliable nest in the nature of Ukraine was dated to 1981; and a steppe polecat (*Mustela eversmanni* Lesson, 1827), traces of which are recorded less and less. A corsac fox (*Vulpes corsac* Linnaeus, 1758) remained only in the eastern protected steppes (Red Book of Ukraine, 2009).

High grass of the protected steppes influences negatively on the nesting and staying of a number steppe species of birds. In Askania-Nova some species stopped the nesting such as demoiselle crane (*Anthropoides virgo* Linnaeus, 1758) and Black-Winged Pratincole (*Glareola nordmanni* Nordmann, 1842). Their nesting was recorded at the beginning of XX century.

However, the protected areas are refuges for many rare species of birds. So, in years with low grass stand the protected steppes become the main place of wintering East-

ern European population of the Great Bustard (*Otis tarda* Linnaeus, 1758). Over the past 10 years, the winter numbers of this species in the Biosphere Reserve "Askania Nova" reached 1100 individuals because of low herbage, and rarely exceeded 200 with high herbage. In the case of the presence of grazing pressure on the reserve steppe, that is practiced in one of the plots in the Biosphere Reserve "Askania -New" in the area of 2370 hectares, the conditions are created for the long-term staying of a number of migratory and wintering rare bird species: Red-breasted Goose (*Rufibrenta ruficollis* Pallas, 1769) from a few dozen to 12 thousand individuals, Lesser White-fronted Goose (*Anser erythropus* Linnaeus, 1758) - a few tens of individuals annually, Common Crane (*Grus grus* Linnaeus, 1758) from 12 to 44 thousand individuals at the same time. This is connected with significant increase of annual temperature of the southern steppe region, which coincides with the planetary warming, as well as a significant watering of once steppe areas by irrigation systems. Active penetration of the forest and steppe birds' complexes is due to the formation of the field wood plantations in the once steppe ecosystems. Typically, flocks of migratory birds are accompanied by large birds of prey: Golden Eagle (*Aquila chrysaetos* Linnaeus, 1758), White-tailed Eagle (*Haliaeetus albicilla* Linnaeus, 1758), Imperial Eagle (Aquila heliaca Savigny, 1809). Moreover, their number has consistently increased the last few years. The high herbage and periodic outbursts of public voles' population (*Microtus socialis* Pallas 1773) on the protected sites of North Sivash conduce to maintenance of a high population of marsh owl (*Asio flammeus* Pontoppidan, 1763).

Significant changes are traced in the structure of entomological complex, which also loses rare steppe species. They are replaced by forest-steppe species (including some rare) and even the forest, which find here new ecological niches and settle successfully.

In the process of the long-term observations for dynamics of steppe ecosystems, we can state that all the steppe protected areas of Ukraine, including the largest reserve steppe of Europe in Askania Nova, are not self-regulating ecosystems, their incompleteness is determined by the absence of a powerful consuming block of the first order in the form of large herbivores and reserve succession does not create the conditions for the preservation of the rare zonal biodiversity. The situation is complicated by insufficient settlement at the legislative level of the regulations on the necessity of pointed management of ecosystems which have lost the ability of self-maintaining autocoenoregulation and autocoenorestoration.

The necessity of development and implementation of technology of the artificial breeding of rare animal species with their further reintroduction to the nature of steppes remains actual problem.

DIALECTIC ASPECT OF EVOLUTIONARY OUTLOOK

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The evolution is historical development of organisms, which, in turn, is a consequence of the fight of contraries. Such fight comes through any existence, and is displayed also in the mind. In doing so, these contraries are perceived as irreconcilable contradictions. Such a problem may be overcame by due philosophic education (dialectic logic). In the opposite case, the theory of evolution will not be perceived in adequate way.

I will give a number of examples:

After my report, devoted to reconstruction of the prototype of the flowering plants, chairwoman (mother of two children!) asked a question: do I recognize the difference between dicotyledons and monocotyledons (classes of the flowering plants). In the daily reality, just practice showed her that descendants may have a common ancestor, but the theoretical statement was incompatible with her outlook.

In my article was written: "with development of asymmetry /of the gastropod shell/"… the reviewer made a remark: "In this case asymmetry would already be and its development would not be required". In such a way, the reviewer considered the asymmetry of shell not as the deviation of symmetry, which could be lesser or greater, but as total lack of symmetry. In the same article, I wrote that the cause of gastropod's shell asymmetry might be the internal asymmetry of their ancestors (in all mollusks the intestine is turned in asymmetric loops). The reviewer answered: "The fact that symmetrical animals were ancestors of gastropods is known to any competent zoologist". In such a way, the reviewer considered the contraries (symmetry and asymmetry) as incompatible contradictions that cannot present in the same organism. I talked with him and asked: "Are the valves of bivalve mollusks symmetric?" He answered "Of course!" "And the lock?" "It's no object!".

In the discussion about the theory of evolution, the creationist asserted that there is no transitional forms between monkeys (including apes) and man. I answered that a chimpanzee is sufficiently closer to a man than to a guenon, therefore, is transitional form. Then he advised that Australian evolutionists placed chimpanzee to the genus *Homo.* The common between the creationist and these "evolutionists" is that both do not see transitional forms. Or the wall, or the complete fusion (the logic of identity).

The evolution passes through critics of an organism by surroundings. In the case when reviewers possess an absolute authority proceeds something like to the artificial selection. Thus, according to the initial version ammonites closed the mouth of the shell by the opercula, positioned on the mantle, anaptychi and aptychi. Afterwards it was put doubt on this version and the given formations were interpreted as jaws.

Number of scientists, including the author of brilliant monography by ammonites, U. Lehman, synthesizing colliding statements of authorities, suppose that jaws of ammonites performed at the same time as opercula [3]. It is sufficiently to remind that in the recent cephalopods the jaws are hind in the dense lump of muscles in order to understand, which monster is proposed in the kind of reconstruction.

The relation to theorization in the scientific periodic could be seen on example of my article, where I prove that the relict cephalopod with the internal spiral shell, *Spirula,* is the descendant not of bent, belemnite-like forms, but of typical ammonites. The article was sent to the "Paleontological journal", the magazine of the Russian Academy of Science. The manuscript was directed on the review to the scientist, whose views I criticize! The deal is that the criticism is perceived as a reference — I can estimate this by reviews on my articles. Such a case was not the first, I expected this, and connected with the reviewer. He promised a positive review, but preferred to keep silence. Instead I received negative comment from editorial board, in which was said: "No new author's actual material is presented. All the conclusions and reasons of the author are grounded on the retelling and/or reinterpretation of the observations of other researches". I. e., by the opinion of the editorial board, the paleontologist should to collect the empiric matter and not to comprehend in the critical way data of his predecessors. By the way, I found very important fact, unnoticed earlier, but I not devoted him a separate article, and considered it in the general context. Subsequently the article was published in the bulletin of the National Museum of nature and ethnography of Moldova, and afterwards was placed on the site of Jurassic Commission of Russia among the selected publications [4].

Currently evolutional view is supported by molecular and genetic data. It is necessary to remark, however that lack of dialectic outlook may lead to disregard to the level of an organism as biological unit. Thus in the botany, the families Aracea (calla, monstera, philodendron etc.) were fused with family of Lemnaceae (duckweeds) on molecular groundings, whereas specialization of the latter to aquatic habit on macroscopic level is too big (fusion of the leaves and stem in one structure, frond, reduction of roots, etc.). Such a step is, in my view, demonstration of predominance of the molecular approach on morphological one at the expense of truth. It may be comparable with placement of whales in the same order with their terrestrial ancestors.

Some characteristic idealization of the data of genetic, in my view, are clearly displayed in the book of R. Dawkins "Selfish gene". So, it is worth to examine some its suggestions.

In the foreword to the first edition R. L. Trivers writes: "There exists no objective basis on which to elevate one species above another" [2: XIX]. In such a way, L. R. Trivers rejects the basic principle of the evolution: progress of the living forms.

In turn, Dawkins assumes that the predecessors of our life were nude nucleic acids, replicators, tending to reproduce themselves, even at the expense of other replicators. The organism is no more than their machines, which are thrown, when they serve the term.

In such a way, the initiative here is prescribed to the gene.

Regarding to the concept, I would to notice that the nucleic acids belong to polysaccharides, common skeletal material. Indeed, R-RNA serves as skeleton of ribo-

somes. Perhaps, it was initial function of the nucleic acids, so the organism cannot be considered as their derivative. Furthermore, after the death the organism is "thrown" with all somatic genes, and genes in gametes would be powerless without a portion of cytoplasm with organelles. So, the concept of "immortal coils" (the name of the third chapter) is idealistic. The conflict, which takes place here, is not between gene and organism, but between the unity and multitude; between an individual and a genus.

It is necessary to remark that, besides to reductionism, this concept is similar with that of Darwin, who accepted for the grounds of the struggle for existence "the high rate at which all organic beings tend to increase" via reproduction [1: 63]. Of course, this ability is principal for the evolution, proceeding in generations. Nevertheless, I think the basic ability, making living organism alive, is the tendency to preserve the constancy of organization and the autonomy from surroundings through constant changes and in spite of them. Otherwise the organisms would adapt themselves to environment in the easiest way — death, decay and fusion with surroundings. The ability to reproduce is an aimed destruction of a living unit, the defensive reaction against hostile environment.

In his book, Dawkins constantly identifies exact genomes with the same individual (the logic of identity). He even states: "If an individual could be sure that a particular person was his identical twin, he should be exactly as concerned for his twin's welfare as for his own. Any gene for twin altruism is bound to be carried by both twins, therefore if one dies heroically to save the other the gene lives on" [2: 93]. I would remind that in several species of cranes, two newly hatched chicks enter deadly fight. The identic thing is not the same one.

So, giving birth to the other organism (or replicator) is already altruistic act. It is even more altruistic in the sexual process, where progeny shares only 50% from each parent.

Dawkins emphasizes egoism of genes. Though some chapters, especially "Nice guys finish first", are devoted to development of altruistic relationship (e. g. in societies of vampire bats), the author says: "We have the power to defy the selfish genes of our birth... We can even discuss ways of deliberately cultivating and nurturing pure, disinterested altruism— something that has no place in nature, something that has never existed before in the whole history of the world. We are built as gene machines…, but we have the power to turn against our creators. We, alone on earth, can rebel against the tyranny of the selfish replicators." [2: 201]

The deal in my view is that Dawkins considers the altruism as a total rejection of the egoism. However, the rejected characteristics is present after its rejection as an element of development — and this is the law of dialectics. Altruist sacrifices his life (or efforts) not because to him has bothered to live. He continue to love his own life, but places welfare of somebody higher. For this reason we appreciate an exploit of hero.

I think that the dialectic of individual and common could lead to the new base of the group selection.

Dawkins is far from such conclusion. Furthermore, instead to anatomize arguments of opponents (among which he mentions the laureate of the Noble Prize Konrad Lorenz, scientific writer Robert Andrey and founder of the human ethology Irenäus

Eibl-Eibesfeldt), and to extract the truth (which is contained in each work), Dawkins pushes their ideas away, accepting his own opinion for the absolute criterion of truth: "The trouble with these books is that their authors got it totally and utterly wrong. They got it wrong because they misunderstood how evolution works. They made the erroneous assumption that the important thing in evolution is the good of the species (or the group) rather than the good of the individual (or the gene) [2: 2]."

It is lagged behind to regret that the famous author carries discussion in such a way, and teaches such approach new generations of scientists.

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BIRD FAUNA COMPONENT DEPENDING ON ITS STRUCTURAL ORGANIZATION

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The fauna of non-passerine species of birds of Moldova since the middle of the XX - th century, became noticeably degrade due to the apparent deterioration of bird habitats. This led to a reduction of majority of species populations. Many of them entered in the risk zone and category of rare and endangered. Disappeared 21 species (12.35% of the former fauna), most of them irretrievably or retaining a ghostly chance of getting a new status. Instable state of the environmental conditions of this period and tendency to deterioration identified advantages and disadvantages of the structural and faunal assemblage in the current situation. Bird species have been tested for conditions of fitness and resistance on a range of environmental and adaptive traits, as well as principles of selection mechanism, according to a concept of life strategies.

The composition of this group consists of four types of landscape-biotopical complexes and seven types of fauna, where prevail wetland species, as representatives of the most biologically productive and common areas in the country. As well as species of the European (Eu) (30.2%) and Transpalearctic (Tp) (20.81%) types of fauna as native by geographical origin. Also there are species of the Mongolian (Mn) fauna (14.77%), which had a great influence on its formation through the close spatial contacts with the territory and environmental compliance with its terms. Included in the overall composition, they populated evenly environmental field on various topical and environmental positions, taking on more vacancies of upper trophic levels and a number of core structural and organizational positions. Therefore, they are characterized by a conservative life strategy. Most of them have relatively large size, demanding large spaces, stable conditions, restricted ration, have low reproducibility. Most of the fauna include species of Siberian (Sb) (13.42%) and Arctic (Ar) (10.74%) fauna's type, but only because of migrant and wintering birds. Fewer shows fauna of the Mediterranean (Md) type (8.72%), it's areal of habitat is partially in contact with the territory of the republic, capturing only its southern regions with their upper boundaries. That's why it is represented only by nesting species and stray birds. Because of zonal barriers its composition in the native fauna is limited to the variety of species and their participation in the structures of topical and seasonal life. Among them, there is no typical migrant and exclusively wintering species. Most of them are nesting wetland species, typical for the area in terms of natural zoning. This type of fauna is characterized by high volatility and instability, as well as strong desire to infiltrate the northern spaces

and the composition of their communities. This fauna is generally conservative, but does not have high success territorial consolidation, and therefore in it behavior is dependent on natural scenarios. Comparing the status and the environmental positions of indigenous origin species of Eu and Tp faunas can be seen that the last act in their choice quite free and easy in terms of their spatial and temporal parameters, while the first are more conservative and inert in the procedural dynamics.

Table 1

Quantitative composition of Non-Passerine bird species

	n	t	e	t (h)	Z	W	O	F	Ur	X from type fauna
Eu	**37(40)** 82,0%	**7** 16,0%	**1(2)** 2,0%		**45(49)** 30,20%	**23(24)** 51,1%	**6** 13,3%	**14(17)** 31,1%	**2** 4,5%	**4 (3n F; 1e W)** 8,16 (75/25)%
Tp	**20** 64,5%	**4** 12,9%	**1(2)** 3,2%	**6** 19,4%	**31(32)** 20,81%	**16** 51,6%	**2** 6,5%	**13(14)** 41,9%		**1e F** 3,13 (100)%
Mn	**11(13)** 50,0%	**6** 27,3%	**5(7)** 22,7%		**22(26)** 14,77%	**15** 68,2%	**5(8)** 22,7%	**2(3)** 9,1%		**4(2n,1eO;1eF)** 15,38 (50/25/25)%
Md	**9(11)** 69,0%	**1** 7,8%	**2(6)** 15,4%	**1** 7,8%	**13(19)** 8,72%	**9(11)** 69,0%	**2(5)** 15,5%	**2(3)** 15,5%		**6(2eW;2n,1eO;1eF)** 31,6(33/33./17/17)%
Sb	**2** 10,0%	**11(12)** 55,0%	**1**	**7** 35,0%	**20(22)** 13,42%	**18(19)** 90,0%		**2(3)** 10,0%		**2 (1t W; 1 eF)** 9,09 (50/50) %
Ar		**10(11)** 62,5%	**1(4)** 6,25%	**5** 31,25%	**16(20)** 10,74%	**15(19)** 93,75%		**1** 6,25%		**4 (3e, 1t,W)** 20,00 (75/25) %
Ci	**2** 100,0%				**2** 1,34%	**1** 50,0%	**1** 50,0%			
Z	**81(88)** 54,1%	**39(41)** 26,4%	**10(22)** 6,6%	**19** 12,9%	**149(170)** 100,0%	**97(105)** 65,5%	**16(22)** 10,1%	**34(41)** 23,0%	**2** 1,4%	**21** 12,35%
X (Z)	**7 4,11%**	**2 1,18%**	**12 7,06%**		**21 12,35%**	**8 4,71 %**	**6 3,53%**	**7 4,11%**		**21 12,35%**

Note: Currently (in the past), X – disappeared, Z - total

Features traits of fauna's types determine their distribution, landscape and biotopical dependence, the number and reaction to the variability of environmental conditions. According to the indicative features of these groups fauna suffered a lot because of the very scanty Md type (3.52%). Then Mn type (2,35%) is more sustainable, but secondary to participate in the formation and faunal species positions. The same number lost by the Ar fauna type, which featured only stray species and migrants. And because of the Eu type, whose representatives in fauna are more than the rest. Tactics of the Tp fauna was the most justified, because by its fauna has missed only 0.59% of the species, most of which were represented by trees and shrub biotope complex. In general, the fauna thinned mainly due to stray species and less nesting. A small fraction of it is because of migrants. All natural systems have lost about an equal number of species because of the magnitude of the human activity. Total 21 species disappeared from the fauna: nesting (n) - 7 (4.11%), migrants (t) - 2 (1.18%), vagrants (e) - 12 (7.06%), wetlands (W) - 8 (4.71%), open spaces (O) - 6 (3.53 %), forest and bush (F) - 7 (4,11%).

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MEGAFAUNA OF THE PLEISTOCENE OF THE SOUTH OF EASTERN SIBERIA – THE INDICATOR OF SLOW CHANGE OF CLIMATE

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To detect changes the original state of biota need data not only the hundreds and thousands, but millions of years, but their accuracy decreases as you go deeper into the geological past of the Earth. It is connected not only with the presence of "white spots" in the fossil record, but the applicability of the principle of actualism. He, especially in paleontology, becomes limited, because the ecology of fossil organisms, especially extinct, not fully comprehended and deciphered.

Detection of an increasing number of traces coenoses led to the positioning of the General trend in ecosystems of Northern Eurasia. Oryctocoenosis usually carry information about the individual links of the biota or some parts of it that have fallen from taphocoenosis. They are not a continuous sequence in its evolution. The choice of the South of Eastern Siberia due to its fairly good study that shows the General orientation transformation of mammalian fauna. Unfortunately, the scope of the thesis is too cramped for a detailed historical insight into the structure of biological diversity. We will restrict ourselves to the most General information, adhering to the perspective that positioning the overall trend of the changes necessary facts, and not opinions about them. The aim of this communication is to draw attention to the fact that the current model of biological diversity in the Pleistocene played a role, it is outdated and no longer carries new knowledge.

…..Due to the lack of homogeneous series of fossil remains, typically, not considered a polymorphism that is not allowed to see his entire range. Ignoring intraspecific polymorphism in the description of new taxa have led instead of allocating species, important for phylogenetic, biostratigraphic builds to an unjustified inflation of their diversity and misinterpretation of the natural environment. Many descriptive genus, species and subspecies are not real and are the morphological types of the same species, which suggests unfounded description of new taxa. The proposed diagnoses of many species mainly represent more or less successful "aphorisms", not the specific criteria that you can follow in the taxonomy. Diagnostic features are nothing more than a manifestation of phenotypic variability, which cannot be identified on a single specimen.

Until recently the mammals of the Pleistocene were represented *Nyctereutes* sp., *Canis* sp., *C. variabilis*, *C. lupus*, *Alopex lagopus*, *Vulpes* sp., *V. vulpes*, *V. corsac*, *Cuon alpinus, Ursus* sp., *U. arctos*, *U.* ex gr. *arctos*, *U. deningeri*, *Gulo* sp., *G.* cf. *schlosseri*,

G. gulo, *Crocuta* sp., *C. spelaea*, *Hyaena brevirostris sinensis*, *Panthera* sp., *P. spelaea*, *Felis* cf. *minor*, *Homotherium crenatidens*, *Archidiskodon meridionalis*, *A* cf. *wüsti*, *Mammuthus trogontherii chosaricus*, *M. primigenius*, *Equus* sp., *E. sanmeniensis*, *E.* cf. *nalaikhaensis*, *E. selengiensis*, *E. beijingensis*, *E. lenensis, E. hemionus*, *E.* aff. ?*hydruntinus*, *E. caballus*, *Sussemionus* sp., *Coelodonta tologojensis*, *C. antiquitatis*, *Itanzatherhium angustirostre*, *Paracamelus knoblochi*, *Cervus* sp., *C. elaphus*, *Eucladoceros* cf. *flabellatus*, *Capreolus capreolus*, *C. süssenbornensis*, *Megaloceros* cf. *giganteus*, *Alces latifrons*, *A. alces*, *Rangifer tarandus*, *Bison priscus*, *B. p.* aff. *deminutus*, *B. p. occidentalis*, *Bison* cf. *bonasus*, *Spirocerus wongi*, *S. peii*, *S. kiakhtensis*, *Gazella* sp., *G. gutturosa*, *Ovis ammon*, *O. nivicola*, *Capra sibirica* (Baryshnikov, Kalmykov, 2005; Ermolova, 1978; Kalmykov, 1981, 1986, 1990, 2003; Vangengeim, Sotnikova, 1981).

…..The lack of not only strict correlation between variables, but also of the inconsistency of morphological features suggests of the polymorphism of the taxa and the transitivity of many signs. These include thin or thick metapodien of horses, long and slender limbs rhino, torsion, and curved horns of antelopes, short or long horns of the bison, thick or thin enamel of elephants, etc. Lack of knowledge of the taxonomy and the lack of clear species diagnoses suggests that many taxa of the genera *Canis*, *Ursu*s, *Gulo*, *Archidiskodon*, *Mammuthu*s, *Equus*, *Coelodonta*, *Cervus*, *Capreolus*, *Alces*, *Spirocerus*, *Ovis* represent the morphological types of the same species, widespread in Northern Eurasia in the Pleistocene, taxonomic (systematic) the category and name of which remains to be seen. Recently it was shown that in the regional list of the mammalian fauna indicate the unproven *E. hemionus*, *E.* cf. *hemionus*, E. aff. ?*hydruntinus*, *Sussemionus* sp., *E.* cf. *nalaikhaensis*, *E. selengiensis*, *E. beijingensis*, *E. caballus*, *C. tologojensis*, *I. angustirostre*, *O. nivicol*a. Comparison them with similar remains of closely related taxa showed (Kalmykov, 2013, 2015, 2016; Kalmykov et al., 2014, 2015), which is a separate morphological types of the same species in time and space.

Currently, we can confidently say that the diversity of large mammals in the Pleistocene was exaggerated by more than 2 times. In the framing of lake Baikal lived *Nyctereutes* sp., *Canis lupus*, *Vulpes vulpes*, *V. corsac*, *Cuon alpinus, Ursus arctos*, *Gulo gulo*, *Crocuta spelaea*, *Panthera spelaea*, *Felis* cf. *minor*, *Homotherium crenatidens*, *Archidiskodon meridionalis*, *Mammuthus primigenius*, *Equus sanmeniensis*, *E. lenensis*, *Coelodonta antiquitatis*, *Paracamelus knoblochi*, *Cervus elaphus*, *Capreolus capreolus*, *Alces alces*, *Rangifer tarandus*, *Bison priscus*, *Spirocerus kiakhtensis*, *Gazella gutturosa*, *Ovis ammon*, *Capra sibirica*.

The modern mammals fauna of the South of Eastern Siberia is now composed of *C. lupus*, *V. vulpes*, *V. corsac*, *C. alpinus*, *U. arctos*, *G. gulo*, *Felis manul*, *C. elaphus*, *C. capreolus*, *A. alces*, *R. tarandus*, *G. gutturosa*, *O. ammon*, *C. sibirica*.

CHANGES OF ALKALINE PHOSPHATASE CONTENT AND ITS FRACTIONS IN BLOOD SERUM IN RECONDITIONED QUAILS UNDER THE INFLUENCE OF A LOCAL PRODUCT

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The radical transformations that took place in agriculture, namely, in the livestock sector, led to enhancement in the poultry area. At the same time, informing the population on proper and natural nutrition boosted the level of breeding and consumption of broilers, rabbits, quails by all social categories. Currently, it is well known and accepted that natural remedies, namely of plant origin, are used for enhancing the adaptive properties, and reducing the negative consequences of stress in animals in different breeding conditions. According to scientific data, in birds under intensive growth, the most affected organ is liver. In this paper are presented the study results of the impact of a local biologically active remedy –BioR, obtained from Spirulina platensis, on health and especially on liver marker parameters - alkaline phosphatase and its fractions.

Our research was conducted on 3 groups of quails, 80 birds each, at the end of their laying cycle, intended to be placed for recondition period. The drug was administered twice, intramuscular, to quails in the experimental group: at the beginning of the study and after approximately 10 days, in doses of 0,5 ml/head, and to the second experimental group, the drug was administered only once, at the beginning of the study, using the same dose of 0,5 ml/head. Birds from the control group were administered saline at a dose of 0,5 ml/head. Quails were monitored and examined during the whole study. For laboratory investigation, blood was collected from five birds each group, at the beginning, and at the end of the study. We would like to mention that the cyanobacterial remedy didn`t cause side effects or deviations in adult quails health. The tested remedy showed anti-stress and adaptive capacities, confirmed by lower body temperature and respiration values during the study.

It has been shown that total alkaline phosphatase in the control group maintained the same level, while in the experimental groups, increased by 1,3 times compared to the control group. The liver thermostable fraction of alkaline phosphatase in the groups treated with BioR increased by 22,6-25,8% compared to the control group. In this context, the thermolabile fraction of the investigated index increased by 1,5-1,7 times compared to the control group.

These are good results, showing the improvement of liver function, confirmed as well through the bio productive indices: body weight at the end of the study, numerical evolution of eggs, and quail meat quality.

CONSIDERATIONS REGARDING EXISTENT BIRDS IN THE WETLANDS OF MEHEDINTI DISTRICT (ROMANIA)

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At the basis of the Convention regarding the protection of natural and cultural world heritage, adopted by the general Convention UNESCO in 1972, there lies the profound, original idea that nature and culture are not opposed realities, but complementary and that the cultural identity itself of different nations bears the prints of the natural environment within which it was born (N. Toniuc, N. Boşcaiu, 1991).

The traditional philosophy of protecting the nature attempted to save the biotopes in the hope that the resident species will be saved too. This philosophy of preserving "in situ" is opposed to the "ex situ" strategy which suggests that once a species is taken out of its ecosystem it can be considered already "faded".

The Romanian scientist, Emil Racoviţă (1934) emphasized the interest in biocoenologic protection within the native biotope opposed to the idiobiologic protection ("reservations are to protect the isolated species").

Preserving a biological diversity within a protected territory is assured when it is treated the way it was before the protection had been implemented, so that the occurring changes are as small as possible. Preserving the flowers and fauna biodiversity is not possible anymore without preserving a variety of large natural environments. The true protection of the flowers and fauna genofond is conditioned by protecting some territories which stand out through their biological diversity (N. Toniuc, L. Purdelea, N. Boşcaiu, 1995).

There have been identified 139 species of birds of European importance within the wetlands of Mehedinti district, framed in 43 families and 18 order.

In presenting the species of birds of European importance within the protected, natural areas along the Danube in Mehedinti district, it has been added the information from standard forms Nature 2000 of sites ROSPA0026 the Course of the Danube Bazias-Portile de Fier, ROSPA0080 Almăjului-Locvei Mountains, ROSPA0011 Blahnita, ROSCI0299 Danube at Gârla Mare-Maglavit, from the Management Plan of the Iron Gates Natural Park (2013), the Integrated Management Plan of sites ROSPA0011 Blahnita, ROSCI0306 Jiana, ROSCI0173 Stârmina Forest, 2.605 Bunget Forest, 2.612 Stârmina Forest and ROSPA0046 Gruia-Gârla Mare (the frame which partially overlaps ROSCI0306 Jiana) (2005), but also from on-sight observations.

Also, there is an analysis of the measures implemented for preserving the environments of bird species of European importance from natural protected areas in Mehedinti district, situated along the Danube.

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ASSESSMENT OF ENDOTOXICOSIS AND HISTIDINE DIPEPTIDES PARAMETERS IN THE DESCENDANTS OF RABBITS TREATED WITH BIOR REMEDY

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Currently cuniculture represents a viable and promising branch of the agro-food industry. Rabbit breeders, as well as food business operators become more and more interested in this field, and for obtaining good profit, they are eager to implement new practices and technologies. As for the current rabbit breeding conditions, the stressogenic factors, different diseases which occur during the metabolic, organ and functional systems disorders, they can generate accumulation in different proportions of peptides with average molecular weight, and necrotic substances. Scientific publications provide information about the ability of peptides with average molecular weight to inhibit erythropoiesis, to cause immunotoxic reactions, etc.; these peptides being considered a nonspecific marker of endogenous intoxication. Despite this, remains unknown the action mechanism of the BioR remedy, obtained from Spirulina platensis, regarding certain marker parameters of endotoxicosis and histidine dipeptides in the descendants of rabbits treated with BioR remedy, reared in intensive conditions.

The experiments were conducted on 4 groups of young rabbits - from birth to weaning, descendants of the rabbits from 4 respective groups. BioR was administered to 3 out of 4 rabbit groups from which descended the young rabbits, intramuscular, using the following doses: 1; 1,5; 2,0 ml/head. The control group was administered 0,9% NaCl solution. Young rabbits did not undergone BioR treatment. For laboratory investigations, from 5 young rabbits each group, blood was randomly collected, at the 45th day of life. Clinical investigations have shown that BioR is well tolerated by rabbits, in various physiological states, as well as by their descendants. According to the obtained results, thought BioR, administered to rabbits, didn`t induce big changes in the average molecular weight peptides level in the rabbits descendants, the parameter registered a level lower by 8,3-13,7% compared to the control group. The dynamic of necrotic substances in serum, in young rabbits, was similar to that of the average molecular weight peptides. In result, the investigated parameter was 1,3-1,6 times lower in young descendant of rabbits treated with BioR, compared with the descendants of the rabbits to whom the remedy was not administered. The study also revealed that serum levels of histidine dipeptides - carnosine, considered as marker of the anabolic processes in the body, is higher by 4,5 - 23,5% in young descendant of rabbits treated with BioR, compared with the control.

Thus, the BioR remedy administered to adult rabbits is well tolerated, with a long duration of action, reducing the phenomenon of endogenous poisoning in rabbit descendants.

ECOLOGY OF MICROMAMMALS INHABITING THE TERRITORY OF THE STATION OF WASTEWATER TREATMENT PLANT OF BEREZA (BELARUS)

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Urbanization, which is accompanied by the transformation of man-made landscape and the pollution of the natural environment leads to a change in structure of the complex of the microtheriofauna. The study of the ecology of small mammals that live in urban areas is of great medical and epidemiological significance.

Territories of wastewater treatment plant (WWTP) are characterized by a number of specific environmental factors, above all, powerful microbiological and chemical contamination of soils and air. The organic mass contained on the station fields, attracts shrews (Soricidae), which feed on invertebrates of different taxonomic groups. In addition, a permanent evolution of heat during the decomposition of organic substances and the cooling of water increases the likelihood of survival in adverse cold period of year. Hilly surface of the territory of stations, sufficient moisture, a variety of herbaceous vegetation, and the lack (or small number) of predators, offer a favorable environment for the settlements of rodents.

Given the uniqueness of the environmental conditions, it can be assumed that the poorly known (possibly even rare) species of small mammals dwell in the territory of stations and (or) in the immediate vicinity. For example, lesser white-toothed shrew (*Crocidura suaveolens*) (inscribed in the Appendix of the Red Book of Belarus of latest versions 2004 and 2015.) is one of the dominant species in numbers near the Gomel city WWTP. However, systematic studies of the ecology of small mammals, living on the analyzed technogenic areas in Belarus are not held. The main causes of this circumstance are the absence of proper research programs and an acute shortage of professional mammalogists with practical skills of diagnosis of sibling species.

Field studies for collection of material were conducted from May to October 2015 on the territory of wastewater treatment plant of Bereza (Brest region) and the adjacent territory. The station is located in the south-eastern part of the city. Nearby are the residential private sector, garage cooperative and agricultural fields. The territory of the station almost completely covered with grass and shrub vegetation.

For catching of animals were used the modernized Barber's traps. Traps were set near the sludge drying beds and at some distance from them, among the thickets of weeds and bushes.

During the research 159 small mammals were caught, which belong to 8 species, 4 species of rodents (Rodentia) and insectivores (Lipotyphla): *Apodemus uralensis, A.*

agrarius, Microtus arvalis, M. oeconomus, Sorex araneus, S. minutus, Neomys fodiens, C. leucodon.

The list of species is preliminary and will be extended presumably for 3-5 species. It must be assumed that a few more species live on the territory of the station, such as *Rattus norvegicus, Mus musculus, M. rossiaemeridionalis, Micromys minutus* and others.

The capture of *C. leucodon* (a poorly studied species listed in Appendix Red Book of Belarus) and A. uralensis are of greatest scientific interest. Among the Belarusian mammalogists there is a perception on the prevalence of *A. uralensis* (the sibling species of *A.sylvaticus*). However, the status of this species is not indicated, even in the latest analytical work on the fauna of the Pripyatsky National Park. These results only partially correspond to the data. Firstly, at the station in Bereza was discovered *A. uralensis*, and, secondly, there are no migrants from forest ecosystems (*A. flavicollis*, *Clethrionomys glareolus*).

In further studies the collected material will be subjected to thorough morphological and anatomical analysis that will identify not only the population characteristics, but also the pathology in the skull structure, and the results will be compared with the information available from other regions of Belarus.

CURRENT STATUS AND DISTRIBUTION OF THE SPECIES *CYGNUS OLOR* (GMELIN,1789) IN MOLDOVA

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There was a sharp decrease in the number and a reduction in the area of nesting of mute swan. Nesting places of mute swan at the end of the first half of the XX century are preserved only in the flooded areas of the lower reaches of the Dniester and Prut Rivers. After the ban of hunting and climate mitigation, alongside with a decrease in the number of severe winters, the population of this species has stabilized and then began to increase rapidly. For example, in the 80s of the 20th century, on the 200 hectares of flooded area, near the village of Antoneuca, Cantemir district, about 20 pairs of swans have made nests, and 2 pairs - on the lake of 10 hectares near Leova town. There are few main reasons of this phenomenon: adaptation to the man's presence as a result of many years of prohibition of hunting and the increase in summer fodder resources as a result of eutrophication of water reservoirs.

The above mentioned reasons combined with high fertility of species led to the observed increase in the number and appearance of new nesting places. At present, main groups of mute swan exists in the lower reaches of Dniester and Prut Rivers. Some pairs can be met on water reservoirs throughout Moldova. About 20-25% of the population starts with breeding. The main accumulations of immature and idle birds are found in the lower reaches of the Prut and Dniester (the lakes near the village of Manta, Slobozia Mare -3 thousand, on the Dniester - 0.6-1 thousand). In July, there is a redistribution of accumulations and an increase in the number of swans in connection with the movement of birds for molting. The main groups of molting swans are on the waters of reservoirs the lower reaches of Prut and Dniester.

The main wintering grounds of mute swans in Moldova are located on the Dniester. During 2000-2016 the growth of the population from 0.5 to 6.5 thousand individuals were observed. Thus, according to O. Mantorov et al (2016) on the site Naslavcea-Calaraseuca with the length of 24 kilometers 2567 individuals were observed and recorded in 2015, on the site Calaraaeuca- Ungur with the length of 8 kilometers was noted and taken into account 447 individuals mute swan, in the area of Oclanda – Unguri with the length of 27 kilometers -1332 individuals, in the area Kremenchug- Kureshnitsa with the length of 18 kilometers - 2423 individuals. It is the most numerous wintering species at this sector in the middle Dniester. This species keeps in broods, with young birds, and large clusters on large shallow areas of the Dniester: Naslavcea, Verejeni, Mereseuka, Valcinet, Ocnita, Otaci, Unguri of Ocnita district, Rud-Arionesti tract in Donduseni and Soroca districts, Balintsy, Iarovo, Oclanda, Kre-

menchug, Holosnita, Kuresnita from Soroca district. The largest accumulations are observed near Kuresnita, Holosnita, Naslavcea, Verejeni, Mereseuka. It winters often with whooper swan, but the latter is inferior in number, and in addition, it keeps in the groups separated from mute swan.

In winter swans sometimes die. It happened many times in severe winters in the waters of the Dniester and Prut. A considerable number of birds, mostly young, die every year. For example, in Western Europe about 50% of young birds perish, on the Azov-Black Sea wintering in Ukraine die from 10 to 85%. Overall growth in the number of mute swan is limited by the wintering capacity and it periodic death as a manifestation of the regular population processes.

Population of mute swan in Moldova is characterized by significant fluctuation in the number in the result of birds' death during wintering time and high reproductive potential (laying of 3-9 eggs, in average 5.8 eggs; broods of 1-9 chicks, in average 4.8 chicks). Moldovan part of mute swan population is characterized by a high nesting conservatism. Changing the nesting place of local groups is only possible in the case of significant changes in wetlands. Mute swan as a whole group of waterfowl has generally quite high adaptive capacity, in view of the high plasticity of the species. An important role in this is played by the favorable attitude of the population to this species.

The study was performed within bilateral project between Moldova and Belarus.

ABOUT THE EVOLUTION OF HOLLOW-NESTING BIRDS IN THE REPUBLIC OF MOLDOVA

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At the present stage of ornithology development hollow-nesting birds are increasingly becoming as model objects in the research on many fundamental problems of evolutionary and population biology. In recent years, a special conference was dedicated to this group of birds (Zvenigorod, 2014).

In the Republic of Moldova this group of birds includes several species belonging to the primary and secondary hollow-nesting birds. Since the 1970-s representatives of this group have permanently changed their status both in species and quantity.

To primary hollow-nesting birds belong woodpeckers, among which in Moldova could be met *Dryocopus martius, Picus viridis, Picus canus, Dendrocopos syriacus, Dendrocopos major, Dendrocopos medius and Dendrocopos minor*. Secondary hollow-nesting birds – is a large group of species mostly passerine that settled in hollows made by woodpeckers. Secondary hollow-nesting birds are presented at the moment by 25 species: *Columba livia, Columba oenas, Otus scops, Asio otus, Athene noctua, Strix aluco, Coracias garrulus, Upupa epops, Jynx torquilla, Corvus monedula, Sturnus vulgaris, Passer domesticus, Passer montanus, Certhia familiaris, Sitta europaea, Parus major, Parus coeruleus, Parus palustris, Ficedula hypoleuca, Ficedula albicollis, Muscicapa striata, Phoenicurus phoenicurus, Phoenicurus ochruros, Motacilla alba, Erithacus rubecula*. Among these birds often nest in hollows the following: *Phoenicurus phoenicurus, Phoenicurus ochruros, Sturnus vulgaris, Passer montanus, Sitta europaea, Jynx torquilla*.

Significant changes in have been taken place in the Moldova's landscape influenced by human activity, which resulted in the changes of avifauna in general and in the fauna of hollow-nesting species. These changes have affected the appearance of new species in nesting avifauna (*Dendrocopos syriacus, Picus viridis, Phoenicurus ochruros*), as well as an increase in the number of *Ficedula albicollis* and the disappearance of *Ficedula hypoleuca*. Earlier, in the middle of the twentieth century several pairs of *Phoenicurus ochruros* nested only on the rocky shores of the Dniester River. In later years its number and spreading began to grow very quickly and by early 2000s it became common species especially in the populated areas.

At the end of the twentieth century a strong conversion of forests (deforestation of old-growth forests) took place, as well as major changes in horticulture policy, expressed in the transition from the old gardens to stunted palmettegardens where

woodpeckers could not cave hollows.To date the old gardens almost completely gone. In addition, if earlier forest enterprises were responsible for hanging artificial nests for birds in all forest biocenosis, at the present time, such work is not carried out at all. It is immediately reflected in the number of species from of hollow-nesting group. So, in the middle of the last century in Central Codri, hollow-nesting birds accounted for 40% of all nesting birds in the forest, and then their share has decreased to 28%, and by 1975 they accounted for only 22% (Ганя, 1981). Due to the transformation of forest ecosystems, has decreased the number of spotted woodpecker - suppliers of hollows for secondary hollow-nesting birds. If in the middle of the last century *Dendrocopos syriacus* was widespread in all old gardens and its number did not concede for *Dendrocopos major*, then in present, its number reduced as well as the number of *Dendrocopos major*. However, the distribution of *Dendrocopos syriacus* is now associated with forests, parks and partly with forest belts because practically no more old orchards left. The number of *Picus canus* also decreased, it is now common mostlyin the floodplain forests, although previously nested in old gardens. Distribution of *Picus viridis*is limited by the northern border of the country, where 1-2 pairs are nesting. It should be noted the appearance of nesting 1-2 pairs of *Dryocopus martius* in the forests of Central Codri. Gradually, its numbers are growing although slowly. Currently, the number of woodpeckers in forests is very low even lower than the density of the natural hollows, where secondary hollow-nesting birds can nest, which creates the need for hanging of artificial nests for birds in forests. If we compare the number of woodpeckers in forests and in the anthropogenic landscape, than in forests is observed the greatest number of *Jynx torquilla* - 13,6 individuals per 100 ha against 2,8 in anthropogenic landscape, at *Picus viridis* (1,2 against 0), *Dryocopus martius* (1,2 against 0), *Dendrocopos medius* (9,3 against 5,7) и *Dendrocopos leucotus* (2,4 against 0), at the same time at 4 species of woodpeckers – *Dendrocopos major* (23,2 against 10,0), *Dendrocopos minor* (12,0 against 3,3), *Dendrocopos syriacus* (15,3 against1,6) и *Picus canus* (4,7 against 1,8) at the end of the last century the number was higher in anthropogenic landscape (Glavan, 2004).

In Moldova's forests in the middle of the last century, artificial nests were occupied by 6 species of birds: *Ficedula hypoleuca, Parus major, Phoenicurus phoenicurus, Passer montanus, Sitta europaea, Jynx torquilla*. The bulk of birds, nesting in nest boxes have 3 dominant species. *Parus major*, *Ficedula hypoleuca* and *Passer montanus*. However, by the end of 1970 *Ficedula hypoleuca* ceased to occupy nest boxes and the number of its in forests began to decline rapidly. Its place was taken by *Ficedula albicollis*, which together with *Parus major* dominated in artificial nests. In subsequent years, the situation has not changed, and these two species continued to be dominant in the population of hollows in forests.

Within the central part of Moldova's forests artificial nests are occupied by 6 species of birds, 3 of which (*Parus major, Ficedula albicollis* and *Passer montanus*) are the most numerous. The population of birds nesting in artificial hollows is formed firstly under the influence of anthropogenic load. Minor significance has weather during separate breeding seasons.

In habitats near the settlements irreversible processes of occupation of artificial nests by *Passer montanus* take place, whichis undesirable rival for hollow-nesting birds.

In the urban environment *Parus major* and *Ficedula albicollis* are characterized by decreasing of basic reproductive parameters (clutch size, reproductive success). Weather features, in addition to the direct influence of temperature, affect the basic reproductive parameters of both species indirectly through the availability and abundance of food items.

The effect of abnormal heat on the natural dynamics on the number of hollow-nesting birds in Moldova's forests is not yet clear, though some literary sources report a notable reduction in the number of *Dendrocopos medius* and *Parus major* in forests of Belarus in response to extreme weather conditions. As a possible causewasidentified some biological features of these species, for example, the fact that they do not make feed stocks for the winter time. Subsequently, their numbers recovered to average of long-term levels (Косенко, 2014).

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DIVERSITY OF THERIOFAUNA FROM PALEOLITIC STATIONS OF MUSTERIAN CULTURE FROM TRINCA II GROTE

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Trinca II grotte is located on the right side of the picturesque gorge in the south west of Trinca village, Edinet district, about 70 m southwest of the cave Trinca I, at the height of about 50 m from the Draghişte River, a tributary of Racovăţ river. Trinca gorge was formed over geological epochs of Badenian and Lower Sarmatian (sublevel Volhinian) (20-12 million year ago) as a result of fluvial erosion of the river Draghişte in nearby limestone rock, which is a fragment of uniqueness string of Recife or Toltres from northwest of Bessarabia. Also, the walls of the gorge from Trinca along millennia under weathering and tectonic processes formed grottoes and niches, which later served as temporary or long-term housing for prehistoric people.

In the walls of the gorge from Trinca archaeologists have discovered and studied so far three caves with traces of existence (primitive tools of hunting and household made of flint and bone, skeletal remains of hunted animals) of the prehistoric men from middle Paleolithic (Neanderthals) and upper Paleolithic (Kromanions) (Анисюткин et al., 1986).

The paleofaunistic material discovered at Musterian sites of human habitation at levels IV and V of the grotto Trinca II is of particular scientific and archaeological interest

As result of systematic position identification of about 1000 skeletal reminiscences the presence of following animals (mammals) was established: fox – *Vulpes vulpes* L.-18/4*, arctic fox - *Alopes lagopus* L.-1, fox-*Vulpes* sp., -7/2, Cave bear – *Ursus spelaeus* Rossen.-243/10, Cave hyena -*Crocuta spelaea* (Goldf.) -9/3, Polecat-*Putorius* sp. -4/2, Wolverine - *Gulo gulo* L.-1, Hare – *Lepus* sp.- 14/7, Cave pika - *Ochotona spelaea* Owen. -4/3, Steppe marmotte-*Marmota bobac aff. paleorossicus* Grom. -12/3, lesser mole-rat -*Spalax leucodon* Nord.-5/1, coomon hamster – *Cricetus cricetus* L.-2/2, vole species: *Microtus gregalis* Pall.-11 M1+2 M2/6. *Lagurus lagurus Pallas, Eolagurus luteus Eversmann, Microtus socialis Pallas, Microtus oeconomus Palla, Clethrionomys glareolus Schreb.,* mammoth -*Mammuthus primigenius Blum.-5/,* horse –*Equus latipes Grom.-194/7, Equus (Asinus) hidruntinus Reg.-1*, whooly rhinoceros-*Coelogonta antiquitatas (Blum.) 8/2,* deer – *Cervus elaphus L. 2/1,* reindeer - *Rangifer tarandus L.- 176/7,* chamois – *Rupicapra rupicapra L.-, bison –Bison priscus Boj.-22,* unidentified bones -126.

Note. * Nominator – number of scheletal remains, denominator – number of individuals.

Association of fauna highlighted in Paleolithic Mousterian stations from the cave Trinca II comprises mainly large hunting animals (horse, cave bear, reindeer, mammoth and others), which were the main feed for people from these staions and their skins were used as bedding on the hard, cold and wet cavern floor and making clothes for cold and long winters of those times.

The most common animal in the reef from Trinca, as well as in other reefs with caves in northern and north-western Moldova in Paleolithic was the cave bear. In Musterian caves from Trinca II there were registered cranial fragments, limbs, other skeletal parts, many teeth. The most interesting skeletal piece proved to be a fragment of upper jaw with teeth Pm4 –M2, whose length is 94 mm, length of 10 upper teeth M2 solitary crown ranges from 42.8 to 51.0 mm.

The latipes horse, the reindeer and the bison were frequent in the reef and the gorge from Trinca in medium Paleolithic and very required by hunters, fact proved by their bones found in Neanderthal hunters houses.

Mammoths rarely appeared in these places, probably due to the steep landscape unsuitable for these giants. In grotte only 4 teeth were found (a premolar Pm 4), two upper molars M1 and M3 and a lower molar (M1) and hollow bone fragments (David, 1998).

Among skeletal pieces discovered in inhabited levels of Neanderthals a jaw fragment with lower row of teeth lower premolar Pm 2 -PM 4 of the PM1 of Gulo gulo is of great interest – it is the second discovery in the Pleistocene of Moldova (first is known from Paleolithic cave Duruitoarea Veche, Rascani district) of this carnivore, which at present lives in far northern areas of Eurasia and North America.

In the caves of Neanderthals from Trinca II grotte other unique mammalian skeletal parts were discovered. In the level V a lower M1 tooth (crown length is 15.2 mm and 8.8 mm height thereof) was found belonging to the goat – Rupicapra rupicapra, while at the IV level - a few fragments of bone and molars of whooly rhynoceros with strong corns on nasal bones (*Coelodonta antiquitatis*).

It was established the presence in Neanderthals caves from Trinca II grottes of rodent skeletal remnants. The bones, rabbit and marmot are "kitchen scraps" of people who lived in the cave, while the remains of pika and voles (*Mictotus gregalis M. socialis, M. oeconomus*, *Lagurus lagurus, Eolagurus luteus, Clethrionomys glareolus*) mentioned above, come from the decomposition of pellets and prey mammmald and birds excrements, temporarily occupying the cave when abandoned by men.

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FAUNA OF REPTILES FROM MIDDLE PLEISTOCENE LOCATION OF KHIRKA

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Middle Pleistocene location is located in the sand pit in the northeast of the village of Khirka Anenii Noi district. The cut consists of two packs of the alluvial deposits. The fauna of reptiles was found in the bottom of the first pack in the diagonal bedded, medium-doped with clay and pebbles of Carpathian sands.

Fossils of turtles are represented by bony plates and their fragments. There were identified the following species: *Emys antique* Khosatzky, 1956, *Melanochelys mossoczyi* (Mlynarski, 1964), *Sakya* sp.

Fossil remains of lizards are represented by fragments of the upper and lower jaws, osteoderms: there were identified the species *Lacerta* sp., *Pseudopus* sp., *Anguis* sp.

Fossil remains of snakes are represented by isolated vertebrae, for diagnostics only trunk vertebrae were used. The following species were identified: *Coluber gemonnensis* (Laurenti, 1768), *Natrix longovertebrata* Szyndlar, 1984., *Natrix natrix* (Linnaeus, 1758), *Coluber* sp.

The reptile fauna of the studied location consists of two ecological groups. The group of aquatic and semi-aquatic reptile is represented by turtles from genera *Emys, Melanochelys, Sakya* and by snakes from genus Natrix. The forest-steppe group is represented by genera *Lacerta, Pseudopus, Anguis, Coluber.*

This reptile fauna belong to Tamanian faunistic complex, biozone MNQ19.

The work was performed within the fundamental project 15.187.0211F.

RESULTS OF WHITE STORK *CICONIA CICONIA* CENSUS IN BELARUS (2014-2015) AND MONITORING POPULATION IN KEY BREEDING AREA

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White Stork is one of the oldest scientific and educational objects of regular monitoring programs and international collaboration. Belarus has officially joined to the international stork censuses in the 1970s only, but the national censuses started in 1957.

In 2014/15 the national White Stork census was organized in the framework of the VII International Census with support of NABU- Naturschutzbund Deutschland. The census was coordinated on the national level by Scientific and practical center of NAS of Belarus for biological resources (Institute of Zoology) and NGO "Akhova ptushak Batskaushchyny" (APB-BirdLife Belarus). Collection of census data was conducted in two ways. For a wide coverage of all administrative regions questionnaire method was used. Paper and electronic forms were distributed to all 118 districts of Belarus. Full (absolute) census of White Stork on 25 sample plots (13 190 sq. km, 6.4% country area) was organized additionally for verification and correction of questionnaire data. The area of sample plots ranged from 50 to 2 000 sq. km. They have been located in the same places during last two censuses - in 2004/05 and 2014/15.

Dynamic of White Stork numbers and distribution in Belarus were analyzed on the base of questionnaire data from eleven national censuses including the last one. So decline of numbers was observed from the end of 1950s until the mid of 1980s, and since the mid of 1990s the increase of numbers was started. Comparison census data for the territory of sample plots showed the number of breeding pairs increased by 3.7% during the last decade.

After correction of available data and its extrapolation the Belarusian population was estimated to be around 22,000-22,500 breeding pairs in 2014/15, mean breeding density - 10.6 breeding pairs/100 sq.km (StD). The highest breeding density was recorded on sample plots in southwestern and western regions, with maximum of 48.7 breeding pairs/100 sq.km. The lowest density occurs in the northern and in the eastern regions located close to the eastern border of current species range.

About 7% on breeding pairs in 2014 was unsuccessful (HP0) and it was almost twice higher than in 2004.The mean brood size on sample plots was 2.4 fledglings for breeding pairs (JZa) and 2.6 for successful pairs (JZm).

According to the questionnaire data of 2014/15, the proportion of nest on different support was following: trees - 28.2%; roofs – 12.6%, pylons – 40.6%, water towers –

16.4%. For comparison, all stork nests in Belarus in 1967 (Tarletskaja 1969) were situated on the trees (69.5%) or on the roofs of building (30.5%).

During the last national censuses, the highest numbers (HPa, StD) and highest breeding success (JZm, JZa) were registered in areas along Pripyat River. Monitoring of numbers, distribution and breeding biology were conducted in 1991-2015 in Pripyat River floodplain on monitoring plot "Turov" with area of 330 km^2. Breeding numbers have increased here almost twice from 1991 (115 pairs) to 2014 (217 pairs). But the catastrophic decline in the numbers as a result of the extreme dry and low water season was observed here in 2015 (180 pairs). The breeding success also was the lowest for all period of our investigation: an average of 1.9 fledglings for breeding pairs in 2014 and 0.8 - in 2015; and 2.4 fledglings for breeding pairs in 2014 and 2.0 in 2015 in 2015.

Spatial redistribution of breeding pairs occurred in floodplain area during the last decades because of meadows lost due to afforestation and overgrowing with bushes. Only 62% of the stork nests were located inside human settlements in 1974, and 99% of birds were breeding here in 2014 and 2015. Mean brood size (JZm) is positively significantly correlated with hydrological conditions in the spring – duration of flooding and water level in Pripyat River. JZm and JZa are higher in the area along riverbed (< 2 km) in comparison with area situated on the distance > 2 km from it. Compared with 1974, proportion of nests on trees and buildings decreased significantly from 51.6% to 1.7% in 2015, and from 41.9% to 11.1% respectively. At the same time there has been a steady increase in proportion of nests on electric pylons: from 1.6% to 69.4%.

In total the increase of synanthropization in White Stork population took place during the past decades in Belarus. Despite Belarusian White Stork population is still numerous nevertheless it is necessary to take protective measures for preserve of the species and its optimal habitats.

Census work in 2015 (collection of missing data) and the data analysis were carried out with the support of the Belarusian Republican Foundation for Fundamental Research (project 215MLD-026). The White Stork investigation in framework the project conducted in collaboration with ornithologists from the Institute of Zoology of the Academy of Sciences of Moldova.

ABOUT THE FINDINGS OF HAZEL DORMOUSE (MUSCARDINUS AVELLANARIUS) IN SOUTH-WEST OF BELARUS

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The common dormouse (*Muscardinus avellanarius*) – one of the little-known species of theriofauna of the country, listed in the Red Book of Belarus (2015) (IV category of national protection).

In the spring of 2016 we collected the pellets of long-eared owl (*Asio otus*) in 'island' pine forest in agricultural land near Lozica village (Malorita district), as well as in Malorita town (Brest region). The complete data on dates and collected matterial are presented in the table.

Place where pellets collected	Collection date	Quantity of pellets	Quantity of *M. avellanarius*
Lozica village	27.04.2016	45	7
	20.05.2016	21	2
Malorita town	07.05.2016	22	1
	20.05.2016	13	1
Total		101	11

Fig. Lower jaw of *M. avellanarius*

The data shows not only significant trophic effect of long-eared owl on the local population of hazel dormouse, but, obviously, the high number of the mammal. Regarding this, in the course of further research it is necessary to:

– determine forest squares where rare species of dormouse inhabits (as is known, hunting range of Long-eared owl is about 1 km^2 from day's rest place).

– import the identified squares in the appropriate information systems in order to limit economical activities in the habitat of hazel dormouse.

- inform appropriate services (representatives of Ministry of Natural Resourses and Environment Conservation and Forestry Department) about the places where rare mammal lives.

It should be noted that agricultural activities in the territory of Malorita district are intensively conducted.

It is relevant to propagandize (through the mass media) the respect for forest resourses of the region.

STRUCTURE, LOCATION AND NUMBER OF WOLF POPULATION IN THE REPUBLIC OF MOLDOVA

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Scientific studies have established that ecological changes of the ecosystems related to the presence of top predators such as wolves, can restore the balance in wilderness areas where the presence of characteristic trophic sources (large ungulates) are abundant, increasing their stability and biological diversity. In the conditions of Moldova the return of the wolf in 2000s in anthropized ecosystems on the background of a number of wild ungulates far below optimal limits brought to the decreasing of this number, particularly in places of their concentration, with quite strong impact on the farms.

The wolf survey in the last years shows that the wolf population in Moldova can be assessed at about 80-90 specimens and is at the phase of structuring and accommodation toward trophic and shelter conditions with the formation of reproductive nuclei in the central zone (Vâșcăuți-Susleni-Tribugeni with the center in forest stand Țâganca; Bârnova–Seseni-Isacova; Petrosu–Măgurele-Bursuceni; Cărbuna-Rezeni-Puhoi; Văsieni–Costești-Sociteni; Strășeni-Sadova-Micleușeni; Gârbăvăț-Copanca-Căușăni and on left bank of Nistru River in Carmanovo-Colosovo) and in the southern zone (Tomai-Cneazevca-Beștemac; Beșgioz-Tvardița-Djoltai; Taraclia-Carbalia) (fig. 1), dislocated mostly outside forest stands at ecotone areas of agrocenoses. In parallel there were observed the expansion of jackal hounds occurred in the south of the country in the early 2000s, which are increasingly common in Nistru and Prut floodplain area (about 9-10 groups with a number of over 120 jackals).

Given the territorial needs of the wolf - no more than two wolves in 10 thousand ha, and to satisfy the correlation of 1:150 between predator and prey for ecological equilibrium conditions, including trophic requirements, it would be need to have 300 deer and wild boar on the republic territory.

In central Codri area on about 100 thousand ha around 40 wolves inhabit, forming 6-8 reproductive hounds, thus having a density of four wolves per 10 000 ha. Also, we must acknowledge that the concentration of wolf hounds is observed in areas with a high density of deer, where the wolves' density is much higher. At the same time, here there were estimated about 240 deer, 2200 roe deers and nearly 500 wild boar, ensuring only half of wolf trophic needs. Thus, it is forced to attack sheepfolds and cattle left without supervising at grazing, as was noticed in spring of this year (2016) near Bardar, Getlova, Susleni, Sociteni, Costești, Căușeni, Hârbovăț villages. Sometimes, the wolf also hunts small animals (hares and even domestic birds near localities). Because in these conditions the wolf is not provided with specific trophic sources, in the vegetation period and often in winter the wolves can hunt in small reproductive groups

(2-3 individuals), often frequenting the places of storage of meat processing industry waste. This type of adaptive structuring of population, determined by the trophic specificity in anthropic conditions favor a higher percentage of reproductive females and finally a numeric jump of wolf population, which under current conditions is an important factor in annual increase of deer populations that at present became the main trophic object in forest ecosystems as well as in agrocoenoses (along with the reestablishment of "field" ecotype). The main problem is not the damages caused to farms by attacking unprotected animals, but it is in the deacrease of the hunting fauna number and primarily ungulates.

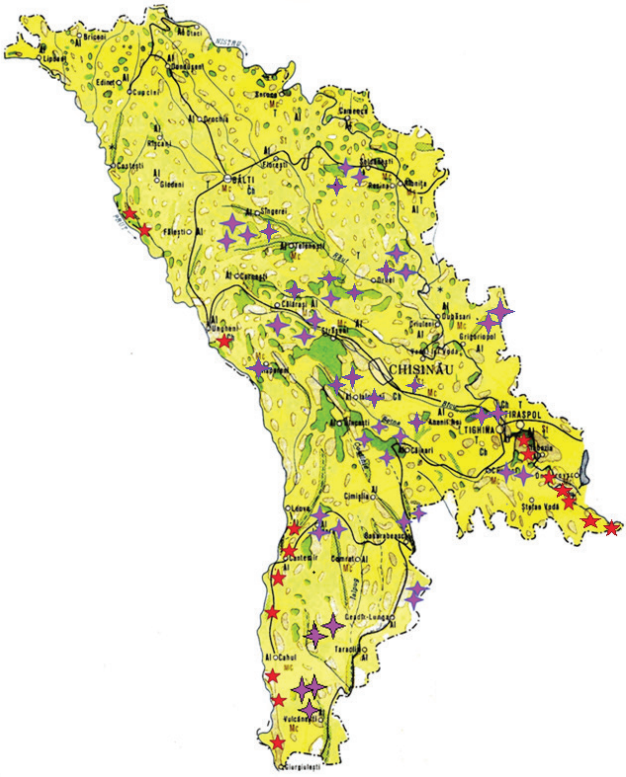

Figure 1. Distribution of wolf ( ) and jackal ( ) hounds recorded on the territory of Moldova in the period march 2013 - may 2016

In order to return to a balance in relations between wolves and fauna of ungulates there are required studies on localization of wolves' hounds, assessment of reproductive process and of mechanisms regulating this process in accordance with the distribution and number of prey species. The mechanism of coexistence of predators in anthropized ecosystems requires the implementation of a strategy to prevent the damage at national level and of compensation systems of damage caused by predators protected by national and international laws in line with the appropriate management of these species.

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STRAY DOGS IN THE CITY OF YAKUTSK

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The city of Yakutsk is classified as a large city, there are about 1/3 of the population of the Republic (315,951 thousand). It is the administrative, cultural and scientific center of the Republic of Sakha (Yakutia). Industrial enterprises here are mainly for the sustenance of the population of the city (food and processing industry, combined heat and power) and do not form the zone of continuous development. The natural conditions can be included as the specific environmental conditions. The climate of the region is sharply continental, with cold winters, the average January temperature is about -40 C. however, for a short summer period is characterized by little precipitation and high temperatures up to +40 °C. Annual amplitude of Yakutsk is one of the largest on the planet, and greater than 100 °C.

Among the environmental problems of Yakutsk deserves special attention deserves a problem of stray dogs. Despite the harsh temperature conditions in winter, due to the architectural specifics of the Northern cities (Yakutsk is in the zone of continuous distribution of permafrost, in connection with which all high-rise buildings built on a pile Foundation), dogs-pariah find here suitable conditions of existence for the entire year. Naturally, the population of street dogs in such conditions also has its own characteristics of size and distribution on the territory.

The aim of this work is to assess the size and structure of the population of street dogs in the city of Yakutsk. Thus our task includes: definition of the number of street dogs in different types of urban environment, identification of population dynamics and peculiarities of the morphological characteristics (size and color).

The census of the population of street dogs in the city of Yakutsk was carried out in 2011-2015 the modified method of sample accounting was used [Poyarkov, 1986] at 12 test sites located in the two main types of urban environment: residential high-rise residential and one-storey. In the study area the area of these two types of environment stood at 6.81 and 3,72 km2, covering census – 8.1 and 14.5% respectively. An account at each site was carried out by triple bypass. Stray dogs were grouped into three categories: the homeless street dogs constantly living in the area of accounting, the homeless stray dogs are temporarily present at the site, street owners dogs.

The population density of street dogs in the city of Yakutsk for 2011-2015 varied quite considerably - from of 22,09 to 107,76 individuals/km^2, peaking in December 2013, a Sharp decline in population density of street dogs in the winter of 2013-2014 related to activities to reduce their numbers, held by the mayor of Yakutsk, in this period, but already in the autumn of 2014 the number of dogs began to increase, and continues to the present time.

In General, two types of environment, there were significant differences in the population densities of neglected dogs, both in housing types and discount sites, dedicated to different neighborhoods. So, in an apartment type environment indicator varied within 3,7-41,6 individuals/km^2, whereas in areas of single-storey blocks of 23,02-99,0 individuals/km^2. This is because these areas adjoin with the zone of industrial development, where survival of dogs is promoted by a number of such favorable factors as the availability of shelters for breeding and minimal disturbance by humans. In addition, marked variations in abundance according to season: in spring and summer urban street dogs dispersed around the town and suburban areas, which is reflected in the lower measurements, and with the end of the summer season the number of dogs in the city increases. In this population of street dogs in the city are constantly being updated due to the high waste in the winter period, and also due to the replenishment of lost and abandoned dogs at the end of the summer season. The percentage of sedentary individuals is only the 38,2, while migrating – 28,9, and aliens 32,9 percent. The blocks of residential one-storey building was inhabited by more sedentary dogs, whereas in areas of high-rise buildings more migrants and newcomers.

The most predominant type of color is black (52,6 per cent). Light and dark colors respectively, and 27,9 per of 19,43 %, and this ratio remained virtually unchanged over the years. Based on our observations, the black and bright colors was due to a more thick, long hair and are representatives of the best type of addition, whereas a dark color is available to representatives of the smooth-coated dogs with long and thin body Constitution. Much less common are small dogs and very large ones can be seen very rarely. This can be explained by the fact that in the North, neglected dogs are subject to rigid action of natural selection.

RUDDY SHELDUCK DISTRIBUTION IN THE REPUBLIC OF MOLDOVA

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The Ruddy Shelduck (*Tadorna ferruginea,* Pallas, 1764) has an extremely large range (8 410 000 km^2), with a global population between 170 000-220 000 individuals (Wetlands International, 2006). This is why the species is globally evaluated as *„Least concern"*, according to the International Union for Conservation of Nature (BirdLife International 2015). The species is known to be breeding since the XIX century in this country, being recorded by several ornithologists during the years.

The area of our study covers the territory of the Republic of Moldova, located in the South-Eastern Europe (33 843 km^2). In the south of the country lies the Moldovian South Plain (known as the Bugeac steppe), which has a surface fragmented by large valleys and cut by ravines, thus being a suitable breeding habitat for the Ruddy Shelduck`s.

Our observations encompass the 2013-2016 period, focusing on recording the breeding seasons. These data are part of wider studies, censuses and monitoring projects carried out since 2013 up to now. During these studies we combined different methods: from fixed points to transects of minimum 2 km between 05:00-10:00 AM. The last method was used only in 2016, as part of a larger project designed to record the breeding species from Republic of Moldova. During the last 4 years (2013-2016) we recorded 12 breeding pairs of Ruddy Shelduck in the Southern part of The Republic of Moldova (Figure 1). Because there are only few information of Ruddy Shelduck at the national level, we will describe shortly our observations.

Congaz lake – in the summer of 2013 there were observed two Ruddy Shelduck pairs with chicks. In June 2015 and June 2016 we encountered a pair with 4 chicks, while on the 21st of May 2016 we observed two families followed by 10 chicks.

Bugeac lake was monitored since the summer of 2015, when a pair of Ruddy Shelducks was observed close to the lake. On the 25th of April 2016 we encountered again a pair, while in May 2016 we noticed an adult on a meadow having distraction behaviour. Although we didn`t notice any chicks, we assume the breeding of the species is

confirmed in this location, due to birds` behaviour and the time when the observations were made.

Taraclia lake is another place where we documented yearly the presence of the Ruddy Shelduck during the breeding season. In June 2013 we noticed a pair with chicks, and then in June 2015 we saw two pairs with chicks. In May 2016 we counted a group of 18 adults of Ruddy Shelduck on the lake.

Svetlîi wetland, situated as well in the Ialpug river meadow is another area where we recorded a pair of Ruddy Shelduck. In June (2016) two adults of Ruddy Shelduck were observed followed by 7 chicks near the lake. In the vicinity of Valea Perjei village (Taraclia distrinct), very close to the Ukrainian border, we noticed a pair of Ruddy Shelduck with 3 chicks on the 1st of June 2015. The record wasn`t followed by other observations, so we don`t have other data which can confirm the regular breeding of this species around the lakes neighbouring the village.

In the summer of 2013 was recorded a flying pair close to Jepar lake (Cimișlia distrinct), near Cimișlia city (Vlad Cioflec, *in verbis*). In April 2016, Cioflec V. mentioned (*in verbis*) two records of Ruddy Shelduck: a pair close to Cioc-Maidan village (Autonomous Territorial Unit of Gagauzia) and one in Ciucur Mingir village (Cimișlia distrinct). As the observations were made in spring, during the courtship display, and were not followed by any other records during the breeding season, we will consider the breeding of the Ruddy Shelduck probable in these two places. The same author mentioned the presence of a Ruddy Shelduck pair in the vicinity of Cenac village (also Cimișlia distrinct) in April 2016. Taking into consideration the very short distance between Cenac and Javgur villages (8km), where a team of Czech ornithologists noticed a pair in flight in the summer of 2013, we assume this might be the same pair which could be breeding in the area. Unfortunatelly, we don`t have any data in order to confirm the breeding.

A pair of Ruddy Shelduck was observed in flight between Iargara and Romanovca villages (Leova distrinct), in Sărata river meadow. The flying birds, most probably, were looking for a nesting place, and having in mind the time when they were observed, we suggest the species is breeding somewhere in the Sărata river meadow, downstream from Sărata Nouă lake.

The most eastern observation of the Ruddy Shelduck is close to Sălcuța village (Căușeni district). We recorded a pair of Ruddy Shelducks on the 28th of May 2016, in early morning. Although we didn`t notice the presence of any chicks, we assume the pair was breeding, as both the adults showed a distraction behaviour. The birds remained still on the ground and didn`t move from the initial place, which led us think there might be a nest or even chicks close to us.

The only location on the Prut river valley we have data from is the Manta Lake. There, in the vicinity of Pașcani village (Cahul distrinct), we recorded two observations. The first one is regarding a pair, noticed on the 5th of June 2014, while another pair was observed in May 2016 (Ion Grosu, *in verbis*). For now, we don`t have data to confirm the breeding in this area.

Section II
INVERTEBRATES

MEASURING THE DEPENDENCE OF FAUNAL RICHNESS ON FLORAL RICHESS

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Studying the formation of local faunae and the likelihood for presence of vulnerable and rare species in core areas of ecological network and poorer refuges is the ground for scientific-practical valuations. Biodiversity territorial assessing, planning the nature protection, weighing the ecosystem shifts in transformed milieu and appraising a capacity for adaptation to changes in landscapes and habitats are among these. A part of that matter is dependence of faunal richness (in insects, other invertebrates, mammals, birds) on the floral richness that follows, in a way, diversity of habitat types. I considered that issue versus a simplified habitual approach distributed among conservationists – description of plant diversity is adequate to description of diversity in a community. It was shown (Андреев, 2002) that masking, imitating and amplifying factors mediate the dependence. Thus, adding a new plant species in a site increases likelihood for new insect species; the adding declines average space of other plants that declines probability for populating the other insects dwelling these plants. Lenz (1991) had shown influences on Odonata of factors: (1) spatial niche diversity – habitat architecture forming by plants; (2) abiotic niche space narrowing by pollution; (3) habitat square inducing statistically the species accumulation; (4) habitat isolation (fragmentation) impeding the accumulation. Correlations of species numbers were: important positive with the factor 1, very strong negative – the factor 2, very weak positive – the factor 3 and very weak negative – the factor 4.

There are animal taxa independent or very dependent on species richness and structural diversity of plants. Therefore the above mentioned habitual approach is poorly grounded.

It would be naturally to think the presence of habitats of certain types and of corresponding them plant associations with totality of these habitats determine plant species richness in the limits of a discrete natural (subnatural) site. How that certainty strong?

There are now data on some taxa and theoretic notions while direct estimates for significance of relations between richness of flora, fauna and habitats are absent. Mainly published data (Andreev et al., 2012) on 151 feasible and identified Core Areas of National Ecological Network (NEN) allow such estimates. Direct estimating the dependence of species richness of highest plants and numerous insects is impossible. Hence relations of highest plants species richness, on the one hand, and insects from Operational List (OL) of the NEN and from lists of protected species, on the other hand, are estimated. OL is ample for use of statistics and data on many sites are. At the

same time OL includes rare species that are present with a probability in each place and may be not fixed. In such cases, therefore, zero values were substituted by the tiny constant. In other cases (highest plants, birds and mammals) incomplete data pairs were removed and the shortest length of samples became 77 pairs.

All parametric correlations of insect and plant species numbers were significant ($p < 0.05$). But, these are quite weak for OL species – coefficient $k_p = 0.58$ – and for species of Red List (RL) of Moldova (in conformity with law) – $k_p = 0.65$, coefficients for species from annexes of Bern Convention and EU Habitat Directive are weaker (0.48 – 0.36). Determination coefficients (R^2) vary in limits 0.13 – 0.42. That may be linked with (1) inequality of linear regression model, (2) real weakness of correlations, (3) acting the uncertain factors. Nonparametric (Spearman's, Kendall Tau and gamma) correlations are significant but weaker, Spearman's one is the best: for OL species $k_S = 0.46$, for RL – $k_S = 0.55$. Thus, inequality of the linear model is not important.

Correlations between variables of plant and mammal species richness is near to insect case: $k_p = 0.54$ with $R^2 = 0.29$, $k_S = 0.40$ (correlations are significant). Correlations of plants and birds variables are poor ($k_p = 0.21$ with $R^2 = 0.04$, $k_S = 0.14$ – correlation is not significant) despite of a link between habitat architecture and faunal richness of dendrophilous birds (Zubcov, 2001).

Some factors determine succession of a habitat (association) and ecosystem (habitat type) on the basis of development of vegetation. Correlations of plant species number with numbers of ecosystems and associations are found significant but weak – $k_p = 0.49$ and 0.53 with $R^2 = 0.24$ and 0.23, $k_S = 0.44$ and 0.61. Correlations for numbers of ecosystems and plant associations made up, correspondingly: with OL insect number – $k_p = 0.38$ and 0.32, $k_S = 0.20$ (correlation is not significant) and 0.23; with mammal species number – $k_p = 0.44$ and 0.47, $k_S = 0.41$ and 0.43; with bird species number – $k_p = 0.52$ and 0.29, $k_S = 0.50$ and 0.26.

Thus, the direct measuring the considered dependence confirms the theoretic notions.

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FORMATION OF THE PARASITOID COMPLEXES IN FOUR INVASIVE MINING SPECIES OF MACROLEPIDOPTERANS IN ROMANIA

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In the last decades, among the invasive insects that have entered Europe, there is included also a series of mining microlepidopterans of the leaves of trees. As some of these species have become important pests, the attention of researchers, both from a theoretical point of view but also a practical one, has turned on the knowledge of the autecological aspects but also synecological ones of these species. In this article, we deal with the formation of the parasitoid complexes that, in certain conditions, can limit consistently the populations of invasive species. All these four species belong to the Family Gracillariidae.

The first of these species that was the most extensively studied is - ***Cameraria orhidella*** Descka & Dimič, 1986 – which was reported in the South West of Romania in 1996, and in the cis - Carpathian area (Moldova) in 2002; in 2003, it spread within the entire Romanian space (including Dobrogea). During this period, big damages were produced to the ornamental chestnut-trees ***(Aesculus hippocastanum)***.

The formation of the complex of natural enemies (parasitoid Hymenopterans) has also constituted the researchers' goal in the territories newly conquered by ***C. ohridella*** in Europe. Thus, between 1997 and 2003, there were reported in these territories about 50 species among which the eulophid chalcidoids dominated evidently. Thus, it could be found that this parasitoid complex was formed of generalist, autochthonous species, the most frequent complex in Europe, being the following: ***Pnigalio pectinicornis* (Z), *P. agraules*** (Walk.)**, *Sympiesis sericeicornis*** (Nees)**, *Pediobius saulius*** (Walk.), ***Chrysocharis nephereus*** (Walk.)**, *Chrysocharis pentheus*** (Walk.), ***Closterocerus trifasciatus*** (Westw.), ***Minotetrastichus frontalis*** (Nees), ***Pteromalus semotus*** (Walk.).

In Romania, the researches were made: in U.S.A.M.V. Cluj-Napoca park with a great floristic diversity in the period 2000-2002; in Bacău town with a smaller floristic diversity and poorer ecological conditions (atmospheric pollution and chemical control) and in Hemeiuş dendrological park (Bacău) with high floristic diversity. The global parasitoid complex in Romania was made up of at least 22 species of which 3 ichneumonidae and 19 Chalcidoidea (17 species belonging to **Family Eulophidae**).

These species are generalist (polyphagous), attacking the mining insects. In Cluj-Napoca, there were identified 16 species with a total relative abundance $A_{(nr.)}$ of 407

specimens, in Bacau 5 species with $A_{(nr.)}$. of 75 specimens and in Hemeiuş 13 species with $A_{(nr.)}$. of 470 specimens. On the whole, those 22 species identified in Romania were represented by $A_{(nr.)}$. = 952, the dominant species being the same as in the rest of Europe. Thus, the eudominant species were: ***Minotetrastichus frontalis, Pnigalio pectinicornis*** and ***Pnigalio agraules***, the dominant species was ***Pediobius saulius*** and the subdominant were: ***Closterocerus trifasciatus*** and ***Pteromalus semotus***. Other species with a lower D % (dominance), also present in the parasitoid complexes, present in other European countries, were found in Romania too: ***Pnigalio soemius*** Walk., ***Sympiesis sericeicornis*** (Nees) ***Scambus annulatus*** Kiss. and so on.

Another invasive species, ***Phyllonorycter issikii*** Kumata-1963, was described from Japan, and in 1977, it was reported in Russia in the Far East; until 2002, it had reached Central Europe. The species was reported on ***Betula platyphylla*** and several East Palaearctic species belonging to the genus **Tilia,** becoming an important pest of some species of ***Tilia (cordata, platyphyllos).*** In Romania, in 2002, there was reported at Hemeiuş and Dărmăneşti (Bacău), and Gheorghiţoaia şi Frumuşica forests, and Podu Iloaiei (Iaşi) and, in 2005, in Copou Park Iaşi and forest nature reserve Hârboanca (Vaslui) on ***Tilia cordata, Tilia platyphylos*** and ***Tilia tomentosa.***

As it concerns the parasitoids complex, up to the present, there are known almost 20 generalist species, and, as in other cases, the eulophids are dominant. In Romania, the complex of parasitoids is in formation, consisting for the time being of 5 species: ***Gnaptodon pumilio*** (Ar % = 9), ***Orgilus obscuratus*** (Ar % = 9), ***Pnigalio soemius*** (Ar % = 18), **Cirrospilus lyncus** (Ar %= 9) and ***Minotetrastichus frontalis*** (A_r % = 55).

Of these species, ***Minotetrastichus frontalis*** and ***Pnigalio soemius*** are also part of the dominant species found in the parasitoid complex in other palaearctic biogeographical zones.

The third species is ***Phyllonorycter robiniella*** Clemes, 1859, originating from North America, reported for the first time in Basel (Switzerland) in 1983; later, it became a pest of the locust tree (***Robinia pseudoacacia***). In Romania, it was signalled near Drobeta Turnu Severin in 1988, and in Moldova (Romania), only in 2002. As it concerns the complex of parasitoids, in 2004, this consisted of 19 species in Hungary, 20 years after being reported in Europe.

In the complex there were dominant ***Achrysocharoides cilla*** Walk. and less ***Holcothorax testaceipes*** and ***Minotetrastichus frontalis*** (Nees), and the parasitic percentages ranged between 38 % and 85 %. In Romania, the complex of parasitoids in formation is composed of five species: ***Sympiesis sericcicornis*** Nees, ***Pediobius saulinus*** Walk., ***Neochrysocharis formosa*** Westw., ***Achrysocharoides cilla*** Walk. and ***Minotetrastichus frontalis*** (Nees). All these five species are found in the respective complex in Central Europe, the most important also being ***Achrysocharoides cilla*** Walk. and the percentage of the parasitation of the host, being 8-24 % for 2008-2011 period.

The fourth species also dealt with, associated with the locust tree is ***Parectopa robiniella*** Clemens-1889, originating from North America and signalled in Europe, in Milan (Italy) in 1970. The species spread in Europe so that, in 1988, it was also reported in Romania, near Drobeta Turnu Severin, and in 1999, in Central and South

Moldova. The parasitoids associated complex, formed of autochthonous species, studied by Hungarian researchers in 2001-2003, is composed of 12 species: also present in the complex of the species ***Phyllonorycter robiniella*** Clemes; ***Achrysocharoides cilla*** Walk. is the dominant species in this complex, too. As it regards the percentage of parasitation of the host, it was 4.03 % - 5.9 %, much lower than in ***Phyllonorycter robiniella*** Clemes. In Romania, the parasitoid complex is identical to that of the species ***Phyllonorycter robiniella*** Clemes, with the exception of the species ***Closterocerus clarus*** Szel that was found only in ***Parectopa robiniella*** Clemens. The species ***Achrysocharoides cilla*** Walk is also dominant, ***Neochrysocharis formosa*** Westw is on the second place, and the percentage of parasitation was small, 0.3 % - 5 %.

In conclusion, the parasitoid complexes are made up of species of Hymenopterans, especially autochthonous, generalist (polyphagous) Chalcidoidae-Eulophidae. The complex of the species ***Cameraria orhidella*** Descka & Dimič is best known from all points of view, and the other 3 species are in the course of formation and stabilization and in some local situations it can contribute consistently to the reduction of the host populations.

LACTO-FERMENTED ORGANIC WASTE - A SUITABLE FEEDSTOCK FOR GROWTH AND REPRODUCTION OF COMPOSTING EARTHWORM, *EISENIA FOETIDA*

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In Moldova inadequate management of biodegradable waste for most of the rural and urban communities is one of the most acute challenges. While a small proportion of the rural population uses organic waste e.g cattle manure to fertilize their fields, a vast majority dumps it to unauthorized places or transports it to the village landfills. The spontaneous decomposition of biodegradable waste leads to environmental pollution, production of annoying odors or attraction of various disease vectors such as insects or rodents. At the same time, it is recognized that biodegradable waste is an important source of organic matter and nutrients that can be recycled to the soil. A technology that would allow soil fertilization and rational management of organic waste is vermi-composting. As a result of vermi-composting a quite homogenous, high nutrient content product can be obtained, however the process is lengthy, being extended to up to 4-6 months. Such an extension leads to losses of nitrogen and carbon matter as NH_3, N_2O and CO_2. An overall shortening of the vermi-composting period can be achieved via preliminary pre-treatment via lacto-fermentation. Wood biochar can be added as a bulking agent, to reduce the nutrient losses and stabilize the organic matter. In this study, a lacto-fermented mix of fecal matter, cattle manure, kitchen waste, molasses and lactic acid bacteria supplemented by biochar was compared to cattle manure alone concerning its effect on earthworm growth and reproduction.

The organic waste was lacto-fermented for 10 days in closed barrels; sauerkraut brine was used as lactic acid bacteria innoculum. In order to assess the reaction of earthworm *Eisenia foetida* to lacto-fermented substrate, 20 healthy earthworms were placed in a plastic container with tested material and mortality was assessed after 48 hours. After this test, the lacto-fermented organic waste was conditioned (aerated for one week), the earthworms were introduced in dark plastic boxes of 532 cm^2 (14x18x38 cm) were used, with an innoculation density of 1500 specimens/$m^2$and an additional 80 day experiment was performed. Shredded wet newspaper was used as bedding ma-

terial. As a control, stored cattle manure was used. The experiment was carried out in triplicates. Each box contained approximately 1000 g of waste and the total experimental period lasted for 80 days. At the end of the first month, when the substrate volume was reduced, an additional 500 g of waste substrate was added to each container, the feeding load proportion of waste to earthworm biomass being approximately 1:1. Mean earthworm adult weight, number of hatched and viable eggs and earthworm mortality were assessed before and after the experiment. The weight of earthworms was measured by digital jewelery balance with a capacity of 0.01-300 g.

The 20 earthworm test showed that without preliminary conditioning (aeration for one week) there was very high earthworm mortality (90%). After one week of aerobic exposure for volatilization of potential toxic substances, the lacto-fermented faeces and biowaste had an overall beneficial effect on earthworm growth and no more mortality was encountered. The mean adult weight of the earthworms grown in containers with lacto-fermented organic waste supplemented by biochar was 1.5 higher than of those grown in cattle manure. At the same time, no shells of hatched cocoons were found in lacto-fermented mix supplemented by biochar as compared to cattle manure, where the number of hatched cocoons was 85.7±7.6. Instead, in lacto-fermented mix supplemented by biochar the number of cocoons ready for hatching was increasing only at the end of the experiment as compared to cattle manure, where this was decreasing. The earthworm mortality in cattle manure was also 12 times higher than in lacto-fermented mix supplemented by biochar. One possible explanation is depletion of the necessary earthworm food materials in the cattle manure at the end of experiment. Most probable the decomposition of degradable carbon materials occurred at a faster rate in cattle manure than in the lacto-fermented organic waste supplemented by biochar. Also, a higher electric conductivity (EC) and $N\text{-}NO_3^-$ content was encountered in the lacto-fermented organic waste and biochar compared to cattle manure (3 and 4 times versus 2 and 3times increase respectively).

As a result of 80 day vermi-composting experiment, a 1.5 higher adult body weight and an increase in the number of hatched cocoons of *Eisenia foetida* was observed when lacto-fermented mix of organic waste was offered compared to untreated, simple stored cattle manure. As the material processed via lacto-fermentation is high in organic acids and anaerobic, preliminary aeration for approximately one week is required before being offered to the earthworms. When earthworms are fed lacto-fermented organic waste a better soil conditioner with a higher $N\text{-}NO_3^-$ and EC can be obtained than when they are fed on cattle manure.

CONTRIBUTION TO THE STUDY OF EDAPHIC COLEOPTERA IN THE BOTANICAL GARDEN OF THE NATIONAL MUSEUM OF ETHNOGRAPHY AND NATURAL HISTORY OF CHIȘINAU

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Beetles are among the most numerous and widespread insects in the world. With a high ecological plasticity, they can be found in all ecosystems. The Botanical Garden of the National Museum of Ethnography and Natural History (NMENH) owning land with forest, grassy, rocky, aquatic and palestra vegetation is a perfect habitat for fauna of beetles. The forest vegetation consists of 26 species of trees, of which *Quercus robur*, *Q. petrea*, *Fagus silvatica and Populuis alba* are edifying tree species in flora of Moldova; 23 species of shrubs and about 80 species of herbaceous plants (Mihailov, Cojuhari, Roșca, 2010).

The Botanical Garden of NMENH was founded in the early 20th century on the Garden-park existing on this territory since the mid-nineteenth century (Cojuhari, 2007). There have been conducted many botanical research on monitoring the floristic composition and its condition (Cojuhari, 2007; Postolache, Cojuhari, 2008; Pană, Cojuhari, 2014). As for fauna, and especially the beetle, the information is quite fragmented with some references found in the studies of Ruscinsky, 1933, and Mihailov et al., 2010. The research undertaken aimed at identifying the diversity of edaphic beetle's species and their role in this habitat.

The entomologic materials were collected from the Botanical Garden of the National Museum of Ethnography and Natural History with an area of 0.5 ha, which has a rich flora (Postolache G., Cojuhari T. 2008). In the period May-September 2012, nine barber traps were installed, which functioned permanently during this period. The extraction was done once every 10-14 days. The materials were determined by binocular magnifier MBS 10, and the recommended Identification Manual was used to identify species.

As a result of the conducted research, we identified 21 species of beetles belonging to 14 genera and four families. The most numerous species belong to the Carabidae family - 10 species in six genera, followed by families Scarabaeidae with five species in three genera, and Silphidae with three species of three genera. The Tenebrionidae family was highlighted by two species of two genera. The synecology analysis of edaphic beetles has highlighted two abundant and dominant species (*Onthophagus verticicornis* (Laich, 1781) and *Onthophagus fracticornis* (Preyss, 1790)) – copropha-

gous species, due to the presence of decomposed rats in Barber traps. The other species were in a small number of specimens.

The results obtained demonstrate that the edaphic beetle fauna in the Botanical Garden of NMENH is quite poor compared with some natural ecosystems. This is explained by the fact that some hygiene works are undertaken in the Botanical Garden, namely there are extracted the death leafage and trees that are necessary for the existence of saprophagous species, which are food for other groups of beetles. In the Botanic Garden, it was identified the rare species of beetles *Oryctes nasicornis* (Linnaeus, 1761), included in the Red book of Moldova (Cartea Roșie, 2015). In the literature, there have been reported some species of phytofagous beetles of Cerambycidae, Chrisomelidae and Meloidae families found here (Mihailov et al., 2010).

Based on trophic preferences, one can be mentioned that the fauna of edaphic beetles was composed of four trophic groups: 48% are phytofagous species, followed by the zoophagous and necrophagous each with 19%, and coprophagous with only 14%.

According to the references `on geographic spread it was found that beetles fauna identified in the Botanical Garden of NMENH belongs to nine zoogeographical areas: Trans-Palearctic, European, Eurasian, Euro-Siberian, Euro-Caucasian, Euro-Mediterranean, Holarctic, Mediterranean, and West-Palearctic zones.

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CHOROLOGY OF SCOLITANTIDES ORION (PALLAS, 1771) IN ROMANIAN SOUTH DOBROGEA

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Scolitantides orion (Pallas, 1771) (Lepidoptera: Lycaenidae) is a Palearctic species with a range spanning a both continents , from the northern Japanese Islands (long 145°E) to Spain (long 15°E). Form north to South, its range spans between the parallels N62°-N30°.

All over its natural range, Scolitantides orion is a very difuse species, showing a wide ecological amplitude inhabiting small areas with a very diverse climatic features. Despite its considerable ecological amplitude, S. orion is generally rare and localized, always confined to areas where its hostplant (members of the dicotiledonous plant family Crassulaceae) grows.

S. orion is a stenophagous/monophagous species feeding as both adult and preimaginal stages on members of Crassulaceae family (mainly species of Sedum, Hyllotelephium and Sempervivum). This trophic dependency makes this species a very good candidate for the study of metapopulations and geneflow among local populations as it causes a patchy distribution all over its range. Because its hostplant inhabits xeric, open rocky places usualy in the mountains, or in otherwise arid habitats unsuitable for other plants, *S. orion* is generally distributed throughout its range in mountain habitats where competition from other plants is low either due to abiotic factors, or due to biotic factors like grazing.

Scolitantides orion usually is a bivoltine species (but sometimes it can have 3 generations per year in the exceptionally warm years. It overwinters in the pupal stage, in the ground at the base of its hostplants, or inside the ant nests with which it is sometimes associated, the species being facultative myrmecophylous.

The Romanian range covers sparsely the whole country, preponderantly in higher regions, the species having fairly large ecological amplitude with a preference for higher altitude, rocky places. During the last years its populations in Dobrogea, like in Mehedinti and the rest of the country showed variations in number/frequency of individuals, voltinism, distribution area, hostplant preferences.

The region involved in the present study mostly spans East of Danube River, approximately between between km 6500-5900N and 6000-6500E of the UTM projection zones, comprising a wide variety of habitats from the Danube to the Black Sea coast and approximately from the Danube-Black Sea Canal to the southern border with Bulgaria.

The aim of this study was to assess the distribution of *S. orion* in the southern part of Dobrogea as I predict that the species has a much wider local distribution than previously documented.

We provide herein distribution data for the butterfly *S. orion* in the Romanian part of South Dobrogea, present a comprehensive list of locations where the species *S. orion* L was sighted, complemented by a map of the species distribution in Romanian southern Dobrogea together with some considerations about the chorology and the ecology of the species and discuss the trends revealed by our 12 year fieldwork study in the region.

THRIPS DIVERSITY (INSECTA: THYSANOPTERA) FROM RYE CROPS IN THE NORTHERN OF MOLDAVIA REGION

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The collections of biological material and observations were made during April to July 2015 in rye crops from five localities (Rădăuți, Horodnic de Jos, Marginea, Poieni-Solca, Suceava country, and Mihăileni, Botoșani country). The biological material were been emphasized with entomological net, with 100 mowings for corn plants at each sampling. In total, we made six samplings were made for each place.

From these five localities were been collected and investigated 2821 individuals of thrips and there were identified following species: *Aeolothrips intermedius* Bagnall (Fam. Aeolothripidae), *Limothrips denticornis* Haliday, *Chirothrips manicatus* Haliday, *Frankliniella pallida* Uzel (Fam. Thripidae) and *Haplothrips aculeatus* Fabricius (Fam. Phloeothripidae).

The most individuals were collected from rye culture from Mihăileni (841 individuals) and the fewest individuals were collected from Marginea (247 individuals) (Tab. 1). The *Aeolothrips intermedius* species is predatory (its individuals are feeding on aphids, thrips etc) and all other species are phytophagous. As dominant species, in all investigated areas, is *Haplothrips aculeatus* species which registered 80.98% thrips individuals in rye crops from Mihăileni and 56.63% thrips individuals in rye crops from Rădăuți, followed by *Limothrips denticornis* and *A. intermedius* (Tab. 1).

Table 1. The abundance and dominance for thrip species identified rye crops from the Northern of Moldavia

Species	Locality									
	Rădăuți		Horodnic de Jos		Marginea		Poieni-Solca		Mihăileni	
	A	D	A	D	A	D	A	D	A	D
Haplothrips aculeatus	363	56,63	215	64,96	171	69,23	476	62,55	681	80,98
Limothrips denticornis	132	20,6	59	17,83	44	17,82	132	17,35	43	5,12
Aeolothrips intermedius	116	18,1	44	13,3	16	6,48	122	16,04	98	11,66
Frankliniella pallida	26	4,06	8	2,42	14	5,67	25	3,29	17	2,03
Chirothrips manicatus	3	0,47	3	0,91	2	0,81	5	0,66		
Limothrips angulicornis	1	0,16	2	0,61			1	0,14	2	0,24
Total	**641**		**331**		**247**		**761**		**841**	

In Romania, systematic studies concerning to the harmful and auxiliary entomofauna from rye cultures were not done. However, Bărbulescu (2001), Popov (2003) and Popov and colab. (2009) mentioned 9 species in the Southern of Romania.

Table 2. Thrips Diversity from rye cultures in Romania

Nr	Species	Southern RO (1)	Southern RO(2)	Nothern Moldavia (3)
1.	*Haplothrips tritici*	+	+	-
2.	*H. aculeatus*	+	+	+
3.	*H. reuteri*	+	+	-
4.	*H. angusticornis*	+	+	-
5.	*Frankliniella intonsa*	+	+	-
6.	*F. pallida*	-	-	+
7.	*Aeolothrips intermedius*	+	+	+
8.	*Limothrips denticornis*	+	+	+
9.	*L. angulicorns*	-	-	+
10.	*Chirothrips manicatus*	+	+	+
11.	*Stenothrips graminum*	+	+	-

(1) – after Bărbulescu, 2001;
(2) - after Popov, 2003, Popov and col 2009;
(3) - authors;

The dominant species for this region is *Haplothrips aculeatus*.

ALIEN SPECIES OF TERRESTRIAL INVERTEBRATES IN BLACK BOOK OF INVASIVE ANIMAL SPECIES IN BELARUS

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Definitions on invasive alien species (IAS) are multiple, they are built using various combinations of a number of criteria: species origin (exotic or non-native), ability to reproduce in the wild (acclimatized and naturalized), environmental impact, etc. It refers to an organism whose presence in a given area is due to intentional or accidental introduction by man or others kinds of human activity. An alien species is considered as invasive when it is naturalized and able to increase population size, to disperse widely in the environment and colonize wide range of semi-natural and natural habitats.

Establishment of so named *blacklists* is one of the attempts to focus on the issue of biological invasions of alien species that pose the most significant threat to regional biodiversity of a certain region. Blacklists contain biological and ecological characteristics, information on invasive species distribution, environmental and economic impact, control measures, etc.

In 2016 'Black book of invasive animal species in Belarus' have been published by Belaruskaya Navuka publishing house. It provides information on the most dangerous invasive species of Belarusian fauna, namely 1 species of reptiles, 3 species of fishes and 2 species of mammals, 6 species of aquatic and 21 species of terrestrial invertebrates. The last ones include 1 species of slugs (*Krynickillus melanocephalus* Kaleniczenko; Mollusca: Gastropoda: Agriolimacidae), 3 species of gall mites (*Aceria erinea* (Nal.), *Aculus hippocastani* (Fockeu), *Vasates quadripedes* Shimer; Arachida: Acariformes: Eriophyidae), 12 species of Hemipterous (*Psylla buxi* L. (Psyllidae), *Parthenolecanium fletcheri* (Cockerell) (Coccidae), *Cholodkovskya viridana* (Chol.) (Adelgidae), *Pemphigus spyrothecae* Pass. (Pemphigidae), *Drepanosiphum platanoidis* (Schrnk.), *Panaphis juglandis* (Gz.) and *Phyllaphis fagi* L. (Drepanosiphidae), *Aphis craccivora* Koch, *Aphis spiraecola* Patch, *Brachycaudus divaricatae* Shap., *Cryptomyzus ribis* L. and *Hyadaphis tataricae* Aiz. (Aphididae); Insecta: Hemipteroidea: Sternorrhyncha), 1 species of Coleopterous (*Harmonia axyridis* (Pall.); Insecta: Coleoptera: Coccinellidae), 1 species of Dipterous (Insecta: Coleoptera: Cecidomyiidae) and 4 species of Lepidopterous (*Cameraria ohridella* Deschka & Dimic, *Phyllonorycter issikii* (Kumata), *Phyllonorycter robiniella* (Clemens), *Parectopa robiniella* Clemens; Insecta: Lepidoptera: Gracillariidae) insects. All these non-native species of terrestrial invertebrates have wide or local geographical distribution in region and have a negative economic or environmental impact under the condition of Belarus.

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SPECIES OF FAMILY HYPOGASTRURIDAE (COLLEMBOLA: HEXAPODA) FROM THE REPUBLIC OF MOLDOVA

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The first checklist of Collembola from the Republic of Moldova published by Buşmachiu (2010) included 25 species from 7 genera of the family Hypogastruridae. However, the first data about hypogastrurid appeared in the doctoral thesis of Stegărescu in 1967 that included two species *Hypogastrura purpurescens* (Lubbock, 1867) and *Orogastrura parva* (Gisin, 1949) from the vineyards, whose presence has not been proved yet.

The present paper summarized the result of long term investigation carried out during 2001 – 2015 years.

At present time Moldavian fauna of hypogastrurid Collembola contains so far 31 species belonging to 9 genera of which two genera *Mesogastrura* and *Microgastrura* and five species *Ceratophysella sigillata* (Uzel, 1891), *Ceratophysella stercoraria* Stach 1963, *Ceratophysella silvatica* Rusek, 1964, *Mesogastrura ojcoviensis* (Stach, 1919) and *Microgastrura dudecimoculata* Stach, 1922 are new records.

The most common species from the family Hypogastruridae were identified in the various habitats such as forest, agricultural fields, pasture and meadows are *Ceratophysella engadinensis* (Gisin, 1949) and *Hypogastrura manubrialis* (Tullberg, 1869). Different types of forests and riparian habitats in the Republic of Moldova inhabit *Ceratophysella succinea* Gisin, 1949 and *Schoettella ununguiculata* (Tullberg 1869).

In spite of a large spectrum of long-term studied habitats, only 31 species from the family Hypogastruridae have been found so far in the Republic of Moldova. The genus *Ceratophysella* includes 10 species and genera *Hypogastrura* and *Xenylla* - 7 species each. One genus such as *Willemia* is represented by two species and other five genera *Choreutinula*, *Orogastrura*, *Schoettella, Mesogastrura* and *Microgastrura* by one species each.

In the climatic condition of the Republic of Moldova the most part of hypogastrurid species have preference to humid silvicolous ecosystems located on the flooding banks of river or are active during winter-time.

ON BIOTIC RELATIONSHIPS OF LEAF BEETLES (*COLEOPTERA: CHRYSOMELIDAE*)

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Due to the strong anthropogenic pressure on the territory of the Republic of Moldova the entomofauna is depleted. However, the goal is to create in the human modified environment not only a highly productive, but also a relatively stable agrocenosis. Leaf beetles (Chrysomelidae) belong to its important components due to their ubiquity and the large number of species. It should be noted that the value of leaf beetles is wider than that of simple pests. However, if the approach is applied to their evaluation as to the components of biocenoses, the role of beetles appear to be somewhat different. Of course, some of the most important pests belong to this group of insects. It is sufficient to recall such mass pests like *Leptinotarsa decemlineata* Say, *Oulema* spp., *Altica quercetorum* Foudr. or the fact that the decorative *Ulmus* spp. in Chisinau were heavily damaged by *Xanthogaleruca luteola* Müll. In general, however, the leaf beetles biodiversity must be preserved. After all, the vast majority of the representatives from these families are not pests. In addition, several species of leaf beetles are used in biological control of weeds. Leaf beetles are a link in the trophic chains of the insect fauna, which is important for the development of an integrated plant protection, as well as to support the biodiversity of entire regional entomofauna. On this basis, it is required to optimize the entomofauna within the agricultural landscapes, taking into account the entire spectrum of trophic links of both leaf beetles and other insects. So, bearing in mind that the representatives of these groups of beetles that live on unusual plants may suffer losses at their detection, their breeding potential will drop in comparison with the inhabitants of conventional plants. To avoid this limiting factor, i.e. the territorial fragmentation of fodder plants, it is advisable to provide a sort of „bridges", which may be in the form of a network of polyfunctional forest strips and their loops with certain plants composition. After all, the biodiversity of fauna of leaf beetles, as well as the insect fauna in general (of which their stability largely depends), is due to the diversity, sufficiency and availability of its food resources. This implies the importance of preserving the natural habitat places with the full range of their plants. The general premise of biodiversity of the insect fauna, including fam. Chrysomelidae, is a "mosaic" of vegetation landscapes, including the presence of habitats of different quality - "oasis" with wild plants and forest areas. At the same time it is one of important factors of creating relatively stable cenoses, which would be able to self-regulate as far as possible along with the suppression of mass species.

SOME ECOLOGICAL FEATURES OF THE PARASITISM

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Having analyze the results of researches of the scientists, who have performed the majority of different general – scientific works, dedicated to the study of entire University, convince us that one of the most fundamental universal problems is a problem of assertion of the forms of interrelation among the various physical bodies, beginning from those between elementary particles of the atoms, prolonging with those of atoms, plants, those of the galactic etc., in the result of which appears the majority of different events and phenomenon of Universe.

And, at a careful look, also in the general biology (and in parasitology), also, a particular interest presents, the forms of interrelations between living organisms from the entire biosphere, and the forms of interrelations between the majority of different organisms and their environment.

This opinion, in principle, is confirmed through the special researches performed in this sense. Thus, for example, in accordance with data from "Encyclopedia of Ecology" of the academician Mr. Ion Dediu, such researches has followed from the moment when the German zoologistErnst Haeckel (1866) has launched his monumental work "GenerelleMorphologie der Organismen" (which exactly indicates the ecological and evolution concept of the author), at the same time, in the same context is concretized (from gr. Oikos – house and logos – word, science). The Science of self-catered of nature, Nature Economy, Study of the house, the Science of Ecosystem. "Through Ecology we understand the totality of the relations of the science (subl. N - I.D.)of the organism with their environment, comprising in large sense all existing conditions. (cited by Haeckel, 1866). Etymological, through Ecology we must to understand the study of the living creatures at their home, in their environment.

Thus, I think we must to acknowledge that all living organisms, ecologically speaking, permanently are in situations of the most different forms of interrelations.

And, from the moment of forming of a special scientific object (that of Parasitology), based on the objective of study of "Interrelations between parasites and the host", this direction of researches become priority in the entire biology. At the same time, proceeding from the study and practice of multiannual personal researches I have stated, that the highlight of "parasitism processes" which took place in the interior of the organism-host, affected by the parasites, is very complex and hard to establish, which make very necessary the study of these fundamental "events", which will favor and state the diagnosis of each concrete parasitizes.

For the assessment of morho-functional and ecological features of the parasitism processes I intervene in statement of the legalities, which conduct the interrelations

between different hosts, between parasites and hosts and environment, I have carried multiple experimental parasitism works. I have performed tens of thousandsof parasitological autopsies in slaughterhouse. During approximate 10 years, together with scientists from Laboratory of Arbo– Virology of the Institute of Epidemiology and Microbiology of the Health Protection Ministry from the Republic of Moldova (who has at disposal a mobile Laboratory, arranged with all necessary for performing of parasitological researches in the land), I have participated to the works of expedition dedicated to epidemiology investigation of parasitism diseases with natural focal on entire territory of the Republic of Moldova, where I have held general-ecological and ecological observations on forms of interrelations between different organisms from different biotope from nature. In parallel, I have investigated and more thousands of animals from different individual households, farms and animal complexes. During this, I have intervene in the parasitological investigation of different patients from polyclinics, hospitals (of corpses in the morgue), who remains with unestablished diagnosis.

In the expeditions I have collected and subject to parasitological autopsies in totally approximate 10 thousand of individuals of wild animals, which belong to 137 systematic species. From the organisms of whose I have prepared approximate 25 000 of total preparations from different organs and I can to highlight (in real) about a thousand of species of parasites.

Intervening in the pedagogical activity to the faculty of Veterinary Medicine from Chisinau (where I have conduct the course of parasitology at first 6 promotions of veterinary doctors), I have stated, that the Parasitology also, as the other biological objects, in its evolution, has follows the way of deductive logics (way of divisions). Thus, have appeared different apart objectives, as: "virus diseases", "bacterial diseases", "proto parasitosis", "helminthosis", "arachnoentomosis" etc. which, in principle, have complicated in the big part the inductive logistics itself of perception of the mechanisms of general-parasitological pathology.

Proceeding from respective situation, the personal investigation I have performed on the way of inductive logistics, on integration way. Thus, firstly, I decide that all parasitizes to meet under an unique name "parasitic processes". Then, reviewing the morpho-functional and ecological features of the parasitic processes highlights during the period, which usually are conducted of some legalities, I can to state that those sets of legalities, which, usually, conducts the activity of all parasitic processes, as we stated: Lawful which conducts the adaptively "Potential" of the parasites, the Lawful which conducts "Relations between parasites hosts", the Lawful which conducts "evolutionary ety of parasites", the Lawful which conducts "The qualitative and quantitative proportion of the parasites", the Lawful which conducts "The specificity of the parasites and relations between species of concrete associations,the Lawful which conducts the Rhythms (heterocronia) of parasites development and the Lawful which conducts the Level of tension in the confrontations between parasites and host. At the same time, I come to the conviction that to have an effective fight with apparent parasitizes is necessary the organization of special parasitological institutions, which will elaborate the the fundamental tactics and strategy of fight (passed through the legalities which are on the basis of the theory of parasites processes) with parasitizes.

Besides, in the basis of these legalities I have expose the text of the thesis of the habilitate doctor, and in the result, I can to elaborate the "Theory of parasitic processes", which I prepare for publishing.

The results of the multiannual parasitological investigations have convinced me definitely, that the parasitism is the one of most spread and complex form of interrelations between organisms.

All parasitic processes, usually, are conducted by a complex of sets of legalities, as: Lawful which conducts the adaptively "Potential" of the parasites, the Lawful which conducts "Relations between parasites hosts", the Lawful which conducts "evolutionary ety of parasites", the Lawful which conducts "The qualitative and quantitative proportion of the parasites", the Lawful which conducts "The specificity of the parasites and relations between species of concrete associations,the Lawful which conducts the Rhythms (heterocronia) of parasites development and the Lawful which conducts the Level of tension in the confrontations between parasites and host. Appears the strictly necessity of organization of Institutions of intervention in the fight with parasitism.

PRESENT PECUIARITIES OF LYME BORRELIOSIS OUTBREAKCS IN NATURAL AND ANTHROPIZED ECOSYSTEMS OF CHISINAU CITY, REPUBLIC OF MOLDOVA

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Vector-borne diseases constitute more than 17% of total number of infectious diseases being caused by a multitude of environmental and social factors. The literature contains updated information on the increasing number of pathogens transmitted by ticks (Acari, Ixodidae), for example in Germany in the last 15 years have been reported at least eight new agents pathogenic or potentially pathogenic to humans, including several species of Borrelia, Rickettsia and Anaplasma.

Studies in Moldova have determined in the ixodid tick population the presence of causative agents of acarian encephalitis, infection with West Nile, Lyme borreliosis, ehrlihiosis, babesiosis, anaplasmosis, bartonellosis, ricketsiosis and tularemia. Currently, according to statistics the most common vector-borne disease in the country is Lyme borreliosis.

Long-term study of the vectors ecology is important for emphasize the changes in the correlation between "pathogen agent – specific vector – receptive host", especially in the context of climate change from the last decades, the expansion of the phenomena of migration and urbanization of new territories, which what contributes to the risk increasing of transmission of pathogens to humans by ixodid populations.

During spring, summer and autumn periods of 2012-2015 962 specimens of ixodid ticks were collected from various natural and anthropogenic ecosystems of Chișinău city, given the peculiarities of their habitats and preferred spreading area. Field works were carried out in 32 points of annual and multiannual monitoring, using the "Flag" method. The species and the sex of collected ixodid specimens were determined. For the presence of Borrelia in the hemolymph and intestine contents 616 adult individuals of ixodid tick were examined. The index of species population density was calculated, as well as dominance and the rate of ixodid contamination with Borrelia, their diversity and territorial spread were determined.

Data on the incidence of Lyme borreliosis in Chisinau city for 2012-2015 were obtained from the Statistical Report "Infectious and parasitic diseases."

Chisinau city is located at 47.0122 N and 28.8605 E and covers an area of about 120 km^2. The faunistic material was collected in natural and anthropogenic ecosystems in the city (Buiucani, Ciocana, Riscani, Botanica districts) and suburban municipality (Vadul lui Voda town, Dobrogea and Hulboaca villages). 83 routes were taken of 200m each.

In the reference period 5 species of ixodid ticks were identified: *Ixodes ricinus* (41.9%), *Dermacentor marginatus* (32.4%), *D.reticulatus* (19.4%), *Haemaphysalis punctata* (3.5%) and *H.inermis* (2.7%). In most studied habitats of annual and multiannual monitoring a diversity of 2-4 species was registered. *I. ricinus* is the most common species of ixodid, recorded almost in all the researched habitat, thus presenting the highest epidemiological significance in terms of borreliosis circulation in nature.

Mean index of *I.ricinus* tick density was 4.8 mature individuals per 200 m route, *D.marginatus* - 3.7 *D.reticulatus* - 2.2, *H. punctata* and *H. inermis* - 0.4 and respectively 0.3 adult individuals per 200 m route. A large number of ixodid ticks was recorded in areas of recreation and leisure near water basins with much vegetation from Ciocana and Buiucani (Sculeni district) constituting 53 and 38 individuals respectively, in the forest belts of Riscani, Ciocana, Vadul-lui-Voda town, Hulboaca vill. from 12 to 40 individuals, in summer camps for children located in forest from Vadul lui Voda town from 4 to 39 individuals per 200 m route.

Microscopic studies for Borrelia identification have revealed that the percentage of infected ticks in 2015 and 2012 was the highest, constituting 36% and 34% respectively, compared to 2014 (22%) and 2013 (21%).

Cases of Lyme borreliosis illness in humans in Chisinau city are recorded annually since 2000, including in 2015 - 97 cases, in 2014 – 59, in 2013 – 65, while in 2012 the highest number of disease cases have been reported – 117. In annual dynamics spring-summer seasonality of the disease was attested, corresponding to the period of maximum biological activity of ticks. At the same time the true incidence of Lyme borreliosis remains underestimated due to low alertness of population on the risks associated with tick bite and low number of doctor visits to diagnose the disease.

We conclude that in natural and anthropogenic ecosystems of Chisinau city five ixodid species were identified, the dominant species being *I. ricinus*. The presence of vectors – Ixodid ticks on the territory of Chisinau, as well as the intense movement of Borrelia in ticks maintain the high risk of occurrence of Lyme disease cases in the human population.

STUDY OF THE ANTHELMINTIC EFFECTIVENESS OF THE ALBENDAGED 10% PRODUCT AT POLI – PARASITES RUMINANTS

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Prevention of parasitosis to farming ruminants remains a current concern of animal breeders and veterinarians (Zgardan E., Erhan D. Rusu St., et al., 2008). The use and marketing of anthelmintics related compounds, which belong to the group of benzimidazole can be considered as an alternative therapeutic range. As proof serve numerous associations of albendazole, tested or undergoing testing of new conditions, looking for their place in the market of veterinary medicinal products in recent years (Darabus Gh., 2004; Kaplan R., 2004; Rialch A., 2014).

The trichostrongilidosis represents helminthosis specific to the ruminants, with gastrointestinal locating to the animals of all ages, manifested clinically by misconduct, diarrhea, weight loss, aestival anemia, cachexia, mainly in late summer and autumn, indicating a seasonal development. Infection occurs at pasture with ingesting food and water. The disease mostly affects young and untreated cases can be fatal (Darabus Gh. et al., 2006).

Gastrointestinal nematodes, in larval and adult stages, at small ruminants and cattle, are caused by parasites belonging to the *Trichostrongylidae* family, which includes the *Trichostrongylus, Haemonchus, Ostertagia, Nematodirus, Cooperia* genres and lung of nematodes of small ruminants *Dictiocaulus and Protostrongylus spp.* Also , we should mention that the improper and reckless use of anthelmintic products, including those based on albendazole, generates the resistance of trichostrongylus to benzimidazole group of substances (Zgardan E., 1974, 1985, Talambuta N., 1995, Cercel Il., 1997, Nicolae C. et.al., 2014, Rialch A., 2014).

Clinical testing "Albendaged 10%" medicine (Euro Prime Pharmaceuticals LLC) was performed at the Scientific-Practical Institute of Biotechnology in Zootechnics and Veterinary Medicine from village of Maximovca, Anenii-Noi district and to a private property, located in the village of Gradiste, Cimişlia district, and the coprologic examination within the Department of Parasitology of SAUM during the years of 2015-2016. Albendaged 10% is a synthetic anthelmintic, which belongs to the group of benzimidazole - derivatives with activity against a wide range of parasites, and

also against the adult stages of *Fasciola hepatica*. This remedy possesses ovicidal action, thus reducing the contamination through pasture. Administered orally, is rapidly absorbed and diffuses into all organs and tissues, causing lysis helminths, regardless of the species and category of animals treated and of their location. Is predominantly eliminated through urine.

The need of parasitosis destruction at sheep is mandatory and must include concrete actions on animals, pasture and husbandry system. Although in most flocks of sheep are recorded the same kinds of parasitic infestations, their combating involves two important aspects: diagnosis and treatment. The diagnosis of the majority of important parasitosis at sheep is based on coprologic examination, which will be conducted at least twice a year, preferably during periods of strong infestations (spring and autumn).

To establish the efficacy of "Albendaged-10% 's anthelmintic preparation, in the household from Maximovca village were selected for the experiment 3 groups of animals of different ages: adult sheep - 37 heads; young sheep - 30 heads; male - 16 heads, and in the private location from Gradiste village: adult sheep - 10 heads; young sheep - 10 heads and males - five heads. The animals showed the following clinical signs: cough, lack of appetite, diarrhea and vomiting. For pre-therapeutic exam 108 biological samples have been collected, used coproovoscopic methods (*Fulleborn, Darling*), coprolarvoscopic (*Popov, Baermann*) and of *successive laundering*. The intensity of invasion with nematodes was set in 5 g. Fetes, and oocysts of *Eimeria spp., F. hepatica* eggs, *D. lanceolatum* in 10 microscopic visual fields (10x40).

After obtaining of the results, after coprologic examination, we administered the Albendaged-10% product, oral suspension, as a method of treatment and prophylaxis in dose of 0.5 ml / 10 kg b.m., as indicated in the statement of administration. After the administration of the product the health of the animals was considerably improved, coughing and diarrhea disappeared. A second sample collecting of feces from the sheep of the experiment was conducted at 12-14 day after treatment. At the coprologic post-treatment examination were not detected eggs or larvae of helminths, the animals were recovered, became active, they have appetite and have not installed adverse reactions in the result of administration of the product, which denotes a highly effective antiparasitic of the "Albendaged - 10%" product, oral suspension.

In the result of the anti-parasite treatment we can certainly confirm that the "Albendaged-10%" product as oral suspension, has a highly anthelmintic effectiveness and is very well tolerated by the animals, general condition of the animals was greatly improved. At the animals disappeared coughing, diarrhea, the animals became active and appeared the appetite.

Throughout the treatment and testing of veterinary pharmaceutical product have not been registered adverse effects after oral administration of recommended doses.

EFFICIENCY OF *LEVAMISOLUM* IN PROPHYLAXIS OF POSTVACCINAL IMMUNODEFICIENCIES IN INFECTED BOVINE

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The immunological reactivity of the organism at stimulation of various antigens is influenced by many factors, among which an important role have parasite infection. The last ones have an opportune character, when the parasite agent proliferates on primary or secondary immunodeficiency fond. The parasite antigens provoke a non-specific stimulation of B lymphocytes and their over demand disturbs the humoral immune response toward the antigens of infection origin. The aim of this study is to investigate the impact of the poliparasitism and antiparasitic chemotherapy in prophylaxis of postvaccinal immunodeficiencies of parasitic order.

The study was accomplished on 4 groups of 5 calves (4-6 months) of Holstein race. The group I (negative control) was constituted of noninfected and vaccinated with anticolibacillar vaccine bovine. The vaccine was obtained from autochthon stem of *E.colli* antigens. The vaccine was administrated subcutaneously in two rounds with an interval of 14 days between them. The first vaccine dose was of 7,5 ml and the second one 10 ml. Lot II (positive control) – bovine infected by *Strongyloides papillosus, Neoascaris vitulorum, Eimeria bovis, E. smithi, E. zuernii, E. ellipsoidalis*, untreated and vaccinated similar to lot I. Lots I and II served as control groups. Lot III – bovine infected by *S. papillosus, N. vitulorum, E. bovis, E. smithi, E. zuernii, E. ellipsoidalis* and complexly treated against parasites with *Amprolium*, *Albendazolum 2,5%* and *Tylosinum 200*, and then they were immunized with anticolibacillar vaccine similarly to group I. Lot IV – bovine infected by *S. papillosus, N. vitulorum, E. bovis, E. smithi, E. zuernii, E. ellipsoidalis* and complexly treated with *Levamisolum*, *Amprolium*, *Albendazolum 2,5%* and *Tylosinum 200*. The *Levamisolum* was administrated as an immunomodulatory drug. At the end of the treatment the calves were immunized with anticolibacillar vaccine.

The results of the parasitological laboratory investigations revealed an invasion extensity by *S. papillosus* of 56% and an invasion intensity (II) – 2-16 larvae, *Neoascaris vitulorum* – 59% and II – 5-8 eggs, *Eimeria sp.* – 65% and II – 2-14 oocysts.

Immunological research results show that, after 15 post therapeutic days, in the group (IV) of infected animals (*S. papillosus, N. vitulorum, E. bovis, E. zuernii, E. el-*

lipsoidalis), treated antiparasitic (*Levamisolum, Amprolium, Albendazolum 2,5%*, *Tyilosinum 200*) and immunized with anticolibacilar vaccine, it was found an average level of 1783.5 ± 256.4 antibodies, i.e. higher by 99.6% (P<0.001) than the initial level; by 80.4% (P <0.001) compared to group (III), infested and treated similarly, but without immunomodulatory (*Levamisolum*); by 80.0% (P<0.001) compared to group II (positive control), infected and untreated, but only by 29.0% (P<0.001) compared to group I (negative control).

Therefore, the obtained results justify the use of *Levamisolum* in the antiparasitic treatment schemes, which is why it is recommended as a remedy for prophylaxis of parasitic postvaccinal immunodeficiencies.

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NEW DATA ABOUT PRESENCE OF THE ZYGAENIDAE FAMILY (INSECTA: LEPIDOPTERA: ZYGAENOIDEA) IN THE FAUNA OF OLTENIA, ROMANIA

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Oltenia Museum of Craiova, Romania

As many other groups of insects, the Zygaenidae family has been little studied in Oltenia fauna Summary data on the presence of species from this family in Oltenia are found in the works published by Ioan Stănoiu alone or in cooperation with Bogdan Bobîrnac, starting since 1965 (Rákosy et al., 2003).

The purpose of this study is the centralization of the data on the presence of this family in Oltenia, completing them with personal data in order to the knowledge stage of the diversity of Zygaenidae in this area of Romania. Given that this work is a first attempt synthesize and centralize the Zygaenidae species of Oltenia, it can constitute a reference point for further research on this family.

The analyzed material was collected during the years 1991-2012, from three counties of Oltenia. It is presented in alphabetical order of collection sites and within sites – in chronological order of the collection date. Abbreviations: DJ – Dolj county, GJ – Gorj county, MH – Mehedinţi county.

After processing the material we identified five species included in four subgenres, two genders and two subfamilies. These five species were collected from seven sites: Bratovoeşti (DJ), Bucovăţ (DJ), Cheile Sohodol (GJ), Craiova (DJ), Ponoare (MH), Secui (DJ) and Segarcea (DJ).

These species are presented in phyletic order, according to Fauna Europaea (http// www. faunaeur.org).

Subfamily PROCRIDINAE

***Rhagades (Rhagades) pruni* (Denis & Schiffermüller 1775)**

Materials: Bratovoeşti, 08.07.2009 – 1 spec.; Segarcea, 12.07.1992 – 1 spec.

Previous mentions in Oltenia: Rákosy et al., 2003.

Distribution in Romania: all over the country.

Subfamily ZYGAENINAE

***Zygaena (Agrumenia) carniolica* (Scopoli 1763)**

Materials: Bucovăţ, 22.07.2002 – 3 specs.

Previous mentions in Oltenia: Rákosy et al., 2003.

Distribution in Romania: Banat, Crişana, Transilvania, Oltenia, Muntenia, Dobrogea (Rákosy et al., 2003).

***Zygaena (Mesembrynus) minos* (Denis & Schiffermüller 1775)**

Materials: Cheile Sohodol, 09.08.1991 – 1 spec.; Ponoare, 06.06.2009 – 1 spec.

Distribution in Romania: Banat, Transilvania and Dobrogea (Rákosy et al., 2003).

***Zygaena (Zygaena) ephialtes* (Linnaeus 1767)**

Materials: Cheile Sohodol, 11.08.2004 – 1 spec.**;** Craiova, 17.06.2006 – 2 specs.; Secui, 30.08.2012 – 2 specs.

Previous mentions in Oltenia: Rákosy et al., 2003.

Distribution in Romania: all over the country (Rákosy et al., 2003).

***Zygaena (Zygaena) filipendulae* (Linnaeus 1767)**

Materials: Bucovăţ, 12.08.1998 – 1 spec.; Craiova, 10.07.2010 – 1 spec.; Secui, 05.05.2008 – 1 spec.; 25.05.2008 – 1 spec.; 27.05.2008 – 1 spec.

Previous mentions in Oltenia: Rákosy et al., 2003.

Distribution in Romania: all over the country (Rákosy et al., 2003).

According to the Catalogue of butterflies (Rákosy et al., 2003), from the Zygaenidae family in the Oltenia fauna were found 16 species and subspecies of the 30 known species in Romanian fauna: subfamily Procridinae – *Rhagades* (*Rh.*) *pruni*, *Jordanita* (*J.*) *graeca*, *J.*(*J.*) *globulariae*, *Adscita statices*, *A. statices drenowskii* and from subfamily Zygeninae – *Zygaena* (*Mesembrynus*) *brizae*, *Z.* (*M.*) *purpuralis*, *Z.* (*Agrumenia*) *carniolica*, *Z.* (*A.*) *carniolica leonhardi*, *Z.* (*A.*) *carniolica wiedemannii*, *Z.* (*Zygaena*) *loti*, *Z.* (*Z.*) *viciae*, *Z.* (*Z.*) *ephialtes*, *Z.* (*Z.*) *filipendulae*, *Z.* (*Z.*) *lonicerae* and *Z.* (*Z.*) *trifolii*.

Our data reconfirm the existence of four species of Zygaenidae previously reported and signal for the first time the presence of the species *Zygaena (Mesembrynus) minos* in Oltenia. Collection sites of this species are located in the north of Oltenia, in the vicinity of Banat where *Z. minos* was previously mentioned. Because the mentioned area was not previously researched, it is possible that this species may have been present in the area long before it was reported for the first time.

Thus now are known 17 species and sub-species of Zygaenidae in Oltenia, with just over 50% of the total listed in the Romanian fauna.

Considering the great diversity of landscape, flora and vegetation of Oltenia and the fact that this family has not been studied specifically it is sure that current data do not reflect the actual presence of the species from Zygenidae family in this historical region.

GENITAL APPARATUS OF PARASITOIDS FROM APHIDIIDAE FAMILY (HYMENOPTERA)

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The discovery of the morphological structure of parasites from the Aphidiidae family, which are specialized in feeding on aphids plant only allow clarification of certain biological processes that previously had no explanation and better understanding of their evolution.

The first article (Stary, 1976), which demonstrated the structure of valve genital 2 from different genera of afidiide are indicated two types: "lanciolata" and "acuta". We conducted this study as we found their correspondence with lifestyle and infecting of various species of aphids. These characters in greatest extent correspond of parasites classification at generis level. What was not known, that in some cases the aphids are dragged by lance, and in others – not. The study of female genitalia gave the possibility to find the answer.

At first we took mummies of aphids *Brevicoryne brassicae* L. on cabbage and after 2 days of output of the parasitoid *Diaeretiella rapae* McIntosh, I placed in pots aphids living. The parasites, when they had aphids reactions, sucked the hemolymph of insect-home because they were of hunger. After several hours parasites infesting the aphids, and they did not have any reaction.

Detailed study of the genital apparatus from another species of parasitoid – *Aphidius ervi* Hal. it gave the opportunity to see the valve 2 two holes, one at the top lance and one lower – at its core, which are the extension of the channel by which the eggs are transported to the outside. When the female lays eggs, aphid has no reaction because the egg, passing the first hole to make the compressed air exits through it, inflating a very fine membrane that hides the lance. In case of nutrition the parasitoid not lay egg and lance remains outside and aphid reacts, being hung with spear.

In case when the parasitoids have valve 2 aciform the aphids are secured by other changes in the structure of genital apparatus. Some species of parasitoids (*Trioxys*) the genital apparatus has two large bobbles (valve 3 is directed up) and in the process of infection by parasitoid, flexible abdomen is directed under standing in front of the body. In this way aphid is pressed to the substrate, as in some species of the genera *Pauesia*, *Toxares* and *Falciconus*, or if aphid is the way of life underground, easily attained by parasitoid (*Aclitus*). In the species of genera *Monoctonus* and *Lipolecsis* valve 3 is robust and large.

The study was performed within the project 15.817.02.12F financed by ASM.

SCIENTIFIC SUBSTANTIATION CONSERVATION STATUS OF TERRESTRIAL AND AQUATIC INVERTEBRATES LIST OF COMMUNITY IN ORDER TO DEVELOP PLANS OF MANAGEMENT OF NATURAL PARKS, NATIONAL AND NATURA 2000 SITES IN ROMANIA

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Between 2010 - 2015 were compiled mappings in field populations of the presence of a number of 14 species from the list nevretebrate European Community (*Carabus hampei, C. variolosus, Rosalia alpina, Cermabyx cerdo, Morimus funereus, Stephanopachys substriatus, Osmoderma eremita, Lucanus cervus, Callimorpha quadripunctaria, Pholidoptera Transsylvania, isophya harzi, Paracaloptenus caloptenoides, Bolbelasmus unocornis* and *Anisus vorticulus*).

The research was conducted in the following five sites included in the national and European network of protected areas:

1 - National Park Cozia (ROSCI0046);

2 - Natura 2000 site - Zarandul East (ROSCI0406);

3 - Natural Park Penteleu (ROSCI0190);

4 - Natura 2000 site - Fagaras (ROSCI0122);

5- Natura 2000 site - South Dobrogea (ROSI0022 - a floodplain - Canaralele Danube; ROSCI0157 - Forest Hagieni; ROSCI0149, Forest Esechioi - Bugeac; ROSCI0083 - Fântâniţa Murfatlar).

The ultimate aim of the research was the development of protected areas management plan by the administration of each site. Simultaneously with the work of mapping the species was made specific habitat mapping.

In some investigated sites were identified at good conservation of species (*Rosalia alpina*, *Lucanus cervus*, *Morimus funereus* in Zarand East); conservation status of vulnerable or affect daily (*Osmoderma eremita, Lucanus cervus, Morimus funereus* - Fagaras Natura 2000 site or the National Park Cozia *Lucanus cervus*). In some sites invertebrate species are considered extinct in the Community list (*Anisus vorticolus* of Canaralele Danube - Natura 2000 site in South Dobrogea ROSI0022).

All studies were completed with proposed measures for improving the conservation status of each species of invertebrates, these measures were introduced in management plans of protected areas. Following thorough observations in the field and based on the specific requirements of populations have been identified, to a large extent, causes and extent of decline, more or less, the vulnerability of the populations of the species.

LUMBRICIDES ROLE IN THE SOIL FORMATION

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Currently degradation of soils globally gained a catastrophic character and is one of the main dangers of global ecological crisis. One way to mitigate degradation and natural restoring soils fertility long time to arable land is their fallow. It is assumed that due to the interaction of the root system of plants and soil biota, the humification processes in the soil will increase and will be improved biological and physico-chemical properties of soils. Different soil types develop in close relationship both with the climatic conditions, geologic structure and anthropogenic context, as well as with microscopic organisms that inhabit and which by their biological activity shaping the evolution and characteristics. In the majority of terrestrial ecosystems soil contains the greatest diversity of organisms. Biological importance of earthworms (Lumbricidae) in soil was established at the end of the past century by Hensenom and Darwin. From ecological perspective, the terrestrial ecosystem has biocenosis composed of vegetation, fauna and microorganisms, the latter creating a living system extremely complex and with very strong interconnections. Soil quality, or "health" of soil is defined by "continued ability of soil to function as a living system in the ecosystem and conditions of use data, while retaining biological productivity, and maintaining of quality air and water of the environment, and maintaining plant, animals and humans health. Microorganisms play an important role in soil fertility as a result of their involvement in the development cycle nutritional elements, such as those of carbon and nitrogen, necessary for plant growth. The excavations carried out of earthworms lead to soil aeration and drainage in addition plant nutrients are released from crop residues that have passed through the intestines of earthworms.

Lumbricides represents 94% of the biomass in the soil fauna. Pedoclimatic each area is characterized by a certain structure of earthworms' species. The number of individuals from different regions varies very high in general from a few thousand up to several million per hectare. Lumbricides transported soil in the upper layers, rich in humus, in the lower horizons and with this, is transported and an impressive number of microorganisms or spores. In a normal soil on arable land, there may be between 100,000 and 1 million earthworms with a weight ranging between 100 and 1000 kg of within one hectare. Mega fauna soil activity is also important in processing the soil surface, opening galleries and through these influencing physico-chemical properties of the soil. The number of pores increases and the dry bulk density of soil decreases when you dig worms its way through the darkness of the earth. Therefore, activity of soil tillage performed by earthworms greatly increases the number of macropores (di-

ameter > 0.5 mm) and creates a network of channels and spaces in soil. This network can rise to 4000, 5000 km per hectare and tunnels can extend to a depth of 2 – 3 m. Tunnels act as 'highways' to the roots in the soil. In a few years, earthworms move tens of tons of soil per hectare up to the surface. Animal life is also very closely related to soil (place of living, resting, feeding, and reproduction).

The future depends largely on "state of health of the earth". Our obligation, of specialists in the research, education, of all workers in agriculture, but also the national economy, the government is primarily that of known soils, we know it well, to protect them from any degradation process, to prevent and combat all actions that lead to reduction or loss of fertility, actions which, unfortunately are taking place increasingly more, not only in the Republic of Moldova, but around the world. In conclusion, we can note that a good knowledge of all aspects of the soil is an essential factor and a working tool particularly useful for a farmer when he will decide what type of crops and fertility treatments that you will use to obtain desired crops.

"Respect the earth and the life in all its diversity".

INFESTED TICKS IXODES RICINUS (LINNAEUS, 1758) THE CAUSATIVE AGENTS OF LYME DISEASE IN LOWER DNIESTER REGION

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Ixodes tick-borne borrelioses (ITB) is attributed to the "new" infections, official report on the cases of ITB is conducted in Moldova since 2000, in recent years the number of cases of tick-borne Lyme disease tends to increase (Gheorghiţa, 2014) [2].

ITB are a group of zoonotic infections from the spirochetosis group, transmitted through the ticks bite, and are characterized by a tendency to prolonged and chronic course.

Infections are transmitted by the tick bite (inoculation), although it is not ruled out the possibility of infection and in contact with the feces of the tick on skin, followed by rubbing them with scratching. (Tsarev et al., 2011) [4].

In the case of the tick improperly removal, the agent can get into the wound.

The aim of research was the investigation of participation of ticks species *Ixodes ricinus* in the circulation of *Borrelia* in the territories of the stationary areas of the Lower Dniester region.

Ticks were collected from 2012 to 2014, at various biological communities in the Lower Dniester region. Stationary collection points, Bender city Park «Friendship of Peoples», Tiraspol Botanical Garden, village Ghyska.

Collected ticks were stored in 70 % ethanol. PCR tests for the presence of DNA of *Borrelia* were held in the Center of Biological Invasions of the Institute of Zoology of the ASM and in the Forsyth Institute, Cambridge, USA (with the assistance of the Doctor of Biological sciences A. Movila). A total of 161 individual (106 female, 55 nymph) were tested. Ticks were identified by standard keys followed by Fillipova [1].

To detect *Borrelia* in ticks site of 16S-23S rDNA gene with species-specific length variation between 480-1050 bp was amplified by PCR «nested» methodology.

In the first stage of PCR we used a pair of specific primers PA (5'-GGTATGTTTAGTGAGGG-3 ') and P95 (5'-GGTTAGAGCGCAGGTCTG-3').

The following oligonucleotide pair was used for the second step of PCR: PB (5'-CGTACTGGAAAGTGCGGCTG-3 ') and P97 (5'-GATGTTCAACTCATCCTGGTCCC-3').

According to the results of the research 3 species of spirochetes were identified. All three species are pathogenic to humans. (*Borrelia burgdorferi sensu stricto, B. afzelii, B. garinii*)

Twenty six persent of ticks were infested with *Borrelia*, *B. afzelii* was the most common species. *B. afzelii* is the causative agent of cutaneous *Ixodes* tick borreliosis in

most cases (Мовилэ, 2008) [3]. This species occurs in 13 % of examined ticks (50 % of infected ticks). As monoinfection *B. afzelii* occurred in 45 % of cases, and 5 % - in combination with other pathogenic microorganisms.

B. garinii is the causative agent of the neurological form of *Ixodes* tick borreliosis. *B. garinii* found in 7 % of examined ticks (26 % of infested ticks). *B. garinii* as monoinfection occurs in 82 % of cases and 18 % - in combination with other pathogenic microorganisms.

Borrelia DNA is more frequently found in females collected in the Botanical Garden in Tiraspol (7,4 %) and city park «Friendship of Peoples» (7,4 %), nymphs infestation in these habitats was respectively 3,8 % and 1,2 %.

During analysis of *Borrelia* infested ticks collected from different stationary points, we found that the percentage of infestation varies from 18 % (Botanical Garden, Tiraspol City) to 40 % (the «Friendship of Peoples», city of Bender). In the forest near the village Ghyska ticks infested with *Borrelia s.l.* were found (27,9 %), the most common species was *B. afzelii* (11,9 %). In the park «Friendship of Peoples» Bender the common species of *Borrelia* was *B. afzelii* - 16,6 %, *B. garinii* were recorded in 9,5 % of ticks. At the Tiraspol Botanical Garden, dominates *B. afzelii* - 21,4 %, *B. burgdorferi s.s.* -14,5 %.

Conclusions. During the carried out investigations in the Lower Dniester region was revealed the circulation of the three species of the *B. burgdorferi s.l.: B. burgdorferi s.s., B. garinii, B. afzelii*. Established the dominance of species B. *afzelii*. Circulation and persistence level of *B. burgdorferi s.l.* in vectors was average of 26,1 %. These results demonstrate the high level of *Borrelia* infected ticks in the recreational - landscape zones (Botanical Garden, Tiraspol – 18,0 %, the park «Friendship of Peoples» Bender 40,0 %).

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DATA CONCERNING THE BUTTERFLIES (LEPIDOPTERA, RHOPALOCERA) FROM THE FOREST NATURE RESERVE BREANA ROȘCANI, GALAȚI (ROMANIA)

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This study brings new data about the diurnal Lepidoptera of a protected area: The Nature Reserve Breana Roşcani Forest. There are no other available list of butterflies from this protected area. Natural Reserve Breana Roşcani Forest is located within the village Baneasa, situated in the NE of Galaţi. The forest covers an area of 154 hectares, of which 78.3 hectares were declared natural reserve since 1969. The reserve has forest and botanical character, here is met Romanian peony *Peonia peregrina var. romanica*, declared a natural monument. It is a xerothermophilic forest and includes species of oak, respectively, downy oak (*Quercus pubescens*) and gray oak (*Quercus pedunculiflora*) and bushes like *Crataegus monogyna* (hawthorn), *Ligustrum vulgare* (common privet) *Prunus spinosa* (blackthorn).

The field research was undertaken in 2009 and 2010 from May to September. There were identified 39 species of butterflies belonging to 5 families: Hesperiidae, Papilionidae, Pieridae, Lycaenidae și Nymphalidae.

As it concern the presence on the Red List of Romanian butterflies, the species founded in the studied area belongs to the following categories: 69% are least concern species, 10% are near threatened species, 18% are vulnerable species and 3% are data deficient species. The most common species in the studied area are: *Coenonympha pamphilus, Maniola jurtina, Vanessa cardui*, *Lasiommata megera, Issoria lathonia, Argynnis pandora*.

Euphrydias maturna partiensis Varga, 1973 – is a rare and localized species, it's presence is reconfirmed for South Moldova, *Carcharodus orientalis* Reverdin, 1913 that is a rare and poorly known species was also identified in the studied area. Other species are protected, being included on the lists of Habitat Directive *(Neptis hylas* Linnaeus, 1758), Bern Convention and Red Data Book of European Butterflies (*Glaucopsyche alexis* Poda, 1761; *Pseudophilotes schiffermüelleri* Hemming, 1929).

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ORTHOPS FORELII FIEBER 1858 (HETEROPTERA, MIRIDAE) – NEW SPECIES IN THE FAUNA OF THE REPUBLIC OF MOLDOVA

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Miridae is the first largest family of Heteroptera. Up to now, more than 11 000 species have been described worldwide (http://research.amnh.org/pbi/catalog/). In the Republic of Moldova is known 179 species of mirids. Most Miridae are herbivorous, especially *Lygus* sp., *Trigonotylus* sp. and *Apolygus* sp. likely become threatening pasture pests.

The species *Orthops (Montanorthops) forelii* Fieber 1858 it was recorded in the northern zone of the country in the village Brinzeni of the Edinet district (N – 48°04'38,5", E – 27°10'51,3", h – 157 m). Single male was captured in the light traps with an ultraviolet lamp.

Morphologically similar species of the genus *Orthops* is different in that it has spines on the legs white or yellowish. The tibia is yellow. The body is reddish-brown or pink hue, the rear edge of the corium reddish, veins of membrane - wings often bright red. Scutellum in a well expressed, sunken points. The second antennal segment is less than 1.5 times as long as pronotum. Vertex of the head with a high keel (Kerzhner, 1964).

The *Orthops forelii* Fieb. is hygrophilous species and lives to preferred in wetlands on *Rumex* spp. In Serbia this species is indicated from Mediterranean sub-alpine rocky pasteres and woodland on rocks (Protic, 2001).

In Europe this species is indicated for the Austria, Bosnia and Herzegovina, Bulgaria, Czech Republic, France, Germany, Greece, Macedonia, Romania, Russia (Caucasus), Serbia, Slovakia, Spain, Switzerland, Ukraine (Carpathes), as well as in Asia – Azerbaijan, Armenia, Georgia and Asian part of Turkey (Aukema, Rieger, 1999).

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RELEASES OF THE ENTOMOPHAGE *PERILLUS BIOCULATUS* F. (HETEROPTERA, PENTATOMIDAE) ON THE POTATOES CROP IN THE REPUBLIC OF MOLDOVA

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Two spotted stink bug *Perillus bioculatus* (Fabricius 1775) is a North American species known as an efficient predator on the Colorado potato beetle (*Leptinotarsa decemlineata* Say). On the North American continent it is common in Canada, Mexico and the United States of America and has two or three generations per year. In the USA he met almost the entire territory, with the exception of the south-east. In Canada *P. bioculatus* controls density population of the phytophage in the southern parts of the country. In Mexico the predator *P. bioculatus* has been registered in many areas (Henry & Froeschner, 1988; Maw et al., 2000).

The nymphs are round to oval in shape. There are five instars. The body length of the four instars averages 1-1,5; 2-3; 4-5 and 6-7 mm, respectively. Mature nymphs of the two spotted stink bug are about 8 to 9 mm long. Adults range in length from 8,5 to 11,5 mm. This species has a different color forms – from white and black to red and black (with various intermediate yellow and black forms) with a distinct black "Y-shaped" marking on the pronotum and two black spots on the thorax. *P. bioculatus* overwinters under plant debris around the margins of potato fields in adult stage.

This species has been mass-reared for biological control of the Colorado potato beetle. It is known, that an average of 1.5 individuals (nymphs of the later instars or adults) *P. bioculatus* per plant reduce the number of Colorado potato beetle population to zero in seven days (Ferro, 1994). For this reason, in the second half of the 20th century two spotted stink bug *P. bioculatus* was introduced into Europe in order to restrain the Colorado potato beetle. However, numerous attempts of the entomologists at acclimatization of the *P.bioculatus* in Europe were not successful. The first information about registration of the two spotted stink bug on the European continent came in 2004, when he was found in the European part of Turkey (Kivan, 2004). Later it was found in other countries: Russia – in Crimean, Seversk, Slavyansk, Dinsk and Krasnoarmeysk districts of the Krasnodar region, Aksai district of the Rostov region, in the Republic of Adygea (Ismailov & Agasieva, 2010; Ismailov et al., 2014; Artohin et al., 2012), Bulgaria (Simov et al., 2012), Greece (Pericart, 2010), Serbia (Protic & Nebojsa, 2012), Moldova (Derjanschi & Elisoveţcaia, 2013, 2014), as well as in 2015 in the North India, Meerut (Prasad & Rishi, 2015).

The populations of the predator in agrocenoses solanaceous crops are affected by different insecticides. Therefore, our attempts to keep the number of natural population entomophage. In 2015-2016 we carried out releases of the entomophage on potato agrocoenosises to maintain the density of the natural population.

Purposely to adapt the predator with factor economic impact against the dangerous pest *L. decemlineata* were carried out the same releases of individuals (adults, nymphs, eggs) *P. bioculatus* in 2015 on the potato crops in 3 localities: village Pelinei, district Cahul – 50 individuals of *P.bioculatus*; village Tetcani, dt. Briceni (2 releases) – 1550 individuals; village Brinzeni, dt. Edinet – 130 individuals of *P.bioculatus*. Total in 2015 were release 1730 individuals (160 adults, 1090 nymphs, 480 eggs). In 2016 we continue releases of the two spotted stink bug *P. bioculatus* on potato agrocoenosises. Were carried out the same releases of individuals (nymphs and eggs) *P. bioculatus* on the potato crops in 5 localities: 2 in the Center (Kishinau, about 10 releases, village Ivancea, dt. Orhei) and 3 – in the North of Moldova (v.Tetcani, dt. Briceni, v. Brinzeni, dt. Edineti and v.Unguri, dt. Ocnita). Total in 2016 were release more than 3000 individuals.

We have studied the bioecological peculiarities of the predator in a new habitat conditions. Was determined that in the conditions Republic of Moldova during the season develops 3 generations of the *P. bioculatus*, first in June-July, the second – in July-August and the third in August-September. Were found all the three color forms of the predatory *P.bioculatus,* which depended on the temperature conditions. Some authors point to the fact that the *P.bioculatus* prefers eggs and larvae of the Colorado potato beetle, and only adult of predator feed on the imago of *L. decemlineata* (Lacey et al., 2001). We have been numerous instances of successful hunting older instar nymphs of the P. *bioculatus* on phytophage adults.

We carry out monitoring of the development entomophage (counted the number of egg-laying, nymphs and adults of the predator *P.bioculatus*) and population density of the pest *L. decemlineata* on the field of potatoes. We have found that for reducing the density of pest population below the economic threshold sufficient release of older nymphs *P. bioculatus* in relation predator: phytophage 1:10-1:15. In addition, in agrocoenosis is stored the number other species entomophages: Coccinellidae, Chrysopidae, Aranea, ensuring protection against potato aphids, leafhoppers, etc.

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EFFECTIVENESS OF IVERMECTIGED 1% TO SOME ECTO- AND ENDO- PARASITOSIS IN SHEEP

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One of the basic reserves of productive potential to agricultural animals is the prevention of parasitic disease. The parasitosis were and remain to be a major problem in the field of domestic animal husbandry, due to economic losses which are recorded in the respective field. At the same time, some zoonoses creates serious social problems, because has the risk of spread and transmission to humans (Screabin K., 1963, Olteanu Gh. et al., 1999, Safiulin R., 2005).

The analysis of the scientific literature in this problem, shows that the parasites in animals are widely distributed (in some cases of 100%) and bring great economic harm to zootechnic sector. It is obvious that the host organism is in a permanent monoparasites relation with population of each species, in the same time with that poliparasitar existing in respective organism. The poliparasitar invasions, actually, are meet at domestic and wild animals, and to humans (Spaskii A. et.al., 1963, Suteu I., 1996, Zgardan E., Erhan D., Rusu St. et al., 2008).

Although the economic situation from the last years in households from the Republic of Moldova is difficult, the domestic animal husbandry remains an important branch of perspective of the zootechnics. Because the treating of parasitic diseases requires the use of specific remedies, knowing of their action mechanism on the host-body has a principled significance. The immunological changes that occur in the body to infestations with parasitic agents and to administration of chemo-therapeutic remedies, are not studied enough. The negative secondary effect of chemo-therapy is directly determined by the action of the medicine on imunogenesis and of massive penetration of somatic or metabolic antigens of the parasite in the body after treatment. Some medicines inhibits the imunogenesis of body and acts negatively on the development of basic disease (Ozeretkovskaia N., 1987, Daugalieva A., Kolenikov V., Novitkii S., 1997, Olteanu Gh. et.al., 2001, Erhan D., 2010, Nicolae C. et.al., 2014).

The prophylaxis and treatment of parasitosis demonstrate that administration of chemical-pharmaceutical remedies, especially of anthelmintic, are aimed at damaging and removing of the parasites from the body. The fight with parasites, usually, takes place without the evidence of protection mechanisms of the body in which they grow

(Suteu I., 1996, Suteu I., Cozma V., 2007, Iakubovskii M., 2008). Having a broad therapeutic spectrum extending on insects, arachnoids, nematodes and low-dose administration, the Ivermectiged 1% medicine, produced by Euro Prime Pharmaceuticals LLC, Republic of Moldova, inoculated at bovines in dose of 1 ml/50 kg b.m., swine - 1ml / 33 kg b.m. and to the sheep in dose of 0.5 ml / 25 kg b.m., make part of macrocyclic lactones, medicines which have taken a real spread in antiparasitic therapy in animals in many of the world tart (Suteu I; 1995). To the sheep, the ivermectin is indicated in the treatment and prophylaxis of pulmonary and gastrointestinal nematodes, of the itch and estrosis (Olteanu Gh. et al., 2001). The avermectins are well tolerated by animals, but small deviations in overcoming of therapeutic dosage does not cause acute poisoning (Darabus Gh. et al., 2003). The aim of the present paper is to assess the action of Ivermectiged product (Euro Prime Pharmaceuticals LLC) containing 1% of ivermectin for the treatment of ecto- and endo- parazitosis, that can be found at sheep in the Republic of Moldova. The tests were carried out on sheeps at a private property, located in the village of Gradiste, Cimişlia district. The consignments of animals were distributed as follows: experimental group of 20 animals (10 adult sheep and 10 young sheep), and the control group - 6 animals (3 adults sheep and 3 young sheep). From the experimental group 35% of sheep, at ante-therapeutic clinical examination, presented crust dermatitis lesions. From the material obtained by scraping, after microscopic examination, were found mites from *Psoroptes ovis* species. The animals have undergone the treatment in accordance with the instruction of administration, inoculate to them 0,5 ml/25 kg b.m. At the recontrol performed at the 14th day of post-treatment was found missing of crusts, absence of psoric reflex, and microscopic examination hasn't revealed evolutionary forms of *Psoroptes ovis*. The ivermectiged administered subcutaneously in a dose of 0.5 ml / 25 kg of body weight has an effectiveness of 97-99% in 7-20 days. Having a broad antiparasitis spectrum, the medicine has the advantage of being administered in any season. This effect is confirmed by Suteu I. and Dulceanu N. (2001) in respect of other avermectin.

The coproparasitologic exam, conducted pre-therapeutic on animals from this experiment, revealed infestations associated with parasites from *Dicrocoelium, Eimeria, Strongyloides* genres (pulmonary and digestive), who presented consecutively following percentage indices: 95%; 30%; 60%. The control group showed a similar level of infestation. After 14 days the coproparasitologic exam revealed the maintenance of infestation with *Dicrocoelium lanceolatum*, of the infection with Eimeria and lack of infestations with lung and digestive strongyls. To the control group have been showed the same values found in ante-therapeutic control. In the result of research on the therapeutic efficacy of the Ivermectiged 1% product to the sheep, we conclude the following: *Dicrocoelium lanceolatum and Eimeria ssp.* were found at ante-therapeutic and at the post-therapy controls, which suggests that the ivermectin does not act in these parasitosis. The ivermectiged of 1% has maximum efficacy in the treatment of lung and digestive strongylidosis. It was also found an efficacy of 97-99% in the treatment of psoroptic scabies at sheep.

INTERSPECIFIC COMPETITION OF *TRICHOGRAMMA* SPP.

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Biological control plays an important role in integrated plant protection. Beneficial insects are rather important in modern biological control practice for reducing pests' density.

The Institute of Genetics, Physiology and the Plant Protection of ASM, Chisinau, Moldova conducts fundamental and applied research with *Trichogramma* to settle technical issues, improve entomophage's quality and effectiveness in plant protection to obtain ecologically safe products. To improve parasitoid quality and efficacy, it is necessary to select the right species best adapted to natural conditions of certain zones with certain species. In mass rearing of *Trichogramma*, the numerical density of the initial colonies grows by tents, even hundreds of times leading to a depression the number of inherited crossings and thus leading to sexual deregulation of the population, and to a lowering of the quality of *Trichogramma*. Such factor as interspecific competition becomes particularly important at *Trichogramma* mass rearing and releasing into the field. At relative trophic specialization of *Trichogramma* competitive capacity impacts its efficacy.

During the rearing of the laboratory host, biological indices have been determined for *T. evanescens* (prolificacy, hatching, females' rate) reared on these eggs. Experiments carried under laboratory and field conditions. Experiments have been made in three climatic chambers SKP-1 at average daily temperatures of 15˚C, 20˚C, 25˚C and relative humidity of 50%, 65%, 80%, at photoperiod lasting for 16 hours. Experiments have been effectuated according to Box-3 plan.

Collecting, identification, storage and accumulation of *Trichogramma* species were done using (according to) (DIURICI, 2008). Five trial variants in five repetitions have been conducted in the Institute of Genetics, Physiology and the Plant Protection Institute of ASM Moldovan Academy of Sciences, using various reports on *Trichogramma* species under laboratory and field conditions: *T. evanescens* – 100%; *T. pintoi* – 100%; *T. evanescens*+*T. pintoi* – 50% +50%

T. evanescens+*T. pintoi*–10% +90%; *T. evanescens*+*T. pintoi*–90% +10%

Laboratory experiments results have demonstrated that during 4 generations of *Trichogramma* development *T. evanescens* Westw. has been gradually substituted by *T. pintoi* Voeg. When share ratio of *T. evanescens* and *T. pintoi* equals to 1:1 passed through Angoumois grain moth eggs (*Sitotroga cerealella* Ol.) after the fourth generation it has been noticed that at T=15˚C combined with different humidity's, *T. pintoi* share has constituted from 68.3 to 83.95% and *T. evanescens* share – 16.1 to 31.7%; at T = 20˚C these parameters have ranged, respectively, from 76.0-95.0% and 5.0 to

24.0%, while at T=25°C – they ranged from 76.1 to 100% and from 0 to 23. 9%. When shares of *T. evanescens and T. pintoi* have equaled respectively to 9:1 substitution rate of *T. evanescens* has been more reduced. However at T-15°C in mixed batch there remained from 42.9 to 45.0% of *T. evanescens* at T=20°C, respectively, from 38.9 to 45.0%, at T=25°C – from 31.5 to 38.35%. At the end of all experiment variants no *T. evanescens* have been found, while at T=25°C similar situation has been observed for the III-rd generation. The mechanism of substituting one species by the other has been explained by different response of *T. evanescens* and *T. pintoi* on temperature and humidity regimes at mass rearing. As a result of the laboratory experiments, it has been established that along the 4 development generations of mixed *T. evanescens* Westw., *T. pintoi* Voeg. gradual substitution of *T. evanescens* by *T. pintoi* occurs. The mechanism of interspecific competition on grain moth eggs was established. In the field of cereal, technical and vegetable crops, *T. evanescens* is dominant specie (up to 95-99%). *T. pintoi* represents a laboratory population, which's preferred host is *Siotroga cerealella* Ol. In the presence of the two species of *Trichogramma* in the biotope, their quantitative ratio depends on the specific conditions of climate and resource of preferred host's egg. Biological indices for *T. pintoi* are higher than ones of *T. evanescens*. Therefore, in the laboratory conditions we substitute *T. evanescens* by *T. pintoi,* but in the field it's opposite.

After the first release of mixtures of *T. evanescens* and *T. pintoi* (50:50%), share in percentage has constituted 91.05% for *T. evanescens* and 8.95% for *T. pintoi*. After the second release respective shares have been as follows – 94.5% and 5.5%. After the first release of mixture of *T. evanescens* and *T. pintoi* (10:90%) egg lying of the cabbage moth have been parasitized at the level of 85.6% by *T. evanescens* and at the level of 14.4% by *T. pintoi*, after the second release – respectively – 88.8 and 11.2%. After the first and second releases of *T. evanescens* and *T. pintoi* mixtures (90:10%) analyses have shown that it is *T. evanescens* that actually controlled the pest in the field while *T. pintoi* has not been found.

As a result of the laboratory experiments, it has been established that along the 4 development generations of mixed *Trichogramma*, gradual substitution of *T. evanescens* by *T. pintoi* occurs. It has been established that under natural conditions species competition has been lower. To the above said contribute fluctuations of temperature and humidity, localization of host eggs in time and space, as well as more intensive accumulation of species that are not specific for this biocenosis (for example *T. pintoi*). However, if further *Trichogramma* release is not made, the dominant species is restored.

In case of presence of two species in the biotope quantitative share will depend on specific climatic conditions and the number of preferable host individuals.

FIRST DESCRIPTION OF SPECIES *PLEUROGENOIDES MEDIANS* OLSSON, 1876 IN CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Initially, the species of trematode *Pleurogenoides medians* Olsson 1876 was discovered and identified in ex. R.D.G., R.F. Germany, ex. U.R.S.S. (Hotenovskii, 1970), Romania (Radulescu et al. 1956b, Capuse et al.. 1957) Poland and other regions.

In Moldova, this species was discovered for the first time in the intestine and stomach of amphibians from green ranids complex: *Rana ridibunda, R. lessonae* and *R. esculenta* in central zones of Codri forest. Some authors have described that hosts for this species of trematode may also include other amphibian species: *Rana terrestris, R. temporaria, R. chensinensis, Tritirus vulgaris, T.cristatus, Pelobates toad, Bufo viridis, B. bufo, B. calama, Bombina bombina, Hyla arborea* (Rijicov et al., 1980).

Pleurogenoides medians Olsson in 1876 species description, the paper was based on the study of 419 specimens that were obtained from species *Rana ridibunda, R. lessonae* and *R.esculenta* caught from four natural basins and eight anthropogenic basins (Fig. 1).

The body appearance can be round, oval or spindle-shaped, with a length from 0,507 to 1,149 mm and a width from 0,243 to 0,588 mm. Cuticle, except the tail is covered with small thorns. Oral sucker has a diameter of 0,066-0,118 x 0,053-0,132 mm, located less subterminal terminal. Ventral sucker has a diameter from 0,050-0,115 x 0,056-0,108 mm, located pre-equatorial. Intestinal branches are short and quite broad, reaching more or less the ventral sucker. Excretory orifice has a short channel with long branches, that reach the ventral sucker. Testicles 0,083-0,085 x 0,083-0,086 mm in diameter, have a round, irregular or oval shape, located on ,ventral side of the sucker. Copulatory organ is disposed in the first half of the body and reaches the ventral sucker. Genital orifice is located marginal to the glottis, the mid esophagus were at branching intestinal. Ovary may be a round shape, oval or irregular 0,045-0,147 x0,042-0,134 mm in diameter, above the intestinal branches at some distance above the testicle or nearly touches. Seminal receptacle is round or elongated, positioned right of the ovarian or testicle and ventral sucker. Vitelogene glands are formed from small ammount of follicles situated to the rear of the oral cavity, at the level of the glottis or intestinal branch. Vitelogene glands are usually composed of two groups of follicles, separated dorsally, which can sometimes be omitted. Uterine loops are positioned

postacetabulare and can not pass this level. Eggs diameter vary between 0,013-0,023 x 0,008-0,012 mm, at one of the poles has a cap, and on the other - a lower edge (Tab. 1).

Biological cycle. For *Pleurogenoides medians* definitive hosts are anurans, in which is frequently detected this trematode. The first intermediate hosts are molluscs *B. tentacle, L. limosa, P. corneus*. Their infestation occurs after ingestion of eggs containing miracidia, which develops sporocysts. Have all the appearance and are located predominantly in the visceral connective tissue of the higher visceral sac and in cavity of gonad, less often in the region of the heart, kidney and the gut at the rear part of the molluscs. Depending on the size of sporocysts they contain from 1-2 up to 4-5 cercariae.

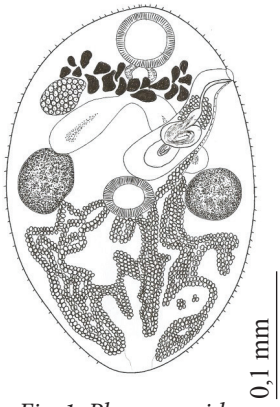

Fig. 1. Pleurogenoides medians Olsson, 1876 – general aspect. Original.

Table 1. Morphometric parameters of the species *Pleurogenoides medians* Olsson, 1876, n =*15*

Characteristics	Average mm	SE	σ	RSD	sdCV	Minim, mm	Maxim, mm
Surface	0,219	0,025	0,097	44,4	9,6	0,084	0,359
body length	0,760	0,051	0,196	25,8	5,0	0,507	1,149
body width	0,405	0,022	0,085	21,0	4,0	0,243	0,588
length of the mouth sucker	0,095	0,005	0,012	19,1	3,6	0,066	0,118
mouth sucker width	0,092	0,005	0,020	21,8	4,2	0,053	0,132
ventral sucker length	0,079	0,005	0,019	23,9	4,8	0,050	0,115
ventral sucker width	0,079	0,005	0,017	21,5	4,3	0,056	0,108
length of posterior testis	0,083	0,005	0,020	23,7	4,6	0,062	0,134
width of posterior testis	0,085	0,006	0,024	28,0	5,7	0,054	0,128
length of testis posterior	0,083	0,005	0,017	20,8	4,1	0,62	0,128
width of testis posterior	0,086	0,006	0,024	28,0	5,7	0,050	0,122
ovary length	0,089	0,010	0,037	41,9	8,9	0,045	0,147
ovary width	0,086	0,009	0,035	40,6	8,6	0,042	0,134
egg length	0,017	0,0008	0,003	18,7	3,5	0,013	0,023
egg width	0,010	0,0004	0,002	16,7	3,1	0,008	0,012

Note: MAE – standard error, σ – standard deviation, *RSD* – relative standard deviation, *sdCV* – error of relative standard deviation.

The second intermediate hosts are various larvae of aquatic insects (dragonflies, beetles, ephemia, plecoptera, caddisflies) and crustaceans (*Gammarus, Asellus*). Metacercariaes of this species are observed at progenesis (larval multiplication). Occasionally, the trematode *Pleurogenoides medians* was found in lizards and river pike (Rijicova et al., 1980).

Aknowledgement: The work was performed within the project 15.817.02.12F financed by Academy of Sciences of Moldova.

DESCRIPTION OF SPECIES *PROSOTOCUS CONFUSUS* LOOSS 1894 IN CONDITIONS OF CENTRAL CODRII IN REPUBLIC OF MOLDOVA

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In some scientific papers on amphibian helmintofauna the species of trematode *Prosotocus confusus* Looss, 1894 was identified as the *Prosotocus fuelleborni* (Travassos, 1930), *Distomum* (*Brachycoelium*) *clavigerum* Dujardin, 1845; *Distomum confusum* Looss 1894; *Distomum clavigerum* Pagenst., 1897; *Prosotocus confusus* Looss, 1899 *Pleurogenes confusus* Klein, 1905 (Rijicova et al., 1980).

In the central zone of Codri in Republic of Moldova the species *Prosotocus confusus* was found in the small intestine and stomach of the amphibian from the complex *Pelophylax esculenta* (Amphibia), although some researchers identified this species only in the small intestine in the amphibians from the complex *Pelophylax esculenta* and other species, such as *R.terrestris, R. temporaria, Bombina bombina, Pelobates toad, Bufo viridis, B. bufo, B. calamita* (Rijicova et al., 1980).

Description of species *Prosotocus confusus* Looss, 1894 in this scientific paper is based on the study of 865 specimens obtained from *Rana ridibunda, R. lessonae* and *R.esculenta* species caught from four natural basins of and eight anthropogenic basins (Figure 1).

Morphologically, the body can be circular, elliptical, ovoid, pear-shaped with a length of 0.396-0.804 mm and a width of 0.295-0.638 mm. Thorns covers the entire body except the rear end, being more dense in the first half of the body. Oral sucker with the diameter of 0.091- 0.084 x 0.153 -0.168 mm is terminal or rarely subterminal and ventral sucker of 0.087-0.091 x 0.177-0.168 mm in diameter is in postcaudal region of the body. Left intestinal branch, as length is shorter than intestinal right branch. Excretory bladder branches reach up to the ventral sucker. The testicles are oval or irregularly shaped, diameter is 0.093-0.084 x 0.093-0.079 mm, situated at the glottis or intestinal bifurcation. Copulatory organ, in appearance of bludgeon, is typically positioned along the left side of the body, rarely - obliquely touching the bottom or middle of the ventral sucker. Genital pore is marginal or submarginal, located in the esophagus or intestinal bifurcation, behind the left testicle, preacetabular. Ovary diameter of 0.042-0.034 x 0.131-0.171 mm is located medial or submedial at the genital pore, preacetabular. Vitelogene glands are located in the first half of the body above the

testicles, from the oral sucker to the level of the bifurcation of the testes or intestine. The ootype comes from the uterus to the left, then turn toward the rear of the body and behind the ventral sucker goes to the right side of the body forming loops aimed at atrium. The metraterm is not big, usually has the appearance of the letter S. The eggs have a diameter of 0.011-0.070 x 0.018-0.012 mm (Table 1).

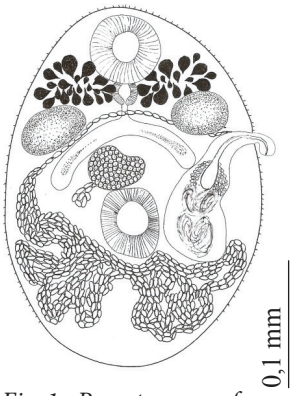

Fig. 1. Prosotocus confusus Looss, 1894 – general aspect. Original.

Biological cycle. Trematoda *Prosotocus confusus* Looss, 1894 is registered frequently in Anuran amphibians - the definitive hosts. The first intermediate host is the mollusk *Bithynia Leach*. In this mollusk the miracidium forms sporocysts, containing 4-8 cercariae. The second intermediate hosts are larvae of dragonflies - *Sympetrum flaveolum*, *S. berth, Aeschna isosceles*, *A. viridis*, *A.granda, Coenagrion puella* larvae of trichopterans *Phryganea grandis*, *Agrypnia* sp., and imago larvae of beetles *Hydrous piceus*, *C. laterimarginalis*, crustaceans and ephemeral.

Tabel 1. Morphometric parameters of the species *Prosotocus confusus* Looss, 1894, n =*15*

Characteristics	Average mm	SE	σ	RSD	sdCV	Minim, mm	Maxim, mm
Surface	0,167	0,021	0,083	49,3	11,0	0,085	0,403
body length	0,514	0,027	0,105	20,5	2,9	0,396	0,804
body width	0,413	0,023	0,088	21,4	4,1	0,295	0,638
length of the oral sucker	0,118	0,005	0,020	17,1	3,2	0,091	0,153
width of the oral sucker	0,117	0,007	0,027	23,4	4,5	0,084	0,168
length ventral sucker	0,131	0,008	0,027	20,3	4,3	0,087	0,177
width ventral sucker	0,114	0,008	0,027	24,0	5,2	0,091	0,168
testis previous length	0,093	0,010	0,034	36,6	7,8	0,050	0,140
testis previous width	0,084	0,010	0,034	40,3	8,8	0,039	0,151
testis posterior length	0,093	0,010	0,036	39,2	9,1	0,043	0,142
testis posterior width	0,079	0,010	0,035	45,2	10,9	0,026	0,148
ovary length	0,081	0,009	0,030	37,1	8,5	0,042	0,131
ovary width	0,072	0,011	0,037	51,2	12,9	0,034	0,171
eggs length	0,153	0,0005	0,002	13,4	2,5	0,011	0,018
eggs width	0,009	0,0004	0,002	17,0	3,2	0,070	0,012

Note: MAE – standard error, σ – standard deviation, RSD – relative standard deviation, *sdCV* – error of relative standard deviation.

The metacercariae of this parasite are predisposed to progenesis (larval multiplication). Trematode *Prosotocus confusus* in some cases has been established in field lizards *Lacerta agilis* Linnaeus, 1758 and snake *Natrix natrix* Linnaeus, 1758 - as optional hosts (Rijicova et al., 1980).

Aknowledgement: The work was performed within the project 15.817.02.12F financed by Academy of Sciences of Moldova.

CORELATION BETWEEN THE CONCENTRATION OF SAME HEAVY METALS FROM THE ENVIRONMENT AND THE *APIS MELLIFERA* L.

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It is known that environmental pollution is a major danger to everything that means life. Among the main pollutants of environment includes the heavy metals, which are characterized by increased persistence and accumulation capacity in the food chain links, manifesting a negative impact on the environment and human health. Harmful impact of high concentrations of heavy metals on human and animal is expressed by disrupting the balance of vital activity, increased incidence of nervous, cardiovascular systems diseases and oncological, decreasing of reproduction and productivity. In this context, monitoring or newer bio monitoring of heavy metals concentration in environmental components represent a special interest, because it allows evaluation in dynamic of environmental factors.

Recently, many countries are more and more focused on the api monitoring concept or bio monitoring of environment via honeybee (*Apis mellifera* L.). The bee attractiveness as ecological detector is based on several peculiarities of morphological and ethological characters; these have been recognized as potential indicator organisms for environmental pollution with heavy metals and pesticides [1, 3, 4, 5]. So the api monitoring could present an important element in the string evaluation measures of pollutants impact in the ecosystem.

In this context, the aim of the research was to determine the content of *Pb, Cd* and *Cu* in environmental components, honeybee body and determining the level of correlation between them. The researches have been conducted in the central area of the Republic of Moldova in the 2012-2013 years. Bees' samples were taken from experimental apiaries located in four research sites - "forest", "agricultural", "transport" and "industrial" with different degrees of pollution and human impact. Determination of heavy metals (*Pb*, *Cd*, *Cu*) has been carried out by atomic absorption spectrometry according to the European standards and norms.

Following the analysis performed was revealed that the contents of *Pb*, *Cd* and *Cu* in both environmental components and in the bees' body vary depending on the human impact, expressed by the presence of pollution sources. The average concentrations of *Pb*, *Cd* and *Cu* in the environmental components (soil, water, flowers) from the "industrial" and "transport" sites have been significantly higher than those from the "forest" site, at the same time recorded values do not exceed allowable limits set by European norms [2].

The highest concentrations of *Pb* in the bees body have been found in the "industrial" and "transport" sites, which exceeded the values of the "forest" site of 5.0 to 4.4 times (t_d=7,73-8,12; P<0,001). Also in these two sites the highest values of *Cd* content in the bees body have been registered, which were of 5.1 and 3.3 times higher than the concentrations of this metal in the "forest" site (t_d=6,04-8,09; P<0,001). The increased concentrations of *Pb* and *Cd* in the bees body collected from the mentioned sites, denote about the environmental quality in these sites and can be explained by industrial pollution and intense movement of vehicles.

Regarding the average concentration of *Cu* in the bees' body, the highest values have been recorded in the "agricultural" site which exceeded with 81.8% the concentration in the "forest" site (t_d=10,66; P<0,001). This is due to the use by farmers of agrochemicals with copper for treatment of agricultural crops. It should be mentioned, that in all studied sites, concentrations of *Pb*, *Cd* and *Cu* in the bees body have been much lower than the harmful dose set from the bees, and do not present danger to health and productivity of the bees families.

Determining the level of correlation between the concentration of *Pb*, *Cd* and *Cu* in the soil and their concentration in the bees' body (r_{xy}=0,97; 0,99; 0,99, respectively) has been demonstrated once again the honeybee sensitivity to the environment ecological state.

Thus, the content of heavy metals (*Pb*, *Cd*, *Cu*) in the environmental components and in the bees body are directly related to the human impact of reference sites. The variation of the studied heavy metals concentration in the bees' body is influenced by the variation of their concentration in the environmental components. Significant correlations have been determined between the concentration of heavy metals in the environmental components and their concentration in the honey bees' body.

Using *Apis mellifera* as bio indicator of environment quality, it was revealed that the studied sites are not polluted, at least, with investigated metals. The use of api monitoring for assessing the environmental quality in various sites with anthropogenic impact, is a convenient and accessible method, to complement the contemporary techniques for estimating environmental quality.

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DATA ON NEMATODE COMPLEXES OF APPLE TREES IN THE REPUBLIC OF MOLDOVA

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The Republic of Moldova has all the natural conditions for intensive development of horticulture. This branch was and likely to remain one the main pillars of national agriculture, because it is a source of wealth, leading to efficiency of the entire agricultural sector of the country. The horticultural sector-primary production and processing industry has a multiplier role in the agroeconomy of the country generating and stimulating added value in other branches such as trade construction and financial services.

Presently seeded fruit growing represent one of the main strategic branches of the national economy, accounting for approximately 19 % of the total agricultural production value. The area of fructiferous tree plantations in 2014 totaled 94,5 thousand hectares, including fruit archers 88,3 thousand ha, or 94,1 % of total fruit production. Orchards are maintained using advanced agrotechnologies and high-quality seeding. A significant input is a great variety of apples which include now both local and popular international breeds. Favorable soil and climate conditions, traditions and accumulated experience allow cultivation of more than 50 varieties of apple trees, obtaining high yields.

Apple is one of the most commercially significant temperate fruit and is fourth among the most widely produced fruits in the world after banana, orange and grape. The main argument in creation and exploitation of apple agrocenoses is determined by their important energetic resources and source of nutrients. Despite favorable conditions particular attention require damages and losses of agricultural production caused by harmful organisms, especially populations of free living and plant parasitic nematodes, causing phytohelmintosis of horticultural plants, or diseases as vectors of infections with serious consequences on apple trees.

Monitoring of free living and plant parasitic nematodes, revealing of complexes and structures of plant parasitic nematodes and their impact, frequency of species depending on adaptation and trophic preferences, abiotic conditions, type of soil and agrotechnological maintenance has a major agrobiological significance.

Apple tree agrocenoses with areas larger than 500 hectares from 5 administrative districts, 2 from northern part of the country (Briceni and Soroca) and 3 from central part (Criuleni, Ialoveni and Calarasi) were investigated. The study was conducted during years 2015-2016, data on nematode complexes were recorded using standard methods including soil sampling in apple trees rhizosphere on 30 - 55 cm depth and segments

of tiny shallow roots. Overall more than 100 samples of soil and plants were examined using modified method of Baerman and fixation in 4 % formalin at 60°C. The taxonomy of the species, frequency and abundance and other biological peculiarities were established using specific literature. Collected material was processed under microscope, identified specimens were deposited in the collection of the Laboratory of Parasitology and Helminthology, Institute of Zoology, Academy of Science of Moldova.

As the result of conducted investigation was revealed that abundance of nematodes in the northern part of the Republic of Moldova ranged from 720 to 1170 specimens per 100 g of sampled soil. In the central part of the country the values varied more comparative to northern part, ranging from 460 to 1300 specimens per 100 g of soil, due to temperature variations and humidity. These values are specific for the environmental conditions of 2015 year, characterized by excess of high temperature and extensive soil drought (more than 45 days during June and August). The analysis of the soil samples from 2016 revealed an abundance of nematodes ranging from 870 to 1680 samples per 100 g of soil in northern part of the republic and 920 to 2200 exemplars per 100 g of soil in central orchards. The excessive abundance of nematodes with approximatively 5-28 % in central part is due to extended periods of high temperatures and humidity.

Altogether 62 species of free living and plant parasitic nematodes from fruit trees crops were revealed. The most frequent proved to be species from genera *Pratylenchus*, *Rotylenchus*, *Ditylenchus* and *Criconemoides*. Also three species *Xiphinema index*. *X. brevicole*, *X. vuitennezi* and *Longidorus elongatus* were identified as vectors of NEPO viruses. Symptoms of premature branches drying, chlorosis virus and embossment with serious and irreversible pathological consequences to apple trees were highlighted almost for all investigated apple agrocenoses, the degree of viral disease ranged within 5-18%.

According to trophic specialization 5 groups of nematodes were established, the most abundant being the group of plant parasitic nematodes (29 species), which seriously affect absorbing bristles followed by specialized endo-, semiendo- and ecto-parasitic adaptations.

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SOIL ANIMALS ADAPTATION TO ANTHROPOGENIC AND CLIMATIC CHANGES

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Soil's importance as environment for Earth's animals consists in the fact that many live species' existence is connected to it.

Numerous organisms that inhabit soil are presented by microorganisms (bacteria, fungi, actinomyces, algae, protozoan), vertebrate and invertebrate animals. Bacteria are most widely represented among soil's microorganisms. Live weight in ploughing horizon is from 3 to 6-7 tones per hectare. The quantity of bacteria in soil depends from its type and cultural state. The number of bacteria decreases with depth. They are especially numerous in upper horizons that are rich in organic matter. Organic matter regime and accumulation in biosphere is remarkable feature of soil environment, providing soil's capacity as storage and source of matter and energy for terrestrial organisms. Earth's soil cover, according to M.M. Cononova (Круговорот вещества в природе .., 1980), contains nearly 2500 milliard tones of humus. Annual synthesis of humus matter in terms of carbon content is equal to 1-2 milliard tones. Humus supply forming period is nearly 800-1500 years.

In present due to wide reclamation of soil cover and soils erosion' intensification, humus' world deposit is in decrease. The annual rate of decrease is 1.2-1.4 milliard tones, and over last 100 years nearly 400 milliard tones of humus is lost. The decrease of rate of humus' de novo synthesis is also registered due to decrease in leaf-fall supply by more than 40% because of agricultural activities.

Soil also plays a key role in evolutional process, as soil cover according to its main ecological particularities can be viewed as transitional environment (between air and water one), through which gradual transition from aquatic habit of life to terrestrial one without rapid changes in organization of breathful.

Some larger animals (earthworms, grubs of some bugs, centipedes et al) inhabit soil as their environment as a whole, serving as porous or compact medium. In the case of a compact medium there is a necessity in special morphological adaptation for digging and tunneling. It also should be mentioned that larger animals depend on the whole more from soils' cluster of features than the inhabitants of microscopic soil reservoirs (protozoons et al) and the inhabitants of leads and cavities (ticks et al).

The fact that soil is a diverse environment for various dimensional groups of animals is of great importance when understanding soil's specifics as a special natural

formation. Such heterogeneity of soil testifies that practically all main types of ecological niches are close inside it in a confined space.

The diversity of soil's environment is a factor that contributes to such common regularity as changes in horizons: many animals that usually live on the surface proceed to life inside the soil when landscapes humidification decreases. Thus soil-inhabiting grubs of Tenebrionidae and Alleculidae appear widely in chernozems, but in the conditions of deciduous forests another species of these family are developing in decaying wood. Soil grubs of Dorcadion, Eumalpmae and many other forms that belong systematic groups the representatives of which do not inhabit soils of forest biogeocenosis also appear in soil. Furthermore, the ants that live in dryer places, build deep underground nidus in steppe.

For larger non-microscopic, but still lesser organisms, soil as habitat is presented by an assemblage of leads and cavities, the movement in which is similar to movement on substrate's surface. Soil's porosity, its water and thermic regime, distribution of debris and humus is of most importance for this category of soil's inhabitants.

Above-ground mode of life requires serious adaptation changes that are hardly achievable at sharp transfer from water environment to above-ground mode of life without intermediate link – soil. For certain group of animals such transfer would be impossible, which would lead to decrease in biological evolution rate and its simplification, e.g. the present diversity of above-ground forms that exist at present would not be possible without soil.

As one considers anthropogenic changes of functions of soil as environment (loss of soils due to erosion, desertification etc), one can state terrestrial organisms' pedological living conditions' worsening and total decrease in livable space. One can also state the decrease in soil-ecological niches' diversity as a result of progress in degradation processes. Simultaneously new anthropogenically conditioned soil-ecological niches appear, part of which is favorable for terrestrial organisms (soils under artificial afforestations, successfully meliorated lands et al).

Together with decrease in terrestrial species' number, down to complete vanishing, new populational structures appear, new man-created place of habitat are reclaimed, which contributes to modern biological evolution features unusual for its natural development. Soil degradation leads to fauna degradation.

GLOBAL WARMING AND THE NEW APPROACHES FOR DEVELOPMENT OF BAITING MATRICES, CONTROL AGENTS AND BAITS FOR TURKESTAN TERMITE *ANACANTHOTERMES TURKESTANICUS* JACOBSON

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It is shown by researches that increased temperatures does not decrease termite activity in arid zones of the Earth. Last decades increased harmfulness of Turkestan termite *Anacanthotermes turkestanicus* Jacobson is observed in semidesert, steppe and desert regions of Uzbekistan regards not only to public housing. It is well-known also a negative impact of products of termite vital functions on the Earth atmosphere ozone layer increasing warming process.

As a result of this prognosticated global warming can lead to more destructive activity of termites in world scale that will demand additional efforts for creation of cheap, efficient and mainly environmentally safe methods of termite control.

It needs to remember also that in wildlife termites play an important role of biodestructors for organic raw material in carbon circulation. Taking this into account the development of measures that inhibits the urbanization of termites and returns them to natural habitat would be an ideal approach.

Use of pest killers against harmful impact of termites, especially in densely populated agro-industrial complexes of Uzbekistan) is impossible due to some evident reasons. Even their main advantages as effect of fast and high percent killing become unacceptable for termites because of specificity of bioecology and behavior of this species of insect.

Therefore existing methods of termite population control are far from perfection. It is necessary to develop integrated strategy of control with use of more effective, ecofriendly and available agents of biocontrol created by nature itself and modified by present-day biotechnological approaches.

One of necessary and top-priority approaches in solution of this problem is even difficult but step-by-step transition in civil and industrial construction to building materials and consumer goods which are non-attractive and even deterrent for termites. In terms of development of new and available means for termite prophylactics and control it is necessary to turn main attention on search of available and effective means of repellent and deterrent action, specific pathogens and specific bioinsecticides and also effective parasites and entomophage of Turkestan termite.

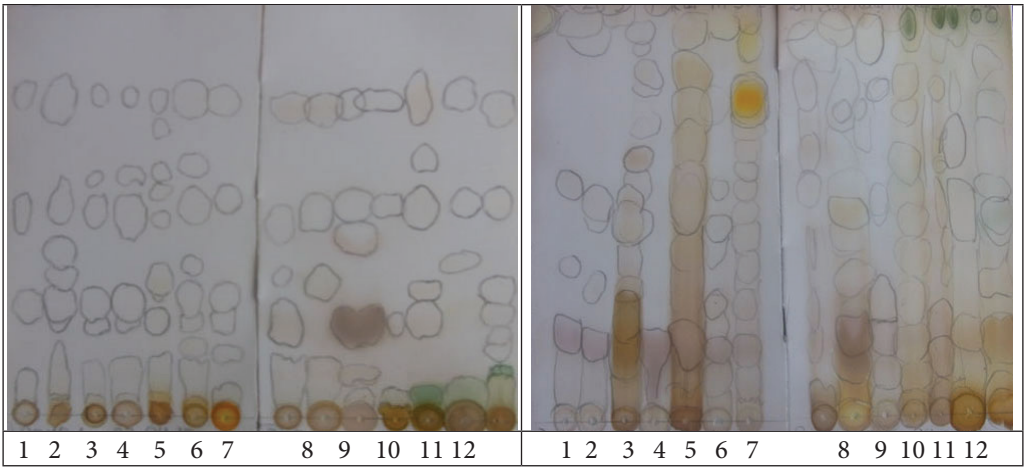
There is a great experience of development of ecologically safe methods for agriculture pests control in Entomology and Mycology Laboratory of Institute of the Gene Pool of Plants and Animals of Uzbek Academy of Sciences.

In the present work the main attention is focused both on search of available and effective components of matrices for baits with termicide effect and on isolation of repellents and deterrents from natural sources and also on laboratory and field tests of them.

To create baiting matrices the assortment of tested attractive materials is expanded towards large-scale agricultural wastes. This will provide cheapness and availability of the main material part of baits.

As regards search of effective repellent and deterrent compounds the perspective samples for preparative isolation and chemical identification of substances with required properties were selected on the basis of local medical flora with using laboratory and field tests.

Work on improvement of design, material and functional characteristics of termite baits directed to their simplification, consumer's functionality and cheapness – necessary factors at their large scale use in coming period of global warming is carried out too.



а) б)

Fig. 1. TLC of attractive (1 - 4) and repellents (5 – 12) plant's extracts in non-polar (a) hexane- ethyl acetate- acetic acid ((90:10:1) and polar (b) chloroform-methanol-25% ammonia (65-35-5) solvent systems

Fig. 2. Samples of potential baiting matrices from wastes of agriculture and food industry tested on natural termite nest of biospheric Baday-Tugay reserve area

WORLD WARMING, ENTOMORESOURCES AND SMART TECHNOLOGIES

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Class of insects *(Insecta)* is the most numerous among zoogenous living organisms containing about 2 mln of species and these animals have a multibillion tons of annual reproduction.

Insects historically originated in the same epoch as plants. Both plants and insects survived difficult periods of sharp climate changes and are safely existed and developed in present-day world being accumulated not less defence mechanisms of survival than plants have.

Unfortunately pharmaceutical industry still is mainly based on pharmaceuticals from plants, on synthetic preparations but preparations from insects and other animals are very seldom, often they represent products of alternative medicine.

Last years world warming is progressively felt due to greenhouse effect. This promotes high development of all flesh including insects which has a real danger for national economy and all mankind.

These animals apart from several dozens of insect species are not used industrially. Even such historically biotechnological originated industries as sericulture and apiculture exist only for production of such main products as silk and honey with coproduckts. But other part of bioorganic materials in these industries practically are not used.

Last decades a biotechnological goods become reality due to intensively developed non-textile direction in science and technology of sericulture. This increases cost effectiveness and employment in the branch.

Precise study of physiological, biochemical and biophysical processes in insects on molecular level can lead to heuristic discoveries of rational ways of bioresources use for progressive achievements in bio-nanotechnology and present day pharmaceutical industry.

The data of nutritive value of protein, carbohydrate and lipid isolates, stimulating and biological activity of pupae, fibroin and sericin hydrolyzates, isolated enzymes inhibitors and methods of sericulture and silk technology wastes utilization are represented in the study.

From the other hand the integrated study of such most important biopolymers as fibroin, sericin and chitin their biosynthesis, biotransformation, obtaining of their different derivitеves and composites and also their physical forming will give not only new biomedical and biotechnological materials but will lead to creation such high-tech processes as like widespread in wild-life 3D printing, self-assembling, biotransforma-

tion of organics combined with ultrafiltration, nano- packaging, programmed regulation of drugs activity and many other.

Different pharmaceutical products are proposed at present for health support. Among these are refined pharmaceutical forms of active substances or their incompletely studied mixtures, biologically active additives with not scientifically reasonable composition as well as complex mixtures of natural components in alternative medicine with long courses of use.

The new effective pharmaceuticals, real Paul Ehrlich's "magic bullits" will replace there with use of last achievement in metabolomics, with strict consideration of natural chelating properties of bioregulators on membrane level and based on the detail studied pharmacokinetics data, on biocompatible nano-dosage, on organ targeted specific effect of action and on other achievements of modern medicine, pharmacology and biotechnology.

Bio- and nano-technological approaches and methods developed in last decades for well studied mulberry silkworm will be significantly useful in complete study of renewable organic raw material of numerous insects.

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A NEW EUROPEAN SPECIES OF SPATHOPUS ASHMEAD (HYMENOPTERA: CHALCIDOIDEA: PTEROMALIDAE)

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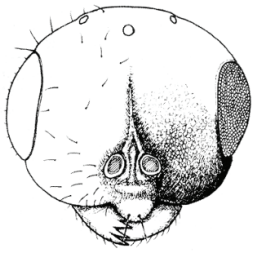
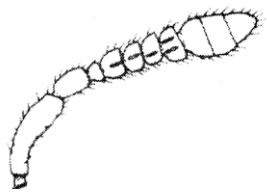
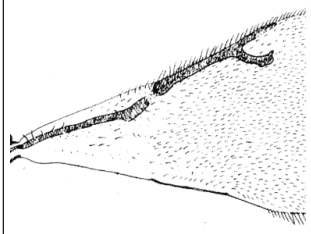
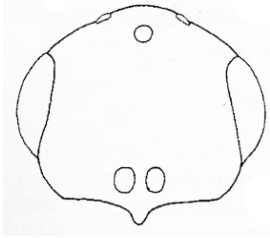
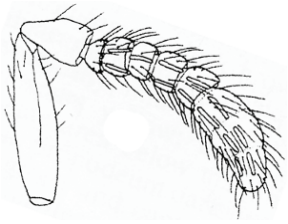
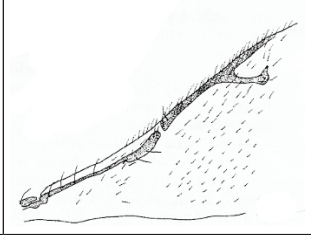
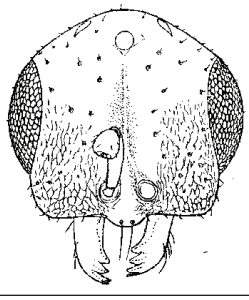
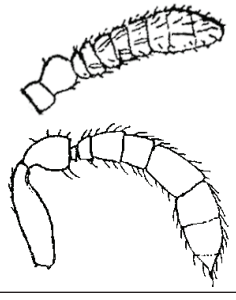
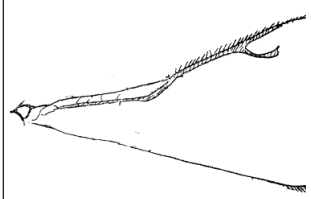
[2]„Alexandru Ioan Cuza" University-Iasi, Faculty of Biology, Department of Biology

A new species of pteromalide *Spathopus* sp. n. was collected with entomological net in a field of lucerne near the village Vulcanesti at 12.VII.2007 (2♀♀) and 1♀ at 20.VII.2008 in Codrii Reserve on the same crop. At the same time this species was collected by prof. Ionel Andriescu and Mircea Mitoiu in eastern Romania. To emphasize this species as new for science were analyzed the collected specimens with literature data to other 3 palearctic species existing in this genus: *Spathopus montanus*, *Spathopus nasalis*, *Spathopus hofferi* and with *Ecrizotes monticola* that has as many similarities.

Table 1. The comparative analysis of genus *Spathopus* Ashmead

Spathopus montanus			
Spathopus nasalis			
Spathopus hofferi			

To highlight the morphological characters that distinguish it from all the above mentioned species were prepared the microscopic preparations of anterior wing and antenna (fig.1), but to the head, thorax and abdomen were done microphotographs with scanning electron microscope (fig.2). After the detailed analyzing on the base of the drawings and the photographs from the literature (tab. 1) and microscopic preparations and photomicrographs made on specimens collected in these localities were highlighted the morphological characters separating it from the rest species namely: antenna with funicular Segment 3 very thin (figure 1), what is not observed to other species even if the funicular segments of *Spathopus hofferi* are strongly transverse. The second character is the postmarginal vein of the anterior wing is shorter than the stigma, contrary to the above mentioned species.

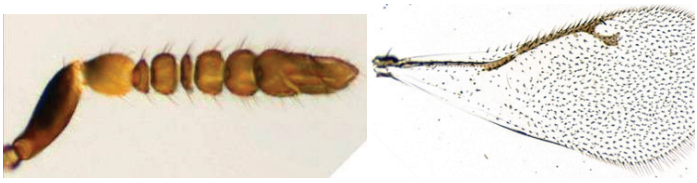


Fig. 1 *Spathopus* sp.n ♀., antenna, anterior wing

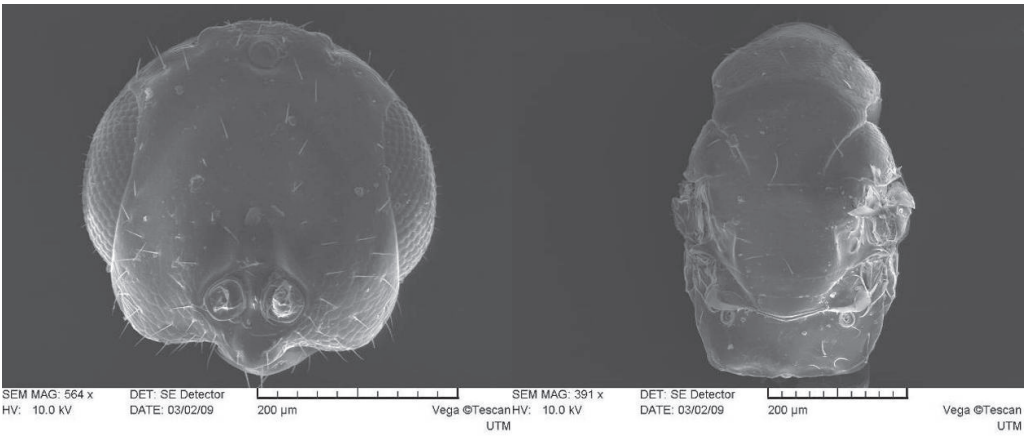


Fig. 2 Spathopus sp. n., head, thorax

In conclusion should be noted that this genus is new for fauna of Republic of Moldova but the species is new for science.

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RISK OF USE OF SEED POTATOES INFESTED WITH *DITYLENCHUS DESTRUCTOR* AT INITIAL PHASE OF DITYLECNHOSIS

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Among the most dangerous pests of potato crop is considered the nematode *Ditylenchus destructor* Thorne, 1945, obligatory parasite of tubers included in the list of quarantine species (e.g. EPPO), which causes damages of 30-80% during storage period in obtained in monoculture potato harvest. Nematode spread occurs with seed potatoes infested material, therefore according to international standard (E ЭКООН S-1) the infestation with parasitic nematode species *Meloidogyne chitwoodi, M. falax* and *Ditylenchus destructor* is not permitted. Pathological processes that take place in the infected tubers are slow and prolonged. Paramonov and Briuşcova distinguished 5 phases of disease that are characteristic for Moldova (Melnik et al., 2014; 2015). Infested seed potatoes are most dangerous in the early stages of ditylenchosis (1; 2) as external symptoms, occurring on tubers in these phases, do not appear by careful selection, therefore such potatoes could be planted in the ground. The nematode *D. destructor* is included in the group of migratory endoparasites, with the possibility of leaving from the parasited plant tissue in the soil, regardless of developmental stages (larva or adult). The nematode feeds only on living cells and to mobility of population contribute to the widening of necrotic zones.

In 2015-2016 there were conducted research to assess *D. destructor* nematode population structure in infested tissue potato tubers in the early stages of ditylenchosis (1 and 2) and the danger of using such tubers as seed material. In Phase 1 of ditylenchosis five varieties of potatoes – *Agata, Romano, Rokko, Blue violet* and *Irga* were obtained by inoculation with *D. destructor* (female + male). To determine the density of the nematodes laboratory analysis was performed after 35-40 days of incubation, during which the nematode not only penetrated the vegetal tissue of mesocarp but also reproduced. During the studies the presence of external symptoms of ditylenchosis in infested potatoes at this stage has not been established. Only by scalpel hollowing and removing the shell was discovered tiny yellowish specks of about 2 mm and the tissue was slightly macerated. The nematode presence in such tissue was determined by applying Baermann funnels. By microscopic analysis it was observed that the obtained suspension contain adult individuals of *D.destructor*, larvae J_2 , J_3, J_4 and eggs. Dominant are larval forms, the most common being those just hatched from eggs (J_2), more seldom –

adult individuals. Density: larvae + mature individuals have increased considerably over the number of nematodes introduces in the process of inoculation, variable depending on the variety of potatoes. More sensitive to infestation, proved to be *Blue violet* and *Irga* (n = 450-970 individuals / gram of infested tissue) and less sensitive - *Agata, Romano* and *Rokko* (n = 120-235 individuals / gram).

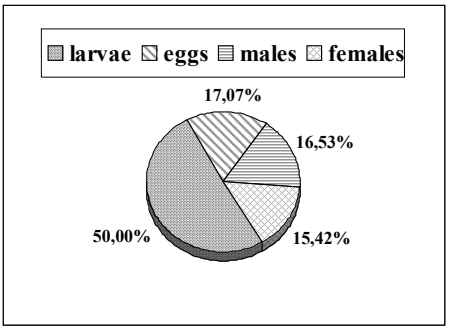

Figure 1. Distribution *D. destructor* (of various ages) in infected potatoes (phase 2 of ditylenchosis)

In phase 2 of ditylenchosis *D. destructor* density was evaluated in infested potatoes of variety *Rokko*, collected from deposits during storage. The infested portion of the tuber surface considerably widens: the diameter (d) - Length / Width = 15-20 x 16-22 mm and thickness of infested substrate = 4-5 mm. By removing the peel of potato on the pulp outskirts accumulation of *D. destructor* individuals is observed. In this phase, the nematode causes necrotic outbreaks. The conjunctive tissue deforms and infested portions detached from healthy tissue. Mesocarp in this section is distinguished from the healthy one by the color, which becomes yellowish or light brown. As in Phase 1, from such tissue a pure culture of *D. destructor* of different ages was extracted from, but their number is much higher. The most numerous are the forms of juvenile *D. destructor* (J_2, J_3, J_4) with the dominance of J_2 (n = 10.1 x 10^3 individuals / gram of infested tissue). The number of males (n = 3271.8 individuals / gram) is larger than that of females (n = 3046.8 individuals / gram). In suspension are also contained parasite eggs (n = 3375 units / gram). According to recalculations, *D. destructor* larvae (J_2, J_3, J_4) constitute 50% of the total units / gram of infected tissue; the following are the eggs - 17.07%, then the males – 16.53% and the females – 15.42% (fig. 1). At a potato tuber infested in Phase 2 can be counted approximately 31.6 x 10^3 units of *D. destructor*. The number of larvae that feed intensively with healthy tissue of the potato mesocarp is high enough -10.1x10^3 and within 18-20 days they become mature stage. A single female can deposit around 200-250 eggs. In the Republic of Moldova *D. destructor* form 4-5 generations (Nesterov, 1970), and the intense reproduction of the parasite causes increase in the density of individuals. It is important to note that *D. destructor* can survive in soil up to 3-4 years on Solanaceae plant and grass remnants.

To avoid cultivation seed potatoes infested with *D. destructor* in the early phases (1 and 2) of ditylenchosis it is necessary: to prohibit the use of potatoes produced on infested plots; to avoid potato cultivation in monoculture; to use methods of potato cultivation in conditions of mixed farming with the introduction of crop rotation.

Aknowledgement: The work was performed within the project 15.817.02.12F financed by Academy of Sciences of Moldova.

STUDY CONTRIBUTIONS OF *OXYPODA ACUMINATA* (STEPHENS, 1832) SPECIES (*STAPHYLINIDAE*: *ALEOCHARINAE*) FROM REPUBLIC OF MOLDOVA

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Synonym:=*Oxypoda lividipennis,O.* *lata* Stephens, *O. luteipennis* Erichson, *O. sheppari* Stephens

Classification: ord. *Coleoptera*, superfam. *Staphylinoidea*, fam. *Staphylinidae*, subfam. *Aleocharinae*, tribe *Aleocharini*, subtrib *Aleocharina*, genera *Oxypoda*

Annual research program is enhanced by study group staphylinid existing in our country. Staphyilinic group included in the research include several subfamilies. For the purposes of follow staphylinid species distribution in natural and agricultural ecosystems, the paper focuses on staphylinid *Oxypoda acuminata* (Stephens, 1832) from sub-family *Aleocharinae*. Among aleoharine studied simultaneously, it falls within the group active predators. The literature is pronounced tendency cohabitation with small mammals: shrews, pets, gophers, moles, interact with social insects (ants), consume small insects, fungi inhabit the corpses of animals, etc..

From my own observations, because consume Diptera larvae, often flying in the first wave (dominate small aleoharinele) for the layer of fresh manure: buffalo, cow, horse, pig, even manure goat and sheep.

It is active both day and night, as evidence were ordinary lamps with ultraviolet light and located in different points of research. In the field, especially in dry years, retired were from flowers and foliage plants Field: the wheat, rape, apricot, apple, potato, strawberry, etc.

Study for whole group of staphylinid and this species in our country, attended by researchers: V. Ostaficiuc, R. Stepanov, V. Ciubcic, S. Bacal, I. Mihailov.

The contribution of evidence existing database overall group of staphylinid is examined material (gained by other researchers) and collected material (accumulated by the author).

Examined material: Cioresti, Nisporeni District, 06.06.1968 - 10 (4 ♂♂, 6 ♀♀), 12.06.1968 - 2 ♀♀ horses manures, 13.06.1968 - 3 ♀♀ gopher's burrow; Calfa, Anenii Noi District, 11.10.1968 - 2 ♀♀ on maize leaves; Hirtop, Dubasari District, 20.06.1968 - 3 ♀♀ cattle manures; Dubasarii Vechi, Criuleni District, 19.06.1968 - 1 ♀ cattle manures; Ghidighici, Chisinau municipalty, 12.07.1968 - 1 ♀ on decomposed plants; Iablona Noua, Glodeni District, 18.07.1968 - 1 ♂ on decomposed plants (leg. V. Ostaficiuc); Ivancea, Orhei District, 20.05.1976 - 1 ♀, 16.10.1976 - 1 ♀ forest, litter (leg. R. Stepanov); Chisinau city, 11.03.2008 - 1 ♀ on dog corpse; Sarata-Mereseni, Hincesti District, 19.05.2008

- 2 (1 ♂,1 ♀) on mushroom; Capriana, Straseni District, 11.07.2008 - 1 ♂ forest, litter (leg. V. Ciubcic); Codrii Tigheci, 31.05.2005 - 2 ♀♀ oack tree (leg. V. Ciubcic).

After collecting the researchers are analyzed, of which 11 points were accumulated 31 (7♂, 24♀♀) specimens.

Collected material: The CENTER: Gratiesti, 17.07.2008 - 1 ♂, 08.09.2009 - 1 ♀ grassland, cattles manures, 24.09.2008 - 1 ♀ wheat; Codru, 09.04.2009 - 1 ♀ apricot orchard; Fauresti, 13.08.2009 - 1 ♀ cattles manures; Chetrosu, 19.07.2008 - 3 ♀♀ bank of Nistru; Bacioi (Chisinau municipality), 12.11.2010 - 1 ♀ on rape; Micauti, 03.06.2009 - 1 ♀ forest, litter; Lozova (Straseni District), 19.08.2009 - 2 ♀♀, 21.06.2011 - 9 (1 ♂, 8 ♀♀) natural researve, wet meadow, cattles manures; Grigoropol city, 29.05.2009 - 1 ♀ cattles manures; Cocieri, 04.07.2008 - 1 ♂ cattles manures; Ustia, 16.05.2009 - 2 ♀♀ cattles manures; Rohii, 26.06.2009 - 7 ♀♀ cattles manures, grassland; Goian, 20.09.2009 - 10 ♀♀ cattles manures; Doibani (Dubasari District), 02.07.2010 - 1 ♀ cattles manures; Dubasarii Vechi, 15.08.2010 - 13 (7 ♂♂, 6 ♀♀) cattles manures; Cimiseni (Ciuleni District), 20.08.2010 - 18 (3 ♂♂, 15 ♀♀) cattles manures; Peresecina, Orhei District, 10.04.2011 - 3 ♀♀ bank of the pond, piles of plant debris;

The NORTH: Pascauti, Riscani District, 20.08.2009 – 2 ♀♀ cattles manures; Dusmani, 16.08.2008 - 1 ♀ cattles manures; Moara Domneasca (Glodeni District), 20.08.2009 - 3 ♀♀ aurochs manures, 1 ♀ forest, litter; Saharna, 28.08.2010 - 91 (63 ♂♂, 28 ♀♀) natural researve, bank of Nistru, resturi vegetale; Tipova (Rezina District), 28.08.2010 - 77 (56 ♂♂, 21 ♀♀) canyon, cattles manures, 15 (6 ♂, 9 ♀) canyon, horses manures; Brinzeni, Edinet District, 21.10.2010 - 7 ♀♀ forest, soil Barber traps, 01.11.2010 - 7 (2 ♂♂, 5 ♀♀) orchard not maintained, soil Barber traps, 27.05.2011 - 1 ♀ forest, light trap; Marcauti, Briceni District, 27.03.2011 - 3 ♀♀ forest, litter;

The SOUTH: Landscape Researve Tigheci, 18.10.2008 - 1 ♀ forest, litter; Musaid, Taraclia District, 19.04.2011 - 1 ♀ wheat; Cahul city, 29.04.2011 - 5 ♀♀ forest strip.

Collection of species occurred during PhD: 2008-2011. During this time were explored 26 points in all three areas of the country and gathered 292 (140 ♂♂, 152 ♀♀) specimens.

According to the annual records, collection points and the number of specimens can conclude that climatic conditions in the country during the period studied were favorable for the development of *Oxypoda acuminata*.

Being frequent manure is presented as an indicator of the state of this microbiotop and the presence of larvae of Diptera and / or other small insects that inhabit; fall into nocturnal insects team because it is attracted to artificial light; agricultural habitats ground that inhabit the place to serve refuge in extreme or development.

MIGRATORY BIRDS SUPPORTING INVASIONS OF *H. MARGINATUM* TICKS AND TICK-BORNE PATHOGENS INTO REPUBLIC OF MOLDOVA

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Migratory birds are often implicated in transporting ticks, which can carry pathogenic agents of several human and domestic animals diseases. By themselves ticks are not highly mobile, and the only ways to expand the habitat are hosts. The present study aimed to evaluate the prevalence and species of exotic ticks infesting wild migratory birds and to assess *Borrelia* and *Rickettsia* infection in the collected ticks.

During spring we systematically caught and examined migratory birds coming to the Republic Moldova for ticks presence. Migratory birds were caught in ornithological nets at natural reserve Prutul de Jos. All birds were identified to species level, and their sex. Birds were placed in bags made of thick fabric, right after birds were examined in the camp for the presence of ticks. After the examination, birds were released without being harmed. Tick species were detached from birds and stored individually in 70% alcohol. Total DNA was extracted using QIAamp DNA Mini Kit. We screened both ticks and for tick-borne pathogens, including *Rickettsia* species and *Borrelia*. Detection of *Borrelia burgdorferi s.l.* was performed by RT-PCR targeting flaB gene. *Rickettsia* spp. were detected by PCR targeting the gltA and ompA genes.

On proprocession of two spring seasons (2014 and 2015), from the 203 avian specimens collected, 19% of birds (n=39) were infested by ticks (n=82). Ground-feeding birds were commonly infested. Four *H. m. marginatum* tick specimens were identified. Most collected ticks (93%) were *Ixodes ricinus* nymphs. Total of 28% of the ticks (n = 23) were positive for infection with *B. burgdorferi* s.l.. Additionally, two of *H. m. marginatum* ticks was positive for *Rickettsia* spp.

Hyalomma marginatum ticks have not been registered on the territory of the Republic of Moldova since the 1980s. *H. m. marginatum* is a tick species usually occurring in relatively dry and warm regions of southern Europe, northern Africa and some parts of Asia. It is a vector of several disease agents of human relevance including Crimean-Congo hemorrhagic fever virus. Reappearance of *Hyalomma* ticks should be taken seriously and draw further attention to the increasing problem of the import and spread of tropical vectors of disease to Eastern Europe.

BOVINE LEUKEMIA - "DISEASE OF PARADOXES" AND POSSIBILITIES OF ITS EFFECTIVE ABOLITION

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Leukemia is one of the most common infectious diseases of cattle, received panzootics (worldwide) distribution after world war II, especially in countries with intensive (largescale) dairy farming and automatic cows milking (technical achievement). While the true cause of the disease were not yet known. Leukemia virus (BLV) was discovered by American scientists Miller I. M., Olson C. only in 1969.

Moldavian science was at the forefront of studying this disease from the position of its viral nature. During 1981-2015 the studies were performed in SPIBZVM made it possible to decipher the mechanism of expansion of the leukemia virus (BLV) and to prove that this process is "handmade" and for the first time in the world (R. S. Moskalik, 1988) to establish the most dangerous way of BLV transmission via the mammary gland during mechanical milking of healthy and BLV infected cows by the same apparatus.

We found that epizootic process of bovine leukemia has some common patterns of development with other infectious diseases and at the same time fundamentally different from them, what was the reason to call the bovine leukemia, a «disease of paradoxes". One of the evidences of this is that the leukemia virus, which is called oncogene – does not contain oncogene. The latest is in the genome of lymphocytes (in the repressed condition) of the organism in healthy animals, the second feature – the leukemia virus does not destroy the cell in which it is localized, but rather being integrated into the genome of lymphocytes stimulates their rapid multiplication, leading to the development of disease – leukemia, and the final stage - lymphosarcoma. It is defined the absence of viremia (free outside the cell finding in the blood) in animals, and therefore specific anti-BLV antibodies present in the blood of infected animals are not able to get in contact with the virus and to inactivate (neutralize) it. For this reason, up to the present time it are not in the world and has negligible perspectives of future to gain specific vaccine effective against bovine leukemia.

We have proved that the leukemia virus is not transmitted by contact (with the exception of natural mating): in the joint keeping of animals, as well as through air, water, feed, that is the source of the pathogen (infected animal) in leukemia - "passive", in contrast to all known infectious diseases, where it (the source of the pathogen) is "active", identifies the pathogen in the external environment, which then in various ways falls into the susceptible (healthy) body.

In leukemia BLV from infected animal to healthy is transmitted by the man who violate the requirements of professional ethics in the service of animal (blood sampling, rectal intervention, vaccination), as proved (R. S. Moskalik, 1991) that falled into the environment BLV is quickly inactivated and therefore no danger of further transmission. We should emphasize that the most important and most dangerous link in the spread of BLV is mechanical milking of healthy and infected cows bey the same milking machine.

Currently, the implementation of the Moldovian scientists instructions (Instructions, 2003, Government Resolution No. 473 dated 26.03.2008, the Program for the elimination and prevention of leukemia in cattle in the period 2008-2015" etc.) allowed to reduce the level of distress (infection) in Moldova by the bovine leukemia more than 12 times - from 48,8% (1991) to 3,7% (2015) and completely eliminate leukemia in the territory of the 6 administrative districts of the Republic of Moldova. At the same time, in many countries, including Russia, the rate of BLV infection is consistently high and is not reducing.

Thus, we established the peculiarities and paradoxes of the development of epizootic and infectious processes in bovine leukemia and it is proved the real possibility of their elimination while respecting the easily achievable requirements of professional ethics (professional conscience) duting service of animals ensure the eradication of bovine leukemia in the territory of the Republic of Moldova up to 2020.

Our experience of cattle recovery from leukemia can be really useful for other countries of the world.

ADVENTIVE AND INVASIVE SPECIES OF COLEOPTERA (INSECTA) RECORDED FROM JAMAICA BAY WILDLIFE REFUGE (NEW YORK)

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The studies were carried out in the Jamaica Bay Wildlife Refuge (JBWR), which is located in Queens, within the limits of New York City. This refuge was managed to provide a variety of habitats for a wide variety of marine and terrestrial plants and animals. The refuge is also productive for the now rare native flora and fauna of the coastal areas

The research was forfeited in different types of habitats and in their microhabitats in the vegetative season of 2008 and 2009. Various collection methods were used to collect the beetles. During field work pitfall traps, consisting of plastic jars (08 cm diameter by 10 cm deep) and some pitfall traps made by the author were used. These traps were installed in spring, summer and autumn in wet and dry habitats and along the border of standing water. Beetles also were collected by sifter and by hand from a variety of habitats. Some adults and larvae came to bait, others were hand captured from mushrooms, margins of ponds, in leaf-litter, under stones and logs , under back, in wood, on the plants, on and in the soil and sandy. Some species taken at light. Classification of the beetles are made after Lawrence and Newton (1995), American Beetles (Arnett Jr. & Thomas (2000), and Arnett et al. (2002). The scientific works of Erwin (1974), Liebher, (1986), Noonan (1991), Lawrence & Newton (1995), Downie & Arnett Jr. (1996), Bousquet (2010), Brunke, Newton et al. (2011), Nomina Insecta Nearctica were used as the primary key ti identify the majority of species. During field research were found 247 coleopteres species, 226 of which are native species and 21 adventives (non-native) species. The non-native species belonging to 20 genera and 7 family. These adventives species were introduced from other regions of the world as Europe, Asia, Palearctic, Central America. The adventive (non-native) species can have a variety of effects on the local ecosystem. Some introduced, accidently or deliberately species, usualy are invasive and can have a negative effect on a local ecosystem, threatening biodiversity in USA, can cause socioeconomic or impair human health. Not all non-native species are considered invasive. Some introduced predarors of Carabidae, Staphylinidae, Coccinelidae have no negative effect and can, in fact, be beneficial as an alternative to pesticides in natural or agricultural ecosystems.

MODEL BACTERIAL STRAINS SURVIVAL AND HELMINTHS EGGS VIABILITY IN THE COURSE OF LONG-TERM STORAGE OF PIG SLURRY

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People are in constant contact with soil either directly or indirectly through food, water or air. Soil can act as a carrier or reservoir of important human diseases, particularly intestinal ones. The risk to public health arising from application of insufficiently treated animal manure to soil may be higher than detected by common methods.With regard to animal wastes we are concerned particularly with representatives of the family *Enterobacteriacea*, the majority of which have zoonotic character and endoparasites that may cause massive parasitic infections in both specific hosts and non-specific ones, such as humans.

Therefore model bacterial strains survival (*Salmonella typhimurium*) and helminths eggs viability (*Ascaris suum*) in the course of long-term storage of pig slurrywas investigated. The experiments were carried out on the raw pig slurry obtained from pig farm. The slurry with model micro-organisms was stored for 115 days in closed plastic containers of volume 5 litre at the following temperatures:

- in a refrigerator at 4°C,
- in a thermostat at 20°C,
- in a thermostat at 42°C.

The initial concentration of the tested *S. typhimurium* strain (3.6 x 10^5 $CFUml^{-1}$) in pig slurry stored at 4° C decreased by day 90 by three orders of magnitude and on day 115 of storage the test strain was no more recovered. The tested strain survived in slurry for less than 115 days at 20°C. The most marked decrease in plate counts of bacteria was recorded in pig slurry stored at 42°C. Our results showed decreased survival of *S. typhimurium* in pig slurry during storage at 20° and 42°C. This indicated that viability of bacteria in stored pig slurry was affected first of all by the temperature during the storage. Increased temperature is an important factor contributing to devitalization of indicator micro-organisms. Our study showed that the number of devitalised *Ascaris* eggs generally increased with the length of storage and the temperature. However, considerable number of *Ascaris* eggs remained viable even after 115 days of storage at 4° and 20°C. Only at 42°C more than 90 % of eggs were devitalised after 12 days

of storage. However, such temperature can only rarely be reached in animal slurries, thus the risk of persistence of this parasite is really high. This hazard increases when raw slurry is used for fertilization of soil or pastures.

Aknowledgement: This study has been realized thanks to the financial support of the project VEGA No. 2/0140/13.

BUMBLEBEES IN THE EUROPEAN NORTH OF RUSSIA: SOUTHERN IMMIGRANTS AND THEIR PRESENCE IN COMMUNITIES

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It was studied bumblebee communities in the European North of Russia (Eastern Fennoscandia, the taiga zone of north Russian Plain, Eastern European tundra).

The aim of this work was the study of bumblebee communities in different types of ecosystems of European North and investigates them in the context of changes of species distribution in northern Europe.

The most abundant species in the study region are usually *Bombus cryptarum* and *B. jonellus*. Some species of bumblebees (*B. distinguendus*, *B. veteranus* and others) are considered as southern immigrants in northern Europe. They will colonise the northern parts of European Russia in the middle and late 21st Century, according the models of future species distribution. These southern species are common in anthropogenic habitats.

Unlike ruderal habitats, bumblebee assemblages of undisturbed ecosystems in the European North have not any southern species as *B. distinguendus* and *B. veteranus*, and are characterised by higher abundance of tundra species (*B. lapponicus*, *B. polaris* and others). Assemblages of ruderal habitats consist, mainly, of ubiquitous and boreal species and a number of southern immigrants. The general pattern is that bumblebee assemblages of anthropogenic habitats in northern Europe are enriched by southern immigrants, which are absent in native taiga and tundra ecosystems.

This study was funded by RFBR, according to the research project № 16-34-60035 mol_a_dk.

NEMATICIDAL POTENTIAL OF VERMICOMPOST MADE BY *EISENIA FETIDA* EARTHWORM ON THE POTATO-CYST NEMATODES

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Two species of the potato cyst nematodes (PCN) *Globodera rostochiensis* (Wollenweber) Behrens and *Globodera pallida*(Stone) Behrens are considered as major quarantine pests of the potato crop in temperate regions of the world which could reduce potato yield from 20 to 70%. Therefore control of these plant pests is essential. The control is generally based on the use of resistant cultivars, crop rotation, cultural practices or chemical nematicides. Although chemical nematicides successfully control plant parasitic nematodes and in practice are frequently used, this control method is generally considered dangerous for nature, beneficial soil organisms and human and animal health. For this reason interest in alternative nematode control methods has grown rapidly during recent years. In this study, the effects of vermicompost with *Eisenia fetida* on the development and survival of the potato-cyst nematodes *G. rostochiensis* (pathotype Ro1) and *G. pallida* (pathotype Pa2) were evaluated as alternative control method to chemicals. Solid vermicompost derived from municipal green wastes (30% leaves and 70% grass) with the addition of *E. fetida* earthworm. Soil amended with this material at different dosages (10, 20, 40 and 60 t/ha) significantly decreased the number of cysts/100 g dried soil, the number of eggs and juveniles/cyst and the number of eggs and juveniles/g soil of both nematode species in comparison to the untreated controls(0 t/ha) (Table 1). The suppressive effect significantly increased with the increase of treatment dose. *G. rostochiensis* was more sensitive to all the tested doses than *G. pallida*. Cyst-forming nematodes invade plant roots as infective J2s that hatch from eggs retained in protective cysts. Treatment with solid vermicompostisonly possible prior to potato sowing. Thisvermicompost represent a new promising control method of potato-cyst nematodes in sustainable agricultural systems.

Table 1. The effect of vermicompost with *Eisenia fetida* applied at different doses on the potato cyst nematodes *Globodera rostochiensis*and *G. pallida*

Potato cyst nematode	*Globodera pallida*					*Globodera rostochiensis*				
Dose	0	10	20	40	60	0	10	20	40	60
Cysts/100 g soil	1.1[1]a[2]	48.0 b	42.2 bc	39.9 cd	35.3 d	54.4a	45.0b	35.9 c	29,6 c	19.2 d
Eggs and juveniles/cyst	222a	218a	219a	184b	188b	215a	174b	169 b	166 b	126c
Eggs and juveniles/g soil	136a	105b	93bc	74cd	62d	117a	78b	60c	49c	24d
Reproduction rate *Pf*/*Pi*	30.2a	23.3 b	20.6b	16.3 c	13.9 d	23.4a	15.6 b	12.0 c	9.8d	4.9e

1 Each value is the average of four replications;
2 For each specie data flanked in any rows by the same letters are not statistically different according to Duncan's Multiple Range test (P=0.05).
*Pf*and *Pi*= Final and initial nematode population density, respectively.

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EXTENSIVITY OF INVASION IN CERVIDS OBSERVED IN THE REPUBLICAN REPRODUCTIVE CENTER OF THE "MÂNDREŞTI" FORESTRY, TELENEŞTI REGION (REPUBLIC OF MOLDOVA)

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The measures for enlargement of the current fauna from the natural reservations and its adjacent areas by introducing the new species of the hunting animals have been undertaken in Moldova during the last several years. These intruduced hunting animals species are gradually adapt themselves to the new living conditions and as a result, easily resist the consequances of some economical activities udertook by humans in the area, and successfully undergo through grow and reproduction processes.

The study on parasitic fauna in wild mammals from the Republican Reproductive Center of the "Mândreşti" forestry, Teleneşti region (Republic of Moldova) has revealed the high level of their infestation with fascioles, dicrocelium, strongiles and protista. The red deer (*Cervus elaphus Linaeus,1758*) have been infested with *Dicrocoelium lanceolatum* (16,6%), *Fasciola hepatica* (14,8%), strongiles larvae (74,0%) and ovocysts of *Eimeria spp.* (45,2%); the Japanese deer (*Cervus nippon Temminsk 1838*) has been infested with *D. lanceolatum* (18,4%), *F. hepatica* (19,4%), strongiles larvae (87,7%) and ovocysts of *Eimeria spp.* (35,6%); roedeer (*Capreolus capreolus Linaeus,1758*) - with *D. lanceolatum* (32,6%), *F. hepatica* (7,5%), strongiles larvae (94,5%) and ovocysts of *Eimeria spp.* (65,8%). The wild boar revealed 5,9% level of infestation with *Dicrocoelium lanceolatum,* larvae of *Strongyloides ransomi* in 86,2% of cases, *Metastrongylus elongatus* - 64,7%, and *Eimeria spp.* (65,3%). The high level of parasitic infestation of the wild animals again demonstrates that they play an important role in maintaining the epizootic chain of these diseases and also have crucial role in infesting humans and domestic animals. Therefore it is of paramount importance that parasitic diseases in wild animals are monitored on annual basis that allows to determin their evolution, emergence of new parasitic agents and elaborating new combating measures for such.Thre is a need to apply the specific measures for the control and prophilactics of the parasitic diseases in these animals which assure, if not total treatment than at least diminuishing the level of the invasion to the one that has subliminal effect. Accordingly, these measures could be developed only knowlingly the biologic paculiarities of the parasites and their hosts but also of the environment, crutial as to assure the interruption of the foodchain of the parasitic agents.

The work was performed within the project 15.817.02.12F.

BIOLOGICAL LIMITATORS IN THE CONTROL OF *MELOIDOGYNE INCOGNITA* AND *VERTICILLIUM DAHLIAE* ON EGGPLANT

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The effect of some biological control agents against combined attacks of the plant pathogen *Verticillium dahliae* and the root-knot nematode *Meloidogyne incognita* on eggplant was verified in an open field trial. A soil at Valenzano (Bari province, Apulia region, Italy), naturally infested by the above mentioned pests was deeply ploughed, rotavated and subdivided in 4 m x 4 m plots, spaced 1 m each other and distributed in a randomized block design with three replications for each treatment. Treatments were: a) *Clonostachys rosea* with fungicidal activity (F) (applied at transplant and 15 days later at 2L/ha) + *Paecilomyces lilacinus* isolate 251 with nematicidal activity (N) [applied in pre (1 week) and post-transplant (40 days later) at 4 Kg/ha] + *Aphanocladium album* isolate MX-95 (N activity) (applied 1 week before transplant and 15 days later at 0,4 L/plant as conidial suspension at 1,2 x 10^7 CFU/mL); b) *Clonostachys rosea* (applied as before indicated) + *Paecilomyces lilacinus* isolate 251 (as before indicated) + chestnut tannins (applied at transplant at 3,2 g/plant); c) *A. album* MX-95 (applied as above mentioned); d) chestnut tannins (applied as in b treatment); e) *A. album* MX-95 + chestnut tannins (applied as in a and b treatments) and f) Azoxystrobyn (F activity) at 20 L/ha + Fenamiphos EC (N) at 62.5 L/ha, both applied at transplant. Untreated plots were used as control. The biological control agents, chestnut tannins and chemicals were applied by injector in localized form to the base of each plant in correspondence of water emitters of PVC drip irrigation lines. In each plot there were three rows of plants with 6 plants/row.

During the growing season the crop received the cultural practices that are common for the area. Fruits were harvested (nine times) during crop cycle and yield recorded. At the end of the experimental trial, plants were uprooted to estimate root gall index caused by the nematode attack according to a 0-5 scale (0= health root system and 5 = root system completely deformed by large and numerous galls). Severity of *Verticillium wilt* was assessed according to a 0-5 scale (0 = health plant; 1 = yellowing of the basal leaves; 2 = widespread yellowing; 3 = wilting; 4 = widespread wilting and 5 = death plant). Stem of each plant was transversely cut 3 cm above the soil level and the severity of vascular discoloration (VD, % area affect) was evaluated accord-

ing to a 0-4 scale (0= no vascular discoloration; 1 = 1-10% VD; 2 = 11-50 % VD; 3 = 51-75 %VD and 4 = 76-100% VD). Nematodes from each plot were extracted from soil samples processing 0,5 L soil sub-sample with the Coolen's method.

Data were statistically analyzed and means compared by Duncan's Multiple Range Test.

All treatments had a positive influence on yield and were effective for a significant reduction of severity of symptoms of *Verticillium wilt*, vascular discoloration and *M. incognita* attacks in comparison to the untreated control (Table 1).

On the base of our results it is reasonably possible consider the use of biological control agents in *Verticillium wilt* and plant parasitic nematode sustainable control, although further investigation are suggested in different areas, crops, periods and types of soil.

Table 1.

Effect of different biological control agents in eggplant protection against *Meloidogyne incognita* and *Verticillium dahliae* attacks

Treatment	Yield (t/ha)		Wilting index (60 days after transplant) (0-5)		Vascular discoloration (0-4)		Root gall index (0-5)		*M. incognita* (Eggs and juveniles/mL soil)	
C.rosea+ *P.lilacinus*251+ *A. album*MX-95	48.5[1]	ab[2]	1.2	a	1.7	a	2.8	b	11.3	a
C.rosea+ *P.lilacinus*251 + chestnut tannins	58.5	b	1.1	a	1.5	a	2.5	bc	13.4	a
*A. album*MX-95	44.7	ab	1.2	a	1.9	a	2.8	bc	14.0	a
Chestnut tannins	42.7	ab	1.1	a	1.8	a	2.8	b	14.3	a
A. album+ Ch.t.	56.4	b	1.2	a	1.5	a	2.6	bc	13.3	a
Azoxystrobyn + Fenamiphos	51.7	ab	1.1	a	1.6	a	2.3	c	8.8	a
Untreated control	36.8	a	1.4	b	2.5	b	4.0	a	22.8	b

[1] Each value is an average of three replications (18 plants/replication);

[2] Data flanked in each column by the same letters are not statistically different according to Duncan's Multiple Range Test (P=0.05).

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ROLE OF ENTOMOPATOGENIC BIOPESTICIDES IN PROTECTING LEPIDOPTERA DIVERSITY

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Different biopesticides, such as viruses, (bacteria, fungi, etc.), microorganism products, animal derived products (pheromones, hormones, insect-specific toxins, etc.), plant derived products have been developed and used across the world (Islam and Omar, 2012). Among all the biocontrol agents, the most important products are microbials (41 %), followed by macrobials (33 %), and, fi nally, other natural products (26%) (Guillon 2003).

Entomopathogenic microorganisms have shown to be a good tool for insect pest control. Numerous natural entomopathogenic microorganisms have been used as biopesticides worldwide as they are naturally organisms. Entomopathogenic biopesticides have many advantages as tool in integrated pest management (IPM), including highly specificity, safe to vertebrates, and ease of genetic manipulation. However, entomopathogenic microorganisms, like others biopesticides, present some difficulties for broad commercial use, such as slow speed of kill, short field stability, high production costs, and current regulations of biological control agents (Regnault-Roger, 2012).

As of 2010, over 24 baculovirus species have been reported to be registered for use in insect pest management throughout the world (Kabaluk et al. 2010). The market share of baculoviruses is 6 % of all microbial pesticides and millions of hectares have been treated with registered baculovirus products over the years (Szewczyk et al. 2009; Moscardi et al. 2011). We have begun research on entomopathogens of phytophagic insects of the Lepedoptera group and present the preliminary results of our research here.

The several Bacillus thuringiensis were selected from the Moldovian insect populations. The strain *B. thuringiensi var.thuringiensis* AS-BN-17, AS-BN-17A izolated from *Hyphantria cunea* Drury cateterpillars showed the most insecticidal activity. While processing the maple (Acer negundo L.) leaves with bacterial culture we observed the 100% mortality of larvae for 5 days. The perspective strains for making of microbial biopreparation for plants protection from Lepidoptera have been selected.

In our researches show the difference between the parameters of biological activity of biological mass obtained on the different days from the infection with baculoviruses. There are not noticed any substantial differences of biological activity in the case of viral suspension with the same concentration (10^7 pol./ml). Good results were registered at the analysis of lethal time necessary for obtaining a death rate of 50% of larvae (TL_{50}). That parameter has minimal value o the first 5 days from infection. In the terms of that aspect, biological mass obtained from dead larvae after these days is characterized by parameters specific to wild strains obtained from natural conditions, that aspect induc-

es the difference of biological activity of biological mass obtained from dead larvae on different days of infection and denotes the possibility of application of that measure in the process of improving baculoviral strains applied for elaboration of viral insecticides (Ciuhrii & Voloşciuc, 1988; Voloşciuc, 2009). Other Authors Also Have Confirmed The Results Of The Investigations In That Field, (Ilienih, 2007).

Since inception of biopesticides, their position and situation still remains in dilemma. Farmers fi nd themselves confused and less confi dent in selecting biopesticides over the synthetics.The growth of biopesticides is indicative of its importance in the sustainable agriculture by producing food crop with lesser chemical use. A concerted effort of research institutes, and government organizations is required to elevate the stature of biopesticides.

This study provides a potentional solution for controlling Lepidoptera vector in Republic Moldova. It finds that the Moldovian bacterium *Bacillus thuringiensis* and baculovirus preparats can reduce the Lepidoptera larvae.

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APOIDEA SPECIES (HYMENOPTERA, APOIDEA) CLEPTOPARASITIC SPECIES FROM THE REPUBLIC OF MOLDOVA

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In many groups of different organisms, that deposit their food in order to feed themselves or their spawns, there are some species or even genera of parasites or predators. Such species steal or feed on others deposited food, and often starve to death or kill the host species. They are called cleptoparasitic species.

Parasitic apoidea species don't build nests, don't collect pollen and nectar reserves for developing a future generation. They usually lay their eggs in the cells of other solitary bee species nests, that is why they are also called cuckoo-bees. Ordinarily cuckoo-bees fly above the host-bees nests that are building a cell with pollen grain mixed with nectar. When a host-bee is not around the cell, the cleptoparasitic bee pervades in the cell and lays its egg onto pollen grain. The hatched cleptoparasitic larva instantly starts feeding, eating all of the host-larva food, and as a result is developing faster. The host-larva starves to death or is also being ate by the parasite.

During the studying of the apoidea species spectrum from the Apoidea superfamily between 1980-1995, 1961 samples were collected. As a result of the samples analysis, for the first time in the Republic of Moldova 68 cleptoparasitic species were indentified and registered. The most cleptoparasitic species belong to their genera or families. This group of cleptoparasitc species differ from their simple relatives: their appearance is similar to hornets, includes colors as black, red, brown, and have a reduced numbers of hairs.

Below is a list of cleptoparsitic species from the Republic of Moldova, identified and registered during the study.

Halictidae Thoms Family. *Sphecodes* Latr. Genus includes 10 species of cleptoparasites : *Sphecodes albilabris* Hagens, *S.crasus* Thoms. *S. cristatus* Hagens, *S. croaticus* Meger, *S divisus* Kby., *S. gibbus* L., *S. marginatus* Hagens, *S. monilicornis* Kby., *S. palucidus* Smith., *S. scabricolli* Wesm. These species parasitize in the nests of species from *Halictus* Latr. Genus and the *Melitturga clavicornis* Latr. bee.

Mehgachilidae Latr. Family, *Stelis* Pz. Genus includes 4 species: *Stelis breviscula* Nyl,. *S. ornatula* Klug., *S odontopyga* Nosk., *S. punctualatissima* Kby. These cleptoparasitic species were observed only at the apoidea species of *Lithurgus, Osmia, Chelostoma, Heriades, Anthidium, Anthidielum, Clisodon*, certain genera.

Megachilidae Latr. Family, *Coelioxys* Latr. Genus include 10 cleptoparasitic species: *Coelioxys afra* Lep., *C. argentea* Lep., *C.aff. argentea* Lep., *C aurolimbata* Forst., *C. aff. Brevis* Eversm., *C. elongate* Lep., *C. inermis* Kby., *C. ruficaudata* Lep., *C. obtuse* Perez. The hosts of these cuckko-bees are the megachile species from the same family. Co-

elixys female bees have an oblong, spiked body that helps them in breaking the megachille bee cell wall, to lay their larva.

Anthophoridae family includes cleptoparasitic bees from 4 genera: *Nomada* Scop., *Ammobatoides* F., *Biastez* Panz., *Melecta* Fros.

Nomada Scop. genus registers 34 cleptoparasite species: *Nomada armata* H.-Sch., *N. bifida* Thoms., *N. bispinosa* Mocs., *N. braunsiana* Sch., *N. chinobarina* F.Mor., *N. diversipes* Latr., *N. goodeniana* Kby., *N. guttulata* Sch., *N. incisa* Sch., *N. emarginata* F.Mor., *N. fabriciana* L., *N. flavoguttata* Kby., *N. favopicta* Kby., *N. fucata* Pz., *N. lineola* Pz., *N. mauritanica* Lep., *N. mozelere* Allken, *N. melathoracica* lmhoff, *N. mutica* F-Mor., *N. mauptialis* Nosc., *N. mobilis* Schok., *N. obscura* zett., *N. opaca* Alfken, *N. panurgina* F.Mor, *N. plativentris* F.Mor., *N. pusilla* Lepeletieri Perez, *N rhenana* F.Mor., *N robusta* F Mor., *N. rufipes* F., *N. sexfo* Pz., *N. signata asciata* Jur., *N. trispinosa* Schmied., *N. zonata* Pz., *N. xanthostica* Kby. This complex of cleptoparasitic species have a large circle of host-bee species on which they parasitize, from the following genera: *Colletes, Andrena, Halictus, Melitta* and *Anthophora*.

Ammobatoides Rad. genus has a single species: *A. abdominalis* Eversm., that parasitize in the nests of Melitturga clavicornis Latr. Host bees .

In *Biastes* Pz. genus were identified 2 cleptoparasitic species: *Biastes brevicornis* Pz, and *B. emarginatus* Sch., that parasitize in the nests of Rophitoides canus Eversm. Bees –the most numerous pollinators of alfalfa seeds. These cuckoo-bees can be also met in nests of the species from the following genera: *Systrofa* Panz. and *Duforea* Lep. from Halictidae. Family.

In *Melecta* Latr. Genus were registered 2 species of cleptoparazitic bees: *Melecta armada* Pz., which parasitize *Anthophora acervorum* L. species, and *Melecta luctuosa* Scop. –a parasite of other species of Anthophora.

In Apoidae family, Psithyrus Lep genus, were identified 4 species : P. flavidus Eversm., P. rupestris F., P vestalis sithyrus campestris P sylvestris. These species from the Republic of Moldova parasitize in the nests of species from Bombus genus. If the adult insects of this group participate indirectly in the pollinating of the entomophilous , they feed themselves on the pollen and the nectar directly on the flowers, as a result of parasitizing their larvae in others species nests.

The interspecific relationships based on trophic links of cleptoparasite apoidea species with their hosts, is a very interesting and poor studied theme. And as it has been found in the period of the last few years, it has a very big practical importance.

CONTRIBUTIONS TO THE STUDY OF SOME INVERTEBRATE DIVERSITY IN THE PARK "RISCANI" CHIŞINAU

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In recent times, urban population growth has intensified the use of recreation areas, green spaces including in and out city. One aspect that emphasizes the negative impact of population is the high concentration of visitors in a limited number of recreational areas and its seasonality, which seriously affects the environment and respectively these areas. Mostly affected are water bodies, parks, gardens, squares by reducing biological diversity, soil compaction and destruction of soil layer, chaotic accumulation of waste, household waste, noise, etc.

Forest-park Rîşcani located between 70-130 m altitudes, among streets M. Sadoveanu and A. Russo was founded in 1964, with an area of 87 ha. Faunal material was collected from multiple biotypes showing different characters in terms of vegetation: the forest edge; forest and meadow. The collection of invertebrates was done using entomological methods (capture plants, manual collection of coleopterans under the arbor by removing litter by using small size rakeand entomological net). The list of species, 83 invertebrates in the Park "Rîşcani" Chişinau belonging to 3 phyla (Annelida, Mollusca and Arthropoda) (collected between March-June 2016).

Phylum Annelida: class Hirudinea, order Gnathobdelida, sp. *Herpobdella octoculata* L.

Phylum Mollusca: class Gastropoda, order Basommatophora, *Anodonta cygnea* Lamarck, *Planorbarius corneus* L., *Bithhynia trocheli* Bielz, *Anisus vortex* L., *Acroloxus lacustris* L., *Radix peregra* Müller, *Viviparus viviparus* L.*;* order Stylommatophora, *Vallonia costata* Müller, *Oxyloma elegans* Risso, *Deroceras reticulatum* Müller, *Helicella obvia* Menke, *Succinea putris* L., *Chondrula tridens* Müller, *Cepaea vindobonensis* Pfeiffer, *Helix pomatia* L.

Pylum Arthropoda: Class Crustacea: order Isopoda, *Asellus aquaticus* L., order Amphipoda, *Gammarus kischineffensis* Sch. **Class Myriapoda**: s/cl. Diplopoda. *Glomeris connexa* C.L.Koch; s/cl. Chilopoda *Lithobius forficatus* L. **Class Insecta**: order Coleoptera with 36 species included in 6 families**:** Family*Scarabaeidae* with te following species: *Oniticellus fulvus* G., *Onthophagus vacca* L., *O. amyntas* Oliv., *O. ovatus* L., *Lethrus apterus* Laxm., *Aphodius rufipes* L., *A. lividus* Oliv., *A. fimetarius* L., *Penato-*

don idiota Herbst, *Valgus hemipterus* L., *Epicometis hirta* Poda, *Cetonia aurata* L., *Melolontha melolontha* L., *Amphimallon solstitialis* L. Family *Carabida e*with the following species: *Cicindela campestris L., Amara aenea* De Geer, *A. communis* Panzer, *Harpalus rufipes* De Geer, *H. atratus*, *H. hirtipes* Panzer, *Zabrus tenebrioides* Goeze, *Plathynus cupreum*L., *P. vulgare* L., *Agonum piceum* L. Family *Cantharididae* with the following species: *Cantharis rustica* Fallen, *C. fusca* L., *C. pellucida* Fabr. Family *Tenebrionidae* with species: *Blaps halophila* F.W., *B. mortisaga* L., *Opatrum sabulosus* L. Family *Meloidae* with species: *Meloe proscarabaeus* L., *M. violaceus* Marsh. Family *Coccinellidae* with the following species: Coccinella *septempunctata* L., *C. quatuordecimpustulata* L., *Psyllobora vigintiduopunctata* L., *Harmonia quadripunctata* Pont.

Order Lepidoptera with 6 species included in 3 families: Pieridae - *Pieris brassicae* L.*;* Family Nymphalidae with species: *Issoria lathonia* L., *Boloria dia* L., *Argynnis aglaja* L. Family Lycaenidae with the fllowing species: *Strymon spini* L., *Polyommatus icarus* F. **Order Hemiptera** with 3 species included in 3 families: Nepidaewith the species: *Nepa cinerea* L. Family Gerridae with species: *Gerris lacustris* L. Family Pyrrhocoridae with species: *Pyrrhocoris apterus* L. **Order Diptera** with 8 species included in 6 families: Tipulidae with the following species: *Tipulaoleracea* Mg., *Culex pipens* L. Family Bombyliidae with species: *Bombylius major* L. Family Califoridaewith species: *Lucilia caesar* L**.** Family Sarcophagidae with species: *Sarcophaga carnaria* L. Family Syrphidae with speci: *Syrphus ribesi* L., *Syrphus vitripennis* F. Family Muscidae with species: *Musca domestica* L. **Order Hemiptera** cu 6 species included in 4 families: Nepidae with species: *Nepa cinerea* L. Family Gerridae with species: *Gerris lacustris* L. Family Miridae with species: *Deraeocoris olivaceus* F*, Leptopterma dolabrata* L., *Liocoris tripustulatus* F. Family Pyrrhocoridae with species: *Pyrrhocoris apterus* L.**Order Raphidioptera:** Family Raphidiidae with species: *Raphidia flavipes* Stein.**Order Hymenoptera** cu 7 species included in 3 families: Apidae with species: *Bombus hortorum* L., *Bombus terrestris* L., *Apis mellifera* L.Family Argidae with species: *Arge ustulata* F. Family Formicidae with species: *Formica rufa* L., *Lasius flavus* L., *Lasius niger* L.

Beetles have very strict requirements to abiotic conditions. In addition, beetles are characterized by high mobility, so any disruption to their specific microclimate causes a rapid individuals moving to a more convenient habitat (Pena, 2001). Insect response to environmental changes is faster than vegetation. The presence of a small number of beetles' species - 2% of the total number of species identified in Moldovan Fauna indicates a habitation change of the studied area.

Inventorying at a certain time, of all beetles species and storing this information in the database can provide, by comparison, information on the ecosystem dynamics.

LARGE BEE-FLY – *BOMBYLIUS MAJOR* L. 1758 (DIPTERA, BOMBYLIIDAE) IN THE REPUBLIC OF MOLDOVA

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The *Bombylius major* L. 1758 species is in our entomological review since 2013. This bee-fly was observedon differentblossom plants like: *Taraxacum officinale, Lamium album, Urticadioica, Trifolium repens, Melilotus albus, M. officinalis, Medicago sativa, Hypericum perforatum, Tilia platyphyllos, T. tomentosa, T. cordata, Rosehips, Malus domestica, Pirus sativa, Prunus domestica* from the campus of the State Agrarian University of Moldova (SAUM) and Didactic Experimental Station „Chetrosu" (DES). Thanks to high population density and interesting morphological appearance that imitate a bees, this insect astonished us in professional plan and we started to studied her biology and ecology in condition of our country. The relevant information regarding the bio-ecology of *B. major*is L. 1758 presented below in this work.

At first look, the adult appears as a bumblebee or bee; this is due of her large body – about 14 to 18 mm in length and up to 24 mm of wingspan. The body is robust, bulging, covered with short hairs dense coloured predominantly in brownish to yellow. The antennae are short and being as arista type. The chest tergits are black and shiny, but covered with a yellow, brown or white pubescence. The wings have appearance of „semi-rigid wing", because of darker upper edge and waves outline. Spindly legs are well developed, especially the first pair with which the insect accost the flowers for to introduce their trunk for to extract the nectar.

The proboscis is black, long approximately body length and sharpened at the tip. Initially insect can cause discomfort: 1) visual – the trunk, the first pair of legs and efficient flight, including the possibility to stay suspended in the air, to swing and jumping; 2) auditory – awful buzzing, due to premotor fly apparat and very effective. At appearance of a threat, *B. major* L. 1758 fly instantly from flower, being very carefully.

Imitating bees, the Large bee-fly approach to the victim nest because at sexual maturity the fly deposited egg in/or near underground nest of bees and wild solitary wasps. In case that the fly cannot to approach to the nest, then the female lay eggs on flowers, which are visited by pollinating insects. The adult is a perfect pollinator, carrying the shaken and deposited pollen on the brush body, but in the larval stage this fly is a parasitoid of other pollinating insects and with this affect their populations.

Larvae are hyper-parasite. After hatching from egg that have a grain of rice size and humidified for to be "wrapped" in sand, the larvae cross the path to the nester catching to the host's body penetrate inside it. For the first, the larvae have three pairs

of false legs in sucker appearance, owing to this it moves quickly and feed with remainders from the wasps nest, being detritophages. During of development the larvae moults, and in the same time the legs atrophied, adhering to the body of the larva-host and become an ectoparasite. In addition, these larvae may can parasite the beetles, butterflies (especially owlet moths), bees and wasps (solitary and wild, especially from the genus *Andrena*) larvae. At full development, the larvae remain to hibernate like pupa into the hosts nests.

Figure 1. The *Bombylius major* L. 1758 species – registered in Moldova during of 2013-2016 (orig.)

In native literature, some authors mention this species: the Negrobov (1983) which represented general information about the spread of this fly – South of Europe; and some morphological aspects (Cozari 2010).

From synonyms of this insect species, we find thehistory of research of this. The earliest dates that describe it and gave scientific name – *Bombylius major* 1758 was Swedish Linnaeus. The next were his country as Sulzer (1761) and De Geer (1776). Then following scientists Fabricius (1781), the Frenchs Geoffroy (1785) and Macquarts (1840), the Germans Wiedemann (1828) and Loew (1855). On the American continent, Lioy studied this species (1864). Among those entomologists, only Frenchman Geoffroy put these fly in another genus – *Asilus* and species *lanigerus*. As can be seen all researchers have accepted genus name – *Bombylius*, only that species were different. During the years for this species has been given10 scientific names.

In conclusion, the species *B. major*during of 2013-2016 was observed in abundance on diverse herbaceous vegetation and woody flower from the SAUM campus and EDS „Chetrosu". The first adults were registered in April (2014) and (2013, 2016), but this year and in late July were observed specimens on honey clover – *Melilotus albus*. The hot conditions of weather in July of 2016 – above 30°C did not stop flying and has been seen on almost dried flowers.

MIMICRY, COMMENSALISM, DETRITOPHAGOUS, PREDATORS, MIGRATION AND ALL THESE IN *VOLUCELLA ZONARIA* (PODA 1761) SPECIES

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The species *Volucella zonaria* (Poda 1761), syn. *Conops zonaria* Poda 1761 (Diptera, Syrphidae) were observed on campus The State Agrarian University of Moldova (SAUM) in Chisinau, on the stems of linden trees in 25.VI.2016. Over 30 flies standing under the shadiest and the thicker branches (Fig. 1). This syrphid flies have not a popular name in Romanian, therefore was named hornet bite because the life of flower flies *V. zonaria* (Poda 1761) and the hornet *Vespa crabro* L. 1758 occurs in absolute commensalism.

In indigenous literature about the genus *Volucella* it exposes on information on species *V. bombylans*, and nothing about the *zonaria*, therefore any information on this species we consider relevant and useful. Hornet mimic hoverfly compared to other species of Sirphidae family has gigantic dimensions: up to 20-22 mm, while through the length and body colour– black with yellow – perfectly mimics *V. crabro* L. 1758. The egg is yellow and about 1 mm. The larva is legless and headless, light brown coloured, with rudimentary mouthparts that have aspect „horns". The pupae is obtect with 35-40 mm in length, and in brownish glossy colored.

Mimetism. The *V. zonaria* (Poda 1761)species is resembling with wasps in that: large body size; the dominant yellow colour of abdomen and wit three transverse black stripes; the shape of the head and the thorax viewed from the dorsal part; forewings rest state are kept stretched along the body. It is distinguished by short arista antennas, very large eyes, in wide and yellow part between the eyes, and the hind wings are modified into halteres.

imago under the linden branch | looking wasp flies = mimetism | the second pair of wings = halteres

Figure 1. The species of *Volucella zonaria* (Poda 1761) – hornet bite (foto Asea M. Timuş).

The Hornet mimic hoverfly winter in the pupal stagein soiland the adult fly in early spring, feeding with pollen and nectare specially of *Buddleja davidii, Cirsium* spp., *Carduus* spp., and other plants (Fig. 2). The female lay eggs in nests of wild bees, bumblebees and wasps, but prefers in those of *V. crabro* L. 1758. For to get into the wasps nest and lay the eggs, and at maturity it can leave the nest without being discovered by the host-victim, evolutionary the fly has been adjusted by the two options. The first option is the morphological changes that are similar to the wasps hosts phenomenon called mimicry; the second one are glands that produce odorous substances or gives off a calming hormone and wasps become gentle and indifferent to what is happening in their nest.

The larva feeds on decaying organic material from the nest wasps: dead wasps and other putrefying materials (species with a so lifestyle is named detritivores or detritophages), they also eat larvae and pupae sick or with abnormal development, such a way of life being called predation.

It is mentioned that hornet mimic hoverfly migrate from hot areas to cold ones, including being registered increasingly in the urban parks, especially in private gardens with ornamental vegetation, the same can be said about *V. crabro* L. 1758 (information from literature and own observations) (Fig. 2).

Months and decades																					Hibernation
IV			V			VI			VII			VIII			IX			X			
I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	
(0)	(0)																				
		+	+	+	+	+	+	+	+												
		flowering plants (pollen and nectar)																			
								o	o	o	o										
								wasp nest													
									I	I	I	I	I	I	I	I					
									detritophagous and predators												
												o	o	o	o	o	o	o	(0)	(0)	(0)
												soil around nests									
Legend: 0 – pupae; (0) – hibernating pupae; + – imago; o – egg; I – larvae.																					

Figure 2. Phenologicaltable of the *V. zonaria* Poda 1761 species (orig.)

In the result of our investigation of *V. zonaria* Poda 1761 species can be concluded the following: in 2016 the fly was registered on plants of the genus *Tilia* from SAUM campus. The hornet mimic hoverfly develops one generation per year, overwinters in the pupal stage in soil in wasps nest. The fly adults feed with pollen and nectar; the larvae consume decaying organic matter, they are also predators. The mimicry was developed to access to the nests hosts and victims (food). The *V. zonaria* Poda 1761 can be considered as an indicator of environmental change in Moldova cities.

CONOPS QUADRIFASCIATUS GEER 1776 – SPECIES REGISTERED IN 2016 IN THE REPUBLIC OF MOLDOVA

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In spring of 2016the *Conops quadrifasciatus* De Geer, 1776 species (Diptera, Conopidae) was recorded in the Republic of Moldova. The specimens of this species were observed in 03.IV.2016 on the plants from campus of SAUM. The species is aentomological curiosity, because imago presents phenomenon of the mimicrism and is very similar to wasps.

For the first time in native literature, the species was mentions in "Animal world. Insects. 1983": "Species widespread in the USSR, Eastern Europe and Asia Minor is "bolishegolovka 4-h polosnaia" *C.quadrifasciatus*". According to the passage it goes without saying that, the species is widespread in the Republic of Moldova too. Other sources indicated that the species spreads from Europe to Siberia, and most often in Central Europe. According to the database of the Fauna Europaea, this species is recorded in the following countries: Andorra, Austria, Belgium, Britain, Czech Republic, Denmark, Finland, Switzerland, France, Germany, Hungary, Ireland, Italy, Lithuania, Luxembourg, Poland, Slovakia and Sweden. For Moldova is indicated as – absent, but for neighbouring states as follows: Romania – present and Ukraine – absent.

Description. The adult has 10-15 mm body length, and due to long legs has a great look insect. The dominant color is dark brown (Fig. 1). The head is large, dark brown and with long spindly antennae. The trunk is brown at the base and the rest black. The thorax is wider than longer, the prothorax being merged through a welding with mesothorax, while metathorax having sharpened aspect on base that obviously is fixed on propodeum.

Prothorax has yellow "ocellus" on the shoulders; the feet are coloured in brown-light with more yellow. The abdomen is black with four yellow prominently transversal stripes, what reminiscent of that of wasps. The tip of the abdomen is frequently thickened and pointing up as at the scorpion.The egg presents a formationas an "anchor" with which it fixed during of flightto the host abdomen.The larvae hatch from the egg and penetrate the insect abdomen where consume it content andthere occurs pupal stage. Species develops one generation per year and overwinter in the imago stage. The *C.quadrifasciatus* species develops one generation per year and overwinter in the imago stage.

Nutritional regime. Adults feeds withflower nectar of plants from families Compositae, Apiaceae (Umbelliferae) and Lamiaceae (Labiatae). Larva is ectoparasite of insects from the genus *Bombus* (*argillaceus, fragrans, muscorum, pomorum, ruderatus, zonatus*) *Andrena bulgariensis, Anoplius samariensis, Xylocopa violacea*. Coincidentally, those species are included in the 3rd edition of Red Book of Moldova, published in 2015.

a

b

Figure 1. Theimago of *Conops quadrifasciatus* De Geer, 1776:
a) dorsal on the wall; b) – laterally in the laboratory (foto A. Timuş)

IN VITRO EFFECT OF ABAMECTIN ON THE CARROT CYST NEMATODE *HETERODERA CAROTAE*

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The effectiveness of an abamectin formulation (Vertimec® EC) for the control of the carrot cyst nematode *Heterodera carotae* Jones was investigated in an *in vitro* hatching test. Abamectin is a mixture of macrocyclic lactones produced by the actinomycete *Sptreptomyces avermitilis* especially known for its acaricidal and insecticidal activities. Cysts of the nematode were subjected for different exposure times (24, 48, 96, 192, 384 hours) to different concentrations of an aqueous solution of the abamectin formulation (0, 1.125, 2.25, 4.5, 9.0, 18.0 and 36 g/ml). Cysts were extracted by the Fenwich can. Batches of 50cysts of similar sizewere placed on 2 cm diam sieves (215 m aperture).Each sieve was put in a 3.5 cm diam Petri dish, and all dishes were arranged according to a complete randomized block design. For each treatment (exposure time x concentration) three replications were considered. Carrot root leachate was used as natural hatching agent. Three ml ofthe carrot root leachate were added to each batch of cysts, which were then incubated in a growth cabinet at 20 ± 2 °C. Emerged juveniles were counted weekly renewingthe hatching agent at the same time, over a 10week period. At the end of the hatching test cysts were crushed and unhatched eggs and juveniles were counted. Numbers of second stage juveniles emerging weekly were expressed as cumulative percentages of the total egg content of the cysts. For each exposure time the untreated cysts (0 concentration) were used as control. From percentages hatch the mortality for each treatment was assessed according to the formula% Mortality = 100 - % hatched juveniles (J_2) where% hatched J_2 = (N° hatched J_2 in treatment/N° hatched J_2 in control)*100

Percentage hatch data were statistically analyzed after transformation in arcsen root square values by ANOVA and the effects of abamectin concentrations, exposure times and their interactions were examined by 7 x 5 factorial design (Table1). On the base of total emergence data, abamectin concentrations needed to obtain 50, 60, 70, 80, 90 and 99.9% nematode mortality were also calculated using probit analysis (Software PlotIT V.3.2) (Table 2).

Results clearly demonstrate the efficacy of abamectinat all tested applied concentrations with an increaseof nematode mortality by the increase of abamectin concentration. Moreover, efficacy increased by increasing exposure time at each concentration.

Table 1

Factorial analysis of different abamectin concentrations and exposure times on percentage hatch of *Heterodera carotae* juveniles.

Abamectinconcentration (g/ml)	Exposure time (hours)				
	24	48	96	192	384
0	62.7[1] (±0.5)	53.6 (±4.3)	58.9 (±2.1)	57.1 (±5.4)	39.4 (±4.8)
1.125	47.0 (±3.6)	43.7 (±6.9)	45.1 (±7.0)	39.9 (±4.9)	32.7 (±4.6)
2.25	43.1 (±9.2)	34.3 (±4.9)	32.4 (±13.3)	30.9 (±2.2)	21.4 (±6.0)
4.5	38.2 (±5.5)	29.0 (±7.3)	34.0 (±4.5)	21.3 (±7.8)	15.7 (±4.1)
9.0	38.4 (±3.5)	25.5 (±5.6)	15.5 (±3.9)	7.6(±0.2)	11.0 (±5.7)
18.0	32.0 (±10.0)	14.5 (±6.7)	14.0 (±5.5)	5.5(±1.9)	7.8(±1.7)
36.0	11.9 (±8.4)	9.4(±3.5)	5.7(±2.8)	3.8(±2.2)	3.5(±0.5)
ANOVA F values Factor A - Abamectin concentrations 36.5** Factor B – Exposure times 11.7** A x B 0.63**					

[1]Each value is an average of three replications. Mean ± standard deviation. ** = F values significant at P=0.01.

Table 2.

Abamectin concentration sneeded to obtain 50, 60, 70, 80, 90 and 99.9% *Heterodera carotae* mortality at the different exposure times

Cyst nematode	Exposure time (hours)	Abamectin concentrations (g/ml) needed for the following % mortalities					
		50	60	70	80	90	99.9
Heterodera carotae	24	9.9	19.6	40.8	97.8	324.8	5,698.7
	48	5.7	9.4	16.3	31.1	75.6	630.7
	96	3.9	6.2	10.2	18.3	40.9	278.0
	192	2.5	3.6	5.5	9.1	17.9	90.3
	384	3.6	5.4	8.5	14.4	30.0	171.4

Aknowledgement: The research was undertaken within the framework of the bilateral project nr. 15.820.18.05.07/It between the National Research Council (CNR-Italy) and the Academy of Science of Moldova nr. 15.817.02.12F.

CONTROL OF THE ROOT-KNOT NEMATODE *MELOIDOGYNE INCOGNITA* BY IVOMEC CONTAINING AN EXAMETABOLITE OF *STREPTOMYCES AVERMITILIS*

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To find new control methods involving a reduction of applied synthetic molecules and a greater use of natural means of struggle, which could be applied to an organic and sustainable agriculture, recognized by the Europe Community since 1991 (EC Regulation 2092), the use of a veterinary antihelmintic product (IVOMEC), based on exametabolites produced by *Streptomyces avermitilis*, was tested in a pot experiment against the root-knot nematode *Meloidogyne incognita*. Tomato seedlings (cv. Rutgers) were transplanted in clay pots (V=1,000 ml) filled with a *M. incognita* infested soil (15 eggs and juveniles/mL soil). Pots were treated at transplant with 250 mL of different concentrations of aqueous solutions of IVOMEC (0.0625, 0.125, 0.25, 0.5, 1, 2 and 4 ml/l) and arranged on benches in a glasshouse at 25±2 °C in a randomized block design with six replicates/treatment. Nematode-infested untreated soil (Control) and fenamiphos (Fen) treated soil were used as controls. During the experiment plants received all the necessary maintenance (irrigation, fertilization, etc.). Two months later, at the end of the experiment, plants were uprooted to estimate root gall index (RGI) according to a 0-10 scale (0 = no galls and 10 = root system completely deformed by the presence of large and numerous galls), eggs and juveniles/g root (Hussey and Barker's method), soil nematode population density (Coolen's method), total nematode population density and the nematode reproduction factor *r* expressed as ratio between final and initial population density (*Pf*/*Pi*) (Table 1). Data from the experiment were subjected to analysis of variance and means compared by Least Significant Difference's Test. All statistical analysis were performed using Plot IT program. Lethal doses of ivermectin (as Ivomec formulation) were also calculated from pot experiment data to obtain different mortalities of the nematode (Table 2). Results clearly demonstrate the efficacy of ivermectin, applied at transplant at different rates (1, 2 and 4 ml/l), to decrease RGI, eggs and juveniles/g root and ml soil, total nematode population density and the reproduction factor, in comparison to the untreated control plants.

Table 1

Effect of different doses of ivermectin as ivomec formulation on *Meloidogyne incognita* infecting tomato plants (cv. Rutgers)

Treat.	Dose c.p. (mL/L)	RGI (0-10)		Eggs and J_2/g root (x 100)		Eggs and J_2/ mL soil		Total nemat. pop./pot (eggs and J_2) (x1,000)		*Pf/Pi*	
Control	---	7.0[1]	A[2]	67.5	A	149	A	1,106	ABC	74	ABC
Fen	43 L/ha	4.3	CDE	68.5	A	127	AB	1,531	A	102	A
Ivomec	0.0625	5.8	AB	45.7	ABC	129	AB	843	BCD	56	BCD
Ivomec	0.125	5.5	BC	56.5	AB	113	ABC	1,237	AB	82	AB
Ivomec	0.25	5.2	BCD	46.8	ABC	78	ABCD	856	BCD	57	BCD
Ivomec	0.50	3.8	DE	35.5	BC	40	BCD	712	CD	47	CD
Ivomec	1.0	3.3	EF	31.5	C	23	CD	434	DE	29	DE
Ivomec	2.0	2.2	FG	4.0	D	12	D	65	E	4	E
Ivomec	4.0	1.3	G	2.5	D	2	D	22	E	1	E

[1]Each value is an average of six replications;

[2]Data flanked in each column by the same letters are not statistically different according to Least Significant Difference's Test (P=0.01).

Table 2.

Lethal doses of ivermectin (a.i.) as ivomec formulation (c.p.) on the root-knot nematode *Meloidogyne incognita* assessed in a pot experiment

Per cent mortality	Lethal doses ivermectin (µg/L soil)
50	LD_{50} = 667
60	LD_{60} =934
70	LD_{70} =1,342
80	LD_{80} = 2,065
90	LD_{90} = 3,732
99.9	$LD_{99.9}$ = 15,317

Aknowledgement: The research was undertaken within the framework of the bilateral project nr. 15.820.18.05.07/It between the National Research Council (CNR-Italy) and the Academy of Science of R. Moldova nr. 15.817.02.12F.

INVESTIGATIONS REGARDING THE INFLUENCE OF BACTERIA FROM RHIZOSPHERE ZONE OF THE PLANTS ON THEIR GROWTH AND DEVELOPMENT AND ON SOME PHYTOPARASITE NEMATODES

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The famous Russian scientist D. Docuceaev considered soil as a living organism of nature. He arrived at this formulation because the soil is overpopulated by different microorganisms, nematodes, viruses and other living organisms. Their spread into the soil is not uniform nor quantitatively (number), or qualitatively (at species level). Most of them, especially bacteria, micromycetes, actinomycetes are concentrated in the area of plant rhizosphere / rhizoplane. Here they find the necessary conditions to survive through the use of substances eliminated by plants in soil, which contribute in one way or another to the processes of seed germination, plant growth and development. Some of them have the capacity to produce biologically active substances, others - to lay phosphorus from organic and mineral compounds of the soil. Among the rhizosphere microorganisms there also are bacteria with the capacity to accumulate atmospheric nitrogen and to protect the plants from pests and various phytopathogen agents. Because of these capabilities the microorganisms can serve as an alternative in partialsolving the additional plant nutrition and respectively – increasing oftheir productivity.

Because of mentioned characteristicsbacteria from plantrhizosphere and rhizoplane became objects of investigation in order to use them for the benefit of plants.

The studiesperformed within our team were focused on the study of the bacterial microflora of corn plantrhizosphere and rhizoplane. To this end rhizosphere soil samples have been collected from different districts of the republic, which served as sources for further isolation of microorganisms needed to complement the laboratory collection of microorganisms and their use in research process.

During the investigations there were selected and highlighted new strains of bacteria potentially stimulating and protective for the plant. Thus, it has been determined that some metabolic products of the bacteria have the property to stimulate the process of germination and productivity in corn. The germination capacity of seeds under the influence of some bacteria of the genus *Pseudomonas(P_3Rf, P_5Rf, P_8Rf)*and*Rhizobium* RD_2increased by 5.0 - 13.3% comparing to controland the productivity of the dry mass under the influence of a considerable number of bacteria grew on average by 9.1% - 20.9%. The highest degree of stimulation occurred in strains of *Pseudomonas*

sp. PP_2, $P_{24}Rp$, PC_5, Rh. japonicum RD_2, the metabolites of which are thinneddilluted in proportion of 1/500-1/1000. The strains assessed as having a high degree of activity were then used as objects for laboratoryinvestigation and vegetativeexperiences (innon-sterile soil pots).

After the analysis of data obtained it was determined that investigatedbacteria in soil conditions contributed to the increase of the gross mass of plants with 6.8%-20.8%, and of the dry - with 14.6%- 21.8%. The best results were obtained when using strains *Ps. sp. PC_5, Rh. japonicum RD_2 și $P_{24}Rp$*with respectively 21.8%, 19.0% and 17.4% compared to the control. The remaining strains have increased the amount of dry matter from 14.6% to 15.9%. It has been found that some bacteria also positively influences the increase in root length, thus increasing relative to the control with 6.2%- 14.5%,being more pronounced in strains *Rh. japonicum RD_2*– with 14,0% and*Ps. sp. $P_{16}Rp$*with 14.5%. The other strains influence on the length of roots but with much weaker outcome measurements –of 6.2% - 9.6%.

Some bacteria: *Ps. sp. PP_2, $P_{16}RP$, Rh. japonicum RD_2*influencepositively upon the high of plant growth. The plants grewwith 7.0% -11.5% more high comparing to the control.

In parallel with the above mentioned, investigations have been conducted on the influence of some bacteria in the rhizosphere of the corn plants*(Rh. japonicum RD_2, Pseudomonas sp. PC_5, P_3Rf)* on the development of nematodes *Ditylenchus destructor* and *D. dipsaci*. The antagonist impact in vitro was studied using *Rh. japonicum, Ps. sp. P_3RF* and *PC_5* and parasitic nematode species. Testing was carried out in laboratory conditions with a temperature of 25-27^{0}C at various time intervals - 1, 2, 4, 8, 21, 24, 48, 72 hours and 7....14 days. As control served nematodes maintained in distilled water. At the end of experience the effectiveness was verified. The results showed an increased efficiency of *Rhizobium* bacteria and of strain *P_3RF* that had lethal action on nematodes *Ditylenchus* in proportion of 70%-75% at an interval of 24 hours, 95% - in 48 hours and 90%-97.5% in 72 hours. After a longer contact (7-14 days) was observed a destructive action on internal organs of parasitic nematodes - median intestine, gonad that lost their contours, were completely deformed, transforming into a homogeneous mass. An increased efficacy was shown by the strain *Ps. sp. PC5*, which caused 90% mortality in the parasitic nematode for 24 hours and 95-100% in 48-72 hours. Unlike *Rhizobium japonicum* bacteria *PC_5* at longer period of contact with nematodes (7-12 days) caused total destruction not only of internal organs but also of cuticle. Using the microscopictechnique we found the remnants of destroyednematodes.

The conclusion made following a review of data obtained is that the investigated soil samples contained multiple strains of bacteria stimulating the processes of growth and development, as well as antagonistic action on parasitic nematodes of agricultural plants.

DISTRIBUTION OF ARRHOPALITIDAE SPECIES (COLLEMBOLA: SYMPHYPLEONA) IN THE REPUBLIC OF MOLDOVA

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The first three species of Arrhopalitidae such as *Arrhopalites caecus* (Tullberg, 1871), *Pygmarrhoplaites pygmaeus* (Wankel, 1860) and *P. secundarius* (Gisin, 1958) were cited from the Republic of Moldova by Buşmachiu, 2010.

The new investigation concerning the fauna of Arrhopalitidae collected from eighteen localities from the Republic of Moldova show that the family Arrhoplaitidae are represented by two genera and four species each: *Arrhopalites* with *Arrhopalites* sp. gr. *diversus*, *A. caecus*, *A. prutensis* Vargovitsh & Busmachiu, 2015, *A. ulehlovae* Rusek, 1970 and *Pygmarrhopalites* with *Pygmarrhoplaites ornatus* (Stach, 1945), *P. pygmaeus*, *P. secundarius* and *P. terricol*a (Gisin, 1958).

Arrhopalitidae were collected mainly in humid habitats like floodplain forest, banks of rivers Prut, Dniester and Răut, shore of Lake Ghidighici and in the soil, litter and decaying woods of the deciduous forest near Donici locality and two scientific reserves: Codrii and Plaiul Fagului. A total number of sampled Arrhopalitidae includes 120 specimens belonging to eight species with peculiar distribution in the studied habitats.

A. prutensis Vargovitsh, Busmachiu, 2015 and *A. ulehlovae* Rusek, 1970 were recorded on the bank of Prut River only, while *Pygmarrhoplaites ornatus* (Stach, 1945), *Pygmarrhoplaites pygmaeus* (Wankel, 1860) and *P. secundarius* (Gisin, 1958) on the bank of Dniester River only.

Several species as *Arrhopalites caecus* (Tullberg, 1871), *Arrhopalites* sp. gr. *diversus*, *Pygmarrhoplaites pygmaeus* (Wankel, 1860) and *P. terricola* (Gisin, 1958) were revealed in the soil and decaying stump of the scientific reserves Codrii and Plaiul Fagului.

Two species *Arrhopalites caecus* (Tullberg, 1871) and *P. terricol*a (Gisin, 1958) were common in the most part of studied habitats.

The results encouraged us to expand the research over other cities and we expect to raise the list of Moldovian Arrhopalitidae. New collected material includes 15 specimens from 5 localities, three of them: Unguri (natural deciduous forest), Varnița (bank of Dniester River) and Condrița (decaying stump from the natural deciduous forest) were not studied before.

ORGANIC FARMING IN MINIMIZING OF CLIMATE CHANGE IMPACTS

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Climate change will have an impact not only on the development of harmful organisms (pathogens, harmful arthropods and weeds), but touch and cultivated plants. Under the influence of high temperatures is expecting profound changes in the immune status of the plant. Prolonged exposure to temperature and water stress cause changes in physiological and biochemical mechanisms of stability and plants become more susceptible to pests.

Expected trends in phytosanitary condition of agro ecosystems can cause an overall increase in crop losses. Extrapolation of the increase of impact of pests on crop plants caused an increase in the number of generations, and their level of virulence and aggressively, expansion and dissemination areas of penetration of new quarantine pests makes it highly likely that the yield loss due to this factor will increase by 1,5-2 times compared with the current, the components in the value of the order of 1,5-2,0 bln lei.

Against the backdrop of general deterioration of the phytosanitary state of agro ecosystems and the consequences of the deepening environmental crisis increases the need to develop new conceptual ideas and strategies for pest control in a changing climate. Measures to combat pests of crops should be directed not against each type, and taking into account the degree of development of all components of an integrated agro-ecosystem. Most acceptable of the integrated plant protection system based on the use of agrocenoses management principles under which appear biocenotic regulation mechanisms in communities, increasing the circulation of beneficial organisms and reduce the degree of development harmful.

Development of ecosystem technologies integrated pest management system involves complex interactions between beneficial and harmful organisms which, on the one hand, should contribute to a significant reduction in the connection between crops and pests, and on the other - strengthening the trophic relations between phytophagous and entomophages. In the context of the predominance of phytophagous and increasing population density, we have developed a system of measures to reduce the extent of the damage below the economic threshold.

To reduce the loss of quality and quantity of agricultural products from pests need to apply modern scientific research achievements and best practices, including organic farming is based on the use biogeocenotic pest population regulation mechanisms. Development and implementation of environmental dynamics of agriculture in the Republic of Moldova, the growing number of farm operators and the volume of production and exports of organic products, demonstrate the need to expand this method of adapting agriculture to climate change.

LM AND SEM MORPHOPATHOLOGY OF *MELOIDOGYNE JAVANICA* INFECTION SITES IN *CAPSICUM ANNUUM* HYPOCOTYL AND ROOTS

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Plant-parasitic nematodes display a wide variety of interactions with their hosts. Among them the root-knot nematodes (*Meloidogyne* spp.) are the most economically important group worldwide distributed, that consists of about 100 species able to induce complex feeding structures in their hosts which supply the nematode with a rich and long-lasting food source. Although species of *Meloidogyne* typically produce root galls on susceptible plants, galls are produced occasionally on above-ground parts. Well established host–parasite relationships of the root-knot nematode *Meloidogyne javanica* Chitw. (Treub) on pepper (*Capsicum annuum*) hypocotyls (cv Yellow Wonder) are described and illustrated as recorded by LM and SEM observations on aboveground feeding sites. Gall induction and formation were studied in glasshouse conditions at 28 ± 2°C. Pepper plants exposed to a range of population densities of 1, 2, 4, 8, 16, 32 and 64 eggs and second-stage juveniles (J2s)/ml soilof the nematode showed the typical susceptible reaction to *M. javanica*. The basic pattern of cellular changes that occur in stems has been compared to those occurring in roots infected by *Meloidogyne* species by histopathological studies. Infected pepper hypocotyl (4-5 mm long) portions, together with galled root segments were selected for histopathological studies. Tissues were fixed in formaldehyde chromo-acetic solution for 48 h, dehydrated in a tertiary butyl alcohol series (40-70-85-90-100 %), embedded in paraffin with a melting point of 58°C and sectioned with a rotary microtome. Sections 10–12 µm thick were placed on glass slides, stained with safranin and fast-green, mounted permanently in a 40% xylene solution of a polymethacrylic ester (Synocril 9122X), examined microscopically and photographed. A number of the sections instead to be mounted for slides , has been appropriately prepared for SEM observations (Fig. 1).

On the basis of the observations of second-stage juveniles of *Meloidogyne* within hypocotyl tissue it is concluded that penetration occurs while the hypocotyls is still below the level. The anatomical observations of roots, stems and hypocotyl obtained with the aid of a light and SEM microscopies demonstrated that *M. javanica* is highly specialized endoparasite on pepper seedlings. In this very compatible interaction, the nematode induce metabolically active multinucleate feeding hypertrophied cells with well developed large galls on roots and stems. Stellar vascular tissues within galls appeared interrupted and strongly disorganized.

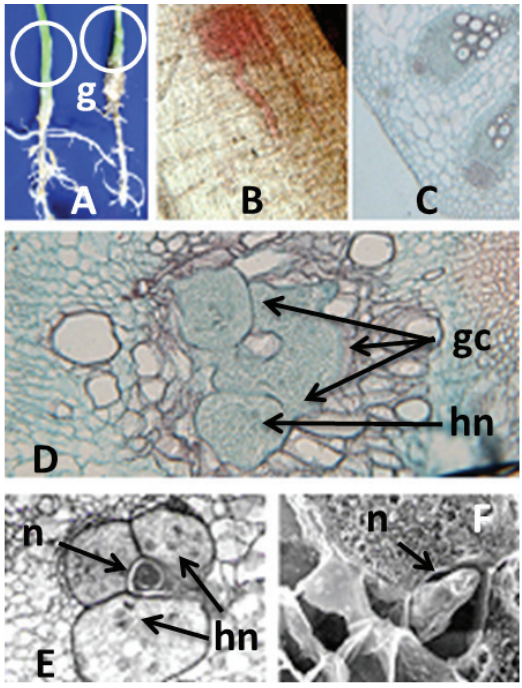

Fig. 1. A) Three weeks old seedlings with distinct hypocotyl galls (g); B) juvenile stage of the nematode inside the gall; C) cross section of hypocotyls showing healthy vascular bands; D) well established feeding site with distinct hypertrophied polinucleated giant cells (gc) and hypertrophied nuclei (hn); E and F) LM and SEM microphotos, respectively, showing in detail the nematode feeding point in cross section hypocotyls galls(n = nematode anterior body).

Aknowledgement: The research was undertaken within the framework of the bilateral project nr. 15.820.18.05.07/It between the National Research Council (CNR-Italy) and the Academyof Scienceof R. Moldova nr. 15.817.02.12F.

MIXED INVASIONS WITH ECTOPARASITES ON PHEASANTS FROM REPUBLIC OF MOLDOVA AND THEIR IMPACT ON HEMATOLOGICAL INDICES

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Parasitological study of wild birds has a multilateral importance to the development of prophylactic measures, scientifically substantiated, with the aim of keeping populations healthy. Birds are hosts of a rangeof dangerous parasitic disease agents to human and domestic animals, can serve as transmitters and thereby cause considerable economic damage. Gamasidmites and some species of malofags, parasitizing on poultry and wild birds, fulfilling its role as vectors of pathogens. It is important to highlight mixt invasions at wild birds. Mixt invasions study presents one of the current problems of contemporary parasitology and ecology. Species composition of parasites in wild birds may influence considerably on their population dynamics, especially during intervals of time. It is proven that the conditions of tests, some species of ectoparasites are able to keep and transmit long time infectious arbovirosis agents (АкбаевМ. Ш. идр., 2000, Toderaş I. ş. a., 2008, Zamornea Maria**,** 2009).

Many measures aimed at increasing the number of hunting animals will not be enough, because parasitic diseases donot only retain growth and development, but also make the capture easier and their mortality. Therefore studying the parasitic fauna on wild animals is highly significant.

To determine parasite fauna at pheasants, parasitological studies were conducted in different biotypes. Sampling was carried out singly and in groups by the methods of Dubinin M., 1955, Luncaşu M., Zamornea M. (Patent of invention. 3441 G2, MD, A01 M 1/20 BOPI nr 12/2007).

Ectoparasiteswere collected from live birds, according to a new process that is more informative. The collected material was subsequently examined with magnifying glass MBS-9 (ob.14x2) and Novex microscope Holland B ob. From 20-40 WF 10x / 20mm. Hematological examination was automatically performed using the appliance model PCE-210 (ERMA INC) and automatic counting leukocyte formula "S.Plius - 4".

The aim of the research was to determine the level of infestation with ectoparasites at common pheasant (Phasianuscolchicus) and to determine the impact on hematological poliparasitosis. It was determined the number of erythrocytes, hemoglobin, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, mean

corpuscular volume, platelet count, mean platelet volume, number of leukocytes, monocytes, granulocytes and eosinophils, according to specialized classical methods.

As a result of performed parasitological investigations in different biotypes of Moldova was established that ectoparasitic fauna of pheasants consists of 8 species of malofags (*Eomenacanthusstramineus, Goniodescolchicus, Menopongallinae, Cuclotogastercinereus, Goniocoteschrysocephalus,Goniocotesgallinae, Goniodesdissimilis, Lipeuruscaponis*), flea species (*Ceratophylushirundinis*) and two species of gamasid mites (*Dermanyssusgallinae, Dermanyssushirundinis*).

Impact quantification of mixed invasions with ectoparasites (biting, fleas, gamasid mites) shows a decrease of hematological indices: RBC - by 20%, the amount of hemoglobin (HGB) - 10.8%, mean corpuscular hemoglobin (MCH) - with 7.1%, the mean erythrocyte hemoglobin (MCHC) - by 13.1%, mean corpuscular volume (MCV) - by 15.3%, platelet (PLT) - 23.7%, mean platelet volume (MPV - 12.5% in the infected group compared the control group.

The analysis of WBC counts results reveals an increase of leukocytes at wild birds in the infected group with 28.9%, monocytes - 9.7% granulocytes - by 9.5% and eosinophils - 9.1% compared with the control group.

The increase of quality and quantity level of parasitic antigens (9.1% at infected pheasants) in the infested body indicates the impact of parasitic agent with host organism.

Therefore, hematological indices reveals a state of spoliation of wild birds (pheasants) in the infected group, caused by mixed invasions with ectoparasites. Birds infected with ectoparasiteswere diagnosed with anemia, caused by reducing the number of red blood cells, hemoglobin and platelet count. Low platelet count is due likely to the increase of the level of infestation, and on the feeding place of parasites have been settled hemorrhages.

The increased percentage of eosinophils can be used as a marker in the diagnosis of mixed invasions with ectoparasites.

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Section III
WATER ECOSYSTEMS

CHEMICAL OXYGEN DEMAND AND ORGANIC MATTER IN THE DNIESTER WATERS

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Chemical oxygen demand is one of the important hydrochemical parameters, which characterize the living environment of hydrobionts, indicating indirectly the level of water pollution with organic compounds. Water permanganate chemical oxygen demand or permanganate index (COD_{Mn}) shows the content of easily degradable organic compounds and of some inorganic compounds (NO_2^-, SO_3^{2-}, Fe^{2+}, etc.), and the water dichromate chemical oxygen demand (COD_{Cr}) is used for the assessment of the state of natural waters, which are highly influenced by human factor.

The water sampling has been carried out during vegetation season of 2015 in the Middle Dniester (Naslavcea, Volcinet, Soroca, Camenca), Dubasari reservoir (Erjova, Goieni, Cocieri) and the Lower Dniester (Vadul lui Vodă, Varnita, Sucleia, Palanca). For determination of COD_{Mn} the standard SM SR EN ISO 8467:2006 was used, of COD_{Cr} - SM SR ISO 6060:2006. On the base of obtained data, the organic matter content was calculated by using the method of Aleokin (1973).

It was revealed that in 2015 the values of COD_{Mn} ranged from 4.89 to 13.81 mgO/l, those of COD_{Cr} varied from 23.64 to 100.92 mgO/l. In the case of both parameters the highest figures were registered in summer and autumn at Soroca station. The ratio between COD_{Mn} and COD_{Mn}, which fitted within diapason 0.12-0.31, proved a low intensity of self-cleaning processes in the river waters. According to the Moldovan *Regulation on environment quality requirements for the surface waters* (2013), the values of COD_{Mn} indicated good - moderately polluted waters (classes II and III of water quality), but those of COD_{Cr} – even polluted and very polluted waters (classes IV and V) in the Dniester River.

During the study the highest content of organic matter was found in summer at Soroca – 75.7mg/l, which is determined by the heavy pollution of natural waters primarily with household waste waters. Altogether for 2015, in 72.7% of the investigated samples in Dniester river the organic matter exceeded 20 mg/l. In 2013-2014 the content of organic matter was in average of 21.2 mg/l, when in 2015 – 26.6 mg/l, this fact being explained mainly by the lower water level in the last year on Moldovan territory. To note its content increased from spring to autumn.

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ASSESSING THE QUALITY OF DNIESTER RIVER BASED ON TBI INDEX

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Benthic invertebrates are animals inhabiting on the bottom of water basins, in the benthic water layer and on different substrates. They are represented by the following taxonomic groups: oligochetes, chironomides, molluscs, crustaceans, tricopteres, ephemeropteres, plecopteres, etc. Among the main requirements for indicator species are their distribution over a sufficiently large area, having an important functional role in the ecosystem, reacting rapidly enough to the changing environmental conditions as well as the availability of information on species ecology.

Under adverse conditions in biocenoses, the species diversity decreases, while the number of more resistant to pollution species increases. Species which are sensitive to pollution, whose species number is declining due to increased pollution (reophilous species, oxiphilous species adapted to the conditions and oligobetasaprobe species). In moderate and heavily polluted waters representatives of *Ephemeroptera*, *Trichoptera*, *Plecoptera* are not found, with the exception of the representatives of *Baetidae* and *Caenidae* families.

The evaluation of water quality according to macrozoobenthos indices was made according to the trend biotic index (TBI) (Woodiwiss,1964), one of the simplest and most used index. The calculation of this index is based on the propriety of mactobenthos to dissapear under pollution pressure, first of all refleced on most sensitive species belonging to *Plecoptera, Ephemeroptera* and *Trichoptera*.

During expeditions, carried out in August 2016, 22 samples of benthic macroinvertebrates from the Dniester river were collected. The sampling stations were located in Naslavcea, Otaci, Soroca, Camenca, Erjova, Goieni, Cocieri, Vadul lui Voda, Varna, Sucleia and Palanca. Sample collections of benthic invertebrates were carried out in accordance with international and national standards. More detailed methods and tools for sample collection of macrobenthos are discussed in the relevant field guidebooks. Therefore, in this study, the widely accepted hydrobiological methods of sample collection and laboratory processing were used.

During sample analysis in the Laboratory of Hydrobiology and Ecotoxicology the following taxa were identified: **Oligochaeta:** *Eiseniella tetraedra* (Savigni), *Tubificidae sp*. **Mollusca**: *Sphaerium rivicola* (Lamarck, 1818), *Viviparus viviparus* (Linne, 1758), *Valvata* (Cincinna) *pulchela* Studer, 1820, *Valvata* (Cincinna) *piscinalis* (O. F. Muller), *Theodoxus fluviatilis* (Linne, 1758), *Theodoxus danubialis* C.Pf.. *Physa acuta* Drp., *Lymnaea auricularia* (Linne, 1758). *Lymnaea stagnalis* (Linne, 1758). *Fagotia esperi* (Férussac, 1823*), Fagotia acicularis* (Férussac, 1823), *Bithinia tentaculata* (Linne, 1758),

Helobgella stagnalis (Linne, 1758), **Crustacea:** *Corophium chelicorne Sars*, 1895, *Corophium sp*., *Chaetogammarus ischus* (Stebbing), *Pontogammarus obesus* (G.O. Sars), **Myzidacea:** *Limnomysis benedeni Czerniavsky, Katamysis warpachowskyi*** (Sars, 1877), *Paramysis lacustris* ,. **Ephemeroptera:** *Caenis horaria* (Linne, 1758), **Trichoptera**: *Mystacides longicornis* (Linne, 1758), *Oecetis lacustris* (Pictet, 1834), **Chironomidae**: *Polypedilium convictum* (Walker, 1856), *Tanypus vilipennis* (K.),*Orthocladius sp*. **Other groups:** *Sialis flavilatera =lutaria* (Linné, l758), *Platicnemis pennipes* (Pallas), *Tabanidae sp*., *Elophila* (larvae), *Sigara falleni* (Fieber), *Haliplus sp* (larvae), *Aeschna viridis* (Linne, 1758).

After sample analysis the TBI index was calculated and the quality of water was determined. The state of benthic invertebrates and taxonomic density of invertebrates are extremely important for the determination of water quality and assessment of the status of aquatic ecosystem in general. Based on TBI index calculations of macrozoobenthos, during the study period, the saprobity zones of Dniester river varied β-mesosaprobic and α- mesosaprobic, the class of water quality being attributed to moderately polluted to critically polluted.

PARTICULARITIES OF PRUT RIVER ICHTYOFAUNA IN 2016 STUDY YEAR

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Investigations conducted in the Prut River basin using sapling seine in the 2016 study year revealed the following ichtyofaunistic features:

1. At the confluence region with Danube River the ichtyofauna is the richest, owing to the ecoton zone (during spring - 25 species and during summer - 27 species were encountered), forming joint contact surfaces between the riverbed, flood plain and Danube River. It noted that in this area the highest taxonomic diversity is found, holding a significant share in catches the invasive and interventing fish species as: *Carassius gibelio*, *Lepomis gibbosus*, *Pseudorasbora parva*, species of *gobies* (*Neogobius fluviatilis*, *Babka gymnotrachelus*, *Proterorhinus semilunaris*, *Ponticola kessleri*, *Benthophilus nudus*) and *Syngnathus abaster.*

This ichtyofaunistic image is largely determined by the major influence of Danube River on Lower Prut ecosystem and presence, in this area, of numerous fish farms, canals, ponds and lakes, which, during high floods, make active mutual exchange of fishery representatives.

Among the native fish species in the area of Danube River confluence become common the following taxons: *Alburnus alburnus,* sapling *of Aspius aspius, Blicca bjoerkna, Rhodeus amarus, Rutilus rutilus, Abramis brama* and *Perca fluviatilis*. During the spring, in the reproductive season, eloquent increase the abundance of *Gymnocephalus cernua*) and *Gymnocephalus baloni*.

2. In Braniste village resort, located directly downstream of the Costesti -Stanca lake, the species diversity (in spring - 15 species, in summer - 18 species) is also determined by the abundant presence of limno - rheophyls fish species as: *Carassius auratus s. lato*, *Pseudorasbora parva*, *Perca fluviatilis*, *Rutilus rutilus*, *Esox lucius* and *Scardinius erythrophthalmus*. At the same time, it should be noted that this hydrobiotop, with clean and transparent water, sandy substrate and with intense shady trees sides, offer a favorable habitats for rheophyls native fish species as: *Squalius cephalus, Barbus barbus, Chondrostoma nasus, Romanogobio kesslerii,* etc.

3. In Cahul halt there is a similar situation, the typical rheophyls ichtyofauna is complemented by ubicvist fish species as: *Pseudorasbora parva, Carassius gibelio, Rutilus rutilus, Perca fluviatilis* and culture one (breeds of *carp*) coming from numerous limitrophe ecosystems with nearby stagnant water (abandoned ponds near Cahul city, Manta ponds, fish farms, flooded canals, etc.).

4. From gobies group inhabiting Prut River, *Neogobius fluviatilis* is the most numerous and frequent in captures, becoming eudominant (D5) species and characteristic one (W4, W5) in most of collection sites of Prut River bed. High values of ecological indexes for intervening species *Proterorhinus semilunaris* are alarming downstream of the Costesti-Stinca dam (Braniste village). In spring this can be a dominant taxon in catches - D4 (D = 8,48% W = 3,39%). From gobies group we have mentioned the emergence and expansion in the Lower Prut of the *Bentophilus nudus* species, first identified in the spring of 2015 (Bulat, 2015).

5. Some allogenic fish species signaled in Prut River in the 2016 study year, the most abundant in catches are *Carassius auratus s. lato*, *Pseudorasbora parva* and *Lepomis gibbosus*, their affinity degree growing in areas with calm water and rich in aquatic vegetation.

6. Among the native fish species caught in the Lower Prut ecosystem in 2016 most representative are those with short life cycle: *Alburnus alburnus* and *Rhodeus amarus* (eudominant in most habitats), and from them of medium size the juvenile of *Squalius cephalus, Aspius aspius, Rutilus rutilus, Abramis brama, Blicca bjoerkna* can be mentioned. Among the taxons with diverse rarity state captured in Prut River ecosystem in the 2016 study year should be mentioned: *Sabanejewia balcanica, Zingel zingel, Leuciscus idus, Barbus barbus, Vimba vimba, Chondrostoma nasus*), *Gymnocephalus baloni*, etc., each of them being identified in species characteristic habitats and at certain times of the life cycle.

7. In the region of the Costesti-Stinca dam control fishering in the summer of 2016 revealed an ichtyofaunistic diversity established of 10 fish species, including the next eudominant (D5) and characteristic (W4 , W5) species: *Alburnus alburnus* (W_{summer} = 8,93%), *Rutilus rutilus* (W_{summer} = 9,57%), *Gymnocephalus cernua* (W_{summer} = 16,11%) and *Perca fluviatilis* (W_{summer} = 10,98%). Among indigenous fish species with major economic and environmental importance which have proved satisfactory strength in catches in the summer of 2016 we can mention: *Aspius aspius* (W_{summer} = 0,79%), *Abramis brama* (W_{summer} = 1,01%) and *Sander lucioperca* (W_{summer} = 1,8%). From interventing fish species, most abundant and frequently represented becomes *Neogobius fluviatilis* (W_{summer} = 2,07%).

When analyzing similarity ecological index (Sörensen) of fish catches fish from Prut River in the summer of 2016 using sapling seine, we find that the greatest degree of similarity of fish communities is observed between the resorts: Sculeni - Leova (83%); Leuşeni - Leova (78%) and Cahul –Giurgiuleşti (77%), and the lowest similarity is found between the resorts Leuşeni and Giurgiuleşti (43%).

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PARTICULARITIES OF DNIESTER RIVER ICHTYOFAUNA DURING 2016

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Scientific investigations carried out in 2016 in Dniester River (the territorial limits of Republic of Moldova) revealed the following ichtyofaunistic features:

1. In the region of Naslavcea village the specific diversity is the poorest (spring - 5 species, in summer - 7 fish species). The determining factor is the construction of the Novodnestrovsk dam that modified hydrological, thermal and hydrobiological downstream. The only opportunistic species became *Gasterosteus aculeatus* Linnaeus, 1758, being in both periods of the year the multidominant one (D5) – D_{spring} = 94,29%, D_{summer}=96,75%; euconstant (C4) – C_{spring} = 80,0%, C_{summer}=60,0 % and caracteristic (W5) – W_{spring} = 75,44 %, W_{summer}= 58,05 %.

2. In resort near Otaci village we see an increase in species diversity as a result of higher specific thermal gradient value and appearance of numerous patches of aquatic vegetation which comtribute to abundance of small fish species. During the summer time 13 fish species were identified, most of them beloinging to the ecological group of opportunistic species with short life cycle as: *Gasterosteus aculeatus* Linnaeus, 1758; *Leuciscus leuciscus* (Linnaeus, 1758); *Alburnus alburnus* (Linnaeus, 1758); *Rhodeus amarus* (Bloch, 1782). About medium sized species, systematically is captured: *Rutilus rutilus* (Linnaeus, 1758); *Perca fluviatilis* Linnaeus, 1758 and *Squalius cephalus* (Linnaeus, 1758). Also, since this collection place are systematically captured the *Cobitis* taxon complex and other guvids species as: *Neogobius fluviatilis* (Pallas, 1814) and *Proterorhinus semilunaris* (Heckel, 1837).

3. The control fishering downstream of Soroca city have demonstrated an ichtyofaunistic picture quite surprising for us, significantly increasing both taxonomic diversity (spring - 19 species, in summer - 22 fish species) and abundance of species in captures. The largest share of specis are formed by eurybiont limno-rheophyls fish species such as: *Rutilus rutilus* (Linnaeus, 1758); *Esox lucius* Linnaeus, 1758; *Carassius gibelio* (Bloch, 1782); *Rhodeus amarus* (Bloch, 1782); *Pseudorasbora parva* (Temminck & Schlegel, 1846); *Cobitis species*, *Perca fluviatilis* Linnaeus, 1758; *Alburnus alburnus* (Linnaeus, 1758), and other species, which is a strong indicator of biological active process of eutrophication and pollution of this hydrobiotop (where waters nurse of Soroca city are diverse directly in Dniester River). Also, there is still a firm ichtyocenotic structure of indigenous rheophylous fish species as: *Barbus barbus* (Linnaeus,1758)

(W_{summer} = 2,74%), *Squalius cephalus* (Linnaeus, 1758) (W_{summer} = 4,02%) and *Leuciscus leuciscus* (Linnaeus, 1758) (W_{summer} = 6,83%), currently facing negative processes of hydrobiotopic alteration and advance of eurytop fish species. However, these species are part of reproductive litophilous fish species guild that is less affected by sudden alternations level during reproductive unlike phytophilous species group.

4. For Camenca city – Erjovo village section is characteristic the keeping of high values of dominance and constance for species of gobies and *Rhodeus amarus* (Bloch, 1782), and a significant increasing of ecological indexes for *Cobitis* complex (*Cobitis taenia s. lato*) (W_{summer} =10,21%) and for *Syngnathus abaster* Risso, 1827 (W_{summer} =11,38%).

5. The scientific fisheries conducted in Goieni Gulf, despite relatively poor specific diversity (spring - 17 species, in summer - 14 fish species), demonstrating the highest quantitative values of Dniester River. Maximum productive contribution in ichtyocenosis structure is brought by eurytope limno – rheophyls small and medium species as: *Rutilus rutilus* (Linnaeus, 1758) (W_{summer} = 34,15%); *Scardinius erythrophthalmus* (Linnaeus, 1758) (W_{summer} = 5,06 %); *Perca fluviatilis* Linnaeus,1758, (W_{summer} = 2,53%); *Alburnus alburnus* (Linnaeus, 1758) (W_{summer} = 3,85%); *Rhodeus amarus* (Bloch, 1782) (W_{summer} = 3,74%). Comparative analysis of catches in the dam of Dubasari reservoirs in different seasons it can be noted the largest differences as a result of hydrobiotop dimensions, offering more opportunities for fish species in space and temporary aspect.

6. Scientific fisheries carried out on the section Criuleni–Vadul-lui-Voda shows a significant increase in species diversity compared to Dubasari reservoir on the account of rheophylous species like *Barbus barbus* (Linnaeus,1758); *Romanogobio kesslerii* (Dybowski, 1862); *Romanogobio belingi* (Slastenenko, 1934); *Leuciscus leuciscus* (Linnaeus, 1758); *Squalius cephalus* (Linnaeus, 1758) (spring - 21 species, in summer - 24 fish species).

7. The greatest ichtyofaunistic diversity in Dniester River, within the limits of the Republic of Moldova, is found in the southern terminal point – Palanca village (in spring - 23 species, in summer - 27 fish species), which is a really ecoton zone and fishery comprises fish representatives of various environmental groups.

8. When analyzing ecological similarity index (Sörensen) of fish catches in Dniester River in spring, 2016, using the sapling seine, we find that the greatest degree of similarity of fish communities is observed between the resorts: Soroca - Camenca - 83% (15 common species), Goieni - Dubasari - 81% (13 species common) and Soroca - Criuleni - 80% (16 common species). The lowest value of similarity – 10% is found between the hypothermoficated Naslavcea resort and the intense limnophycated dam of Dubasari (1 common species).

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COMPARATIVE PARTICULARITIES BETWEEN THE ICHTYOFAUNA OF DNIESTER AND PRUT RIVERS (TERRITORIAL LIMITS OF REPUBLIC OF MOLDOVA)

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Following the many years of studies conducted on Dniester and Prut Rivers ichtyofauna (Moldova's territorial limits) it became possible to elucidate the comparative aspects between these two large water macroecosystems (Bulat et al., 2014).

Although the Danube basin (which includes Prut River) and Dniester are separated by geographic barrier of Black Sea, their ichtyofauna have many common points, but the differences become clearer only in the current intensification of anthropogenic pressure. High similarity of ichtyofauna of these two hydrographic basins is due to the shallow continental shelf between the Danube mouths and Dniester estuary, which shows that during the glacial period Dniester River, was a tributary of the Lower Paleo-Danube (Serban, Bănărescu, 1985).

Therefore, at the moment, we found the following comparative particularities of ichtyofauna between Dniester and Prut Rivers (Moldova's territorial limits):

1. Active processes of limnophilous, silting and eutrophication of the Dniester River ecosystem as a result of multiple fragmentations, has led to substantial expansion seaside area, characterized by large areas of shallow water, rich in aquatic vegetation. This has become particularly attractive habitat for euritope opportunistic species with short and medium life cycle (*Alburnus alburnus, Rutilus rutilus, Rhodeus amarus, species of gobies, Cobitis complex*, *Carassius s. lato, Syngnathus abaster, etc.*), where they have found favorable place for nutrition, reproduction and refuge. Unlike Dniester River, coastal areas of the Prut riverbed is characterized mostly by steep banks, poor in aquatic vegetation and flowing faster water, and transparency which is a feature for low water of Prut River becomes an additional cause of decreasing the primary production of ecosystem, and thus on the secondary one (Ungureanu, 2014).

2. As concerning the diversity and share in the catches of fish species with different rarity status (*Vimba vimba, Ballerus sapa, Pelecus cultratus, Leuciscus idus, Zingel zingel, Zingel streber, Alburnoides bipunctatus, Barbus petenyi, Lota lota, Sabanejewia balcanica, etc.*), Prut River significantly outcompete Dniester River, which indicates a higher anthropogenic pressure on river ecosystem.

3. Greater abundance of *Gymnocephalus cernua* in Costesti–Stica reservoir, and including some of rheophyls species as: *Barbus barbus, Vimba vimba, Squalius cephalus, Chondrostoma nasus, Ballerus sapa,* etc., involves a more favorable ecological status

of this anthropic aquatic ecosystem compared to Dubasari accumulation on Dniester River (Bulat, Davideanu, 2016).

4. Ichtyofauna of Dniester River is more affected by interventing species abundance than in Prut River: *the species of gobies, Syngnathus abaster, Gasterosteus aculeatus, Pungitius platygaster, Clupeonell acultriventris, Atherina boyeri etc*. The determining factors of active pontisation of Dniester ichtyofauna, serve anthropogenic negative processes of hydrobiotopic alteration, and, not least, the fish overexploitation with selective effect (causing undermining of trophic level of ichtyophagous and top large competitors, naturally serving as a force major regulatory in ecosystem).

5. From the native fish species of *Cobitis complex* is well represented in Dniester River ichtyofauna than in Prut River (except *Sabanejewia balcanica*) while *Gymnocephalus complex* (*Gymnocephalus cernua, Gymnocephalus baloni and their interspecific hybrids*) is better represented in Prut River (except *Gymnocephalus acerina*).

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CONTRIBUTIONS TO THE STUDY OF MOLLUSKS IN FRESHWATER ENVIRONMENT OF ACCUMULATION LAKE VATRA

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Functional state of malacofauna can serve as bio-indicator of environmental quality and highlights the search for new solutions for protection, use and exploitation of biological resources. Pronounced biotope heterogeneity of the ecosystem in reference to accumulation Lake Vatra, determines favorable living conditions for different species, serving as an important area for biodiversity conservation. From this point of view, it differs from other accumulation lakes from the small rivers of Moldova, approaching the richness of large accumulation lakes ecosystems, serving as important refuge for many species.

The work is mainly aimed to present the situation of water mollusk fauna in the accumulation Lake Vatra. Collection and conservation were conducted according to specific methods. Determination of the species was carried out according to the literature: (Лихарев, 1952; Kerney et al., 1984; Grossu,1983, 1995).

Storage Lake Vatra (Ghidighici) is an artificial water basin used for purposes of exploitation of its natural resources, created in 1962 on the River Bic about 75 km from springs and 9 km north of Chisinau. The waters of the basin are mainly used for recreational purposes, in fish farming and irrigation. The aquatory area is about 800 ha. The study of fauna material from the investigated area, allowed the identification of 16 species of aquatic mollusk belonging to two classes: Bivalvia and Gastropoda falling in 5 orders, 10 families and 10 genera.

One of the objectives of the work-study are the ways of malacofauna forming in the Lake Vatra (Ghidighici). Thus, from the literature we find that during 1965-1966 to improve trophic base for fish in accumulation Lake Vatra, the following species have been populated from Lake Cuciurgan: *Viviparus viviparus* and *Monodacna pontica* (Ярошенко, 1964). Lake's malacofauna was largely influenced by the River Bic. The malacofauna diversity of the accumulation Lake Vatra has evolved in the way of increasing from the 2 species in 1966, introduced from Cuciurgan, up to 16 species - in this study.

For a more appropriate and accurate interpretation of the obtained results and to achieve expected objectives a complex of factors have been analyzed, such as topography, facies types, aquatic vegetation, depths, species predilection to different aquabiotops and causes that determine it, also ecological map of the accumulation lake have been used (Bulat, 2009).

Abundant aquatic vegetation characterizes zone I or the "end of the lake". For this area is characteristic the richest numerically forms of phytophiles, specifically in studied zoocenosis. Specific collected phytophiles are *Radix ovata, Radix auricularis, Lymnea stagnalis, Bythynia tentaculata, Physa acuta.*

In zone II ("the diversity zone") and V ("Island") take place most significant alternations of depths and is characterized by a high concentration of Dreiseena polymorpha and *Anodonta cygnea* species.

In zone IV (" wide area") are located the largest depths with depressions of up to 6.2 m.

In zone III ("the tongue zone") and VI ("coastal zone") is the characteristic aquabiotop to lithophile species, species with preference for rocky-sandy substrate. In this zoocenosis mollusks are represented by the following species: *Fagotica eisperi, Dreissena polymorpha, Theodoxus fluviatilis, Theodoxus euxinis.*

Looking at the abundance and dominance of mollusks in accumulation Lake Vatra, we find that *Dreisseina polymorpha* species has the greatest abundance and refers to the category of eudominant species. The abundance of this species is correlated with high trophic resource, taking in account the fact that it is determined that the percentage of dreissena participation in mineralization of aquatic substances is 14.8%. The category of dominant species consists of the following: *Lymnea stagnalis, Anodonta cygnea* species and at the opposite side are *Theodoxus fluviatilis, Fagotia esperi.*

Ghidighici accumulation lake water quality largely depends on the water quality of the River Bic, because it is one of the main water sources of the lake. The River Bic brings with its waters a fairly large amount of organic substances that influence the development of phytoplankton and overall water quality of the lake.

Based on quantitative and saprobic parameters of malacofauna, the water quality of the accumulation Lake Vatra (Ghidighici) has been evaluated. In the specific composition of malacofauna was established the percentage of β - mezosaprobic species, so water quality of the accumulation Lake Vatra (Ghidighici) is "weak polluted". Rational use of biological and recreational potential of the lake can make a significant contribution to the environmental education of the population and further development of the national infrastructure of leisure.

COMPARATIVE RESEARCH OF THE TENCH BREEDERS REACTION ON THE ENDOGENOUS AND EXOGENOUS STIMULATION OF THE SEXUAL PRODUCTS IN THE INDUSTRIAL AND POND REPRODUCTIVE CONDITIONS

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Tench (*Tinca tinca*, Linnaeus, 1758) is a rare species in the Moldavian lakes and their less numerous populations are unable to adapt to environmental conditions (habitat damage by changing hydrological regimes of rivers, the backwaters area reduction and the lakes desilting after improvement works). In this connection it is necessary to develop methods of directing the productivity of tench in the natural and artificial reservoirs. The purpose of comparative research conducted in the laboratory has been studying the reaction of the reproducers of tench (in the natural and artificial reservoirs) on the endogenous and exogenous stimulation of spawning under the industrial and pond conditions. The experimental works were held at the breeding fish complex from Moldavian State Regional Electric Station.

In the first series of experiments was conducted endogenous and exogenous stimulation of the natural reproduction of tench, captured in the lake and pond and placed in the five plastic containers, decorated with natural and artificial substrate in optimal reproductive conditions. The container 1 were introduced by four females and eight males captured in the pond; the container 2 to 4 females and eight males captured in the lake; the container 3 to 4 females captured in the pond and eight males captured in the lake; the container 4 to 4 females captured in the lake and eight males captured in the pond. The container 4 were introduced by two reproducers groups (one female and three males) captured in the lake during spawning. After three days the reproducers of containers 1-4 were injected with acetone carp pituitary suspension: 0.5 and 5.0 mg / kg for female (with an interval of 12 hours) and for males by 2.0 mg / kg. Reproducers of container 5 have not been stimulated with exohormons.

In the second series of experiments we studied the effectiveness of natural reproduction of tench at different stages of domestication in the pond conditions, using artificial, natural and combined substrates. They were experienced three variants. The first variant: in the particular pond were introduced 7 females and 15 males, captured in the lake 1.5 - 2 months until the start of the breeding. Variant two: 10 days before the start of the reproduction, in the particular pond were introduced 7 females and 14 males of tench from the nursery pond, where they were maintained over one year. Variant three: in particular pond were introduced seven females from the lake (cap-

tured 1.5 - 2 months before the spawning period) and 14 males from the nursery pond, where they maintained over one year and were captured 10 days until the start of the reproduction.

Research has shown that only domesticated reproducers of tench effectively stimulated with exohormons under industrial conditions. In females caught in the lake matured very few low-quality eggs. This is not necessary the hormonal stimulation of spawning domesticated reproducers in the pond. For its maturing enough to maintain optimal thermal conditions and to provide with the appropriate substrate.

It was found that the females caught in the lake and introduced into the pond for a natural breeding matured in fewer and spawned fewer eggs. It is in fact explained by the conditions of the tench feeding in a pond. Bat the most likely cause of disturbing the reproductive behavior of wild tench was the influence of stress produced in the process of catching, handling and transporting of fish. While the responsible for lack of reproductive behavior are mostly males.

Research of the effectiveness of spawning tench on the various types of substrates have shown that its reproducers prefer natural substrates of the lake. Bat the substrate combination was reported the highest density of eggs filed. This phenomenon can be explained by the fact that the eggs portion, which does not adhere to the vertical stems of natural substrate, is not deposited on the bottom but on the horizontal artificial substrate.

Comparative analysis showed that the females caught in the lake largely avoid artificial substrate than females reared in a pond. This difference can be explained as the result of recent domestication. The density of eggs deposited on the artificial substrate that imitate the branches of aquatic plants is high enough to be used for the reproduction of the domesticated tench.

The performed experiments show that for the industrial and ecological reproduction of the tench can be used the wild reproducers domesticated at least one year in the nursery ponds.

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FISHERIES BIOLOGICAL ASSESSMENT OF A NEW HETEROZYGOUS LINE OF SMALL SCALE CARP

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Creating of broodstocks, types, lines and species of carp with high viability and resistance to diseases is, first of all, the development of environmentally friendly technologies of growing pond fish without water pollution with antibiotics, sanitary substances facilities and reducing contamination by pathogens that have a negative impact on public health. Robust performance of gene pool system that uses the breeding objects is an indicator of the industry development in general, improves the quality and competitiveness of the pond fish in the internal market [1].

Created gene pool of carp that is presented by four breeds: Carp Teleneshtskiy scaly (Тч6), Carp Teleneshtskiy frame (Тр6), Carp Kuboltskiy scaly (Кч8) and Carp Myndykskiy scattered scales (Мр8) and also homozygous line by scale gene – Carp Purple scaly (Фч2), has greatly increased the number of thoroughbred fish.

The results of interbreeding carp conducted earlier showed that the crosses were heterozygous that gave the opportunity to introduce the offspring of first generation into the carp breeding [1].

Many authors noted that by using interbreed crosses in selection, the created first generation is often ahead of the original parent forms [1,2,3].

Previous studies of interbreeding domestic carp species have shown that the heterozygous combination of Carp Teleneshtskiy frame x Carp Myndykskiy scattered scales has a special breeding value in reproduction.

The carps with the genotype that included 62,5% of inheritance from Carp Ukranian frame, 31,25% of inheritance from Carp Hungarian and 6,25% of inheritance from Carp "Chefa", previously created basing on Lauzitskiy and Aishgrundskiy carps, were used as a initial material for creating Carp Teleneshtskiy frame. Carp Teleneshtskiy frame is a double recessive by gene of scaly covering, ssnn genotype, does not give the gene segregation in offspring and was tested according to transferrin CC. Carp Teleneshtskiy frame belongs to the fattening type of carp.

Carp Myndykskiy scattered scale has similar recessive genotype of scaly covering ssnn and was tested for phenotype of transferrin AD. Identified allele D indicates the presence of the part of Amur Carp inheritance.

Carp Myndykskiy scattered scale belongs to stocker type of carp. Both species are characterized by an increased nutritional value, the proportion of the edible parts of

the body is 4.5-5.0 % more and fat content in the meat is higher than other species of carp scaly have.

The main focus of Carp Myndykskiy scattered scale selection is to increase the productivity, to improve the exterior indicators and growth rate.

Consolidation in the interbreeding of genotypes of these two carp species obviously lead to adding features such as the increased tolerance for winter conditions, the activity in search of food and the ability to eat at relatively low temperatures of water.

Getting of a new heterozygous line of mirrored cross was carried out with the participation of females selected from an elite group of Carp Teleneshtskiy frame with its characteristic indicators of body height index l/H-2,28-2,32, the proportion of length of head to its height 1.4 and the ratio of the length to the height of the caudal peduncle 1.1.

Males of Carp Myndykskiy scattered scale were characterized by parameters: l/H-2,75-2,80; C/hC -1,15 and pl/h - 1,30.

In parallel, the eggs of thoroughbred and interbreed crossing were laid on incubating.

Rearing of the thoroughbred and interbreed larvae to viable stages of development showed that with the same starting weight - 1.50 mg, the interbreed crossings had a faster growth rate, better survival rate - 57,0-61,0% and fish productivity, at that the multiplicity of mass increasing of reared larvae can be an indicator of the growth rate.

According to the data of several authors, the weight and length of pre-larvae after hatching and larvae that switched to a mixed feeding, not much depend on the crossing combinations, but depend on the female ability to produce larger eggs.

Heterosis effect in combination Tp x Mp in regard to the parent's form of Tp is: on the basis of survival rate - 13.0%, of an average weight of larvae - 27.6% and fish productivity - 45.0%. The advantage of heterozygous cross of Tp x Mp in regard to the other interbreeding combinations on the basis of productivity was lower and ranged within 4,3-11,4%.

Growing of hybrid's offspring of Tp x Mp with the stocking density of 50 000 pieces/ ha showed that the high growth rate of fingerlings was retained.

The received new heterozygous line of mirror carp Tp x Mp exceeded the thoroughbred offspring by body weight by 16,0-22,6%, on survival rate - by 7.0%, by fish productivity of yearlings - by 31.0%.

Identified at the stage of rearing, the specific combining ability of initial parental forms was confirmed for yearlings of interbreeding cross Tp x Mp in the form of manifestation of heterosis by viability and growth rate.

Comparison of exterior indicators of thoroughbred yearlings of new generations of selection and new heterozygous line showed that the generations of improved breeds fit to the performance standards, while maintaining the specificity of attributes of "body shape" with a little variability.

Heterozygous line occupies an intermediate position on the basis of exterior indicators: index of body height - 2.56, the ratio pl/h - 1,24; C/hC -1,25.

Grown yearlings of new line of mirror carp have been characterized by significant coefficients of fatness and physical development - 4.0. By the nature of exterior indicator manifestation is clearly observed the influence of matroclinous effect that was

showed in a shift toward decreasing of the length of caudal peduncle, and increasing of back width and girth index.

Further the formation of a new genetic structure of small scale carp will continue by using reproductive and absorbing crossings during the synthetic selection, which will allow to replenish the gene pool of carp and to diversify the marketable products.

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MEASUREMENTS OF ENVIRONMENTAL RADIOACTIVITY IN LOWER DANUBE REGION

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Radioactivity is a natural phenomenon on Earth and natural sources of radiation represent features of the environment. The radioactive contaminants find their ways to man mainly through food chains, either directly by consuming water, the vegetation and agricultural products or indirectly by taking contaminated animals food products, i.e., milk, meat, fish and eggs. The monitoring of radionuclides (natural or man-made) in various environmental compartments is a necessity for human health and assessment of population exposure to ionizing radiation.

The paper presents a synthesis of the results obtained for the environmental radioactivity levels in selected areas of Lower Danube region, in Romania, Republic of Moldova and Ukraine. Most of the results were obtained in the frame of the Romania-Ukraine-Republic of Moldova cross-border project MIS ETC 1676 (INPOLDE) implemented by the collaborating institutions: Dunarea de Jos University of Galati (UDJG), Romania, Institute of Zoology and Institute of Geology and Seismology of Academy of Sciences of Moldova, Chisinau, and Ukrainian Scientific Centre of Ecology of the Sea, Odessa, Ukraine (2013-2015). Other part was achieved with the participation of UDJG students at activities projected in the grant no. 24/2016 of Joint Institute of Nuclear Research, Dubna, Russia.

The investigated sites were located in RO-MD and RO-UA borders in Lower Danube basin, Lower Prut River reserve and Danube Delta. 50 measurements were carried out in each target site in the period April 2014-June 2016 in localities of Galati county (Galati town, Oancea, Slobozia-Oancea, Vladesti, Vadeni) and Tulcea county (Isaccea, Tulcea), Romania, Cahul town, Republic of Moldova, and aquatic ecosystems of Prut river (Galati-Cahul-Gotesti area, Romania-Moldova border), Lower Danube River (Galati-Tulcea), Danube Delta (Tulcea county and Romania-Ukraine border), and Lake Manta (Moldova).

The results demonstrate that the natural gamma dose rate varied with site, day and hour, due to the temporal fluctuations of terrestrial and cosmogenic radioactivity, meteorological conditions, geological background and presence of radiation emitted by building materials. The obtained average value of gamma radiation dose rate is minimum in a location in Danube Delta, and maximum in Northern part of Tulcea Coun-

ty, Romania, in Isaccea locality, near a quarrying. The results were compared with the official reports for outdoor gamma dose and with the respective annual average values Romania and Moldova, our results being in most cases lower than the attention limit of 250 nGy/h. Also, it can be noted that the dose rates were in general in the normal range of variation given by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Report for the total outdoor range of gamma dose rate, which is 52-163 nGy/h. Based on the obtained values, annual radiation doses were calculated and compared with the allowed limit of 1 mSv/year for an individual member of the general public.

The obtained results are an important statistical element for annual evaluation of radioactivity in Lower Danube Euroregion and for national reports and will serve as a base in further investigations and preparation of maps of terrestrial gamma dose rates.

On-going work is carried out in order to sustain the monitoring activities of the project MIS ETC 1676 for the complex investigation of aquatic and terrestrial ecosystems in Lower Danube Euroregion. The measurements are carried out in relation with water and foodstuffs radioactivity and radon and thoron gaseous radionuclides emission.

NUCLEAR AND ATOMIC ANALYTICAL TECHNIQUES FOR ELEMENT ANALYSIS IN VARIOUS ENVIRONMENTAL MATRICES

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The present paper aimed to review several applications of nuclear and atomic spectrometric techniques for the determination of major, minor and trace elements in selected environmental samples (water, animal tissues, aquatic plants, bottom sediments, soils, vegetation, wastes) and to present some aspects of their suitability in enviromental and life sciences for the detection of heavy metal contamination and other toxic inorganics and biomonitoring.

The employed techniques are: particle-induced X-ray emission (PIXE) and particle-induced gamma-ray emission (PIGE), instrumental neutron activation analysis (INAA), energy dispersive X-ray fluorescence (ED-XRF), atomic absorption spectrometry (AAS), inductively-coupled plasma optical emission spectrometry (ICP-OES), inductively-coupled plasma mass spectrometry (ICP-MS) and a comparison is done as regards their capabilities - the limits of detection, selectivity, matrix effects, the nature of the sample that can be used, rapidity of sample preparation, non-destructivity, cost of analysis, multi-element determination capability, etc.

The environmental samples investigated were collected from selected polluted and natural protected areas at the RO-MD and RO-UA borders in Lower Danube basin, Lower Prut River reserve and Danube Delta, and also from Kavala area, Eastern Macedonia and Thrace, Greece.

The results obtained by ion beam techniques PIXE and PIGE at 3 MV Tandetron of Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH) for samples collected in the frame of the Romania-Ukraine-Republic of Moldova cross-border project MIS ETC 1676 (INPOLDE) are compared with those determined by related nuclear techniques - AAS, ICP-OES and ED-XRF – employed at the collaborating institutions: Dunarea de Jos University of Galati (UDJG), Romania, Institute of Zoology and Institute of Geology and Seismology of Academy of Sciences of Moldova, Chisinau, and Ukrainian Scientific Centre of Ecology of the Sea, Odessa, Ukraine.

The techniques will be further applied for completion the database of the project MIS ETC 1676 and to build new maps of pollution points in the Lower Danube Euroregion and Black Sea basin, as well as to establish the background concentrations for trace elements which are not of anthropogenic origin.

We acknowledge the MIS ETC 1676 grant awarded by European Union (2013-2015), the Erasmus+ programme between UDJG, Romania, and TEI Kavala, Greece (2014-2016), and research grant no. 24/2016 of Plenipotentiary Representative of the Government of Romania to JINR Dubna, Russian Federation. The financing of the approved PAC experiments at IFIN-HH nos. B040/2015 and B054/2016 is highly appreciated.

SPECIES DIVERSITY OF THE DNIESTER RIVER ZOOPLANKTON COMMUNITIES IN 2013 – 2015

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The aim of the work was to study the species diversity of zooplankton in the different sectors of the Dniester River within the boundaries of the Republic of Moldova. Sampling of zooplankton was carried out in the littoral zone of the river at a depth of 1.0 – 1.5 m. A total of 99 quantitative zooplankton samples were collected seasonally during 2013 - 2015 by filtering 100 liters of water through a plankton net (mesh size 55 μm) at 11 stations of the Dniester River and Dubossary reservoir: Naslavcea, Valcinet, Soroca, Camenca (Dniester River, medial sector), Erjovo, Goiani, Cocieri (Dubossary reservoir), Vadul lui Voda, Varnita, Suclea, Palanca (lower sector of the Dniester River). The main taxonomic groups of zooplankton (*Rotatoria*, *Copepoda*, *Cladocera*) have been identified according to Kutikova (1970), Kutikova & Starobogatov (1977), Negrea (1983), Naberejnyi (1984), Tsalolihin (1994) and Alekseev (1995) with using a stereo zoom Discovery V8 ZEISS and a microscope Micmed-2 LOMO.

Species diversity (SD) is one of the most important characteristics of biotic communities that reflect the complexity of its specific structure. Presently more than 30 different indices are proposed for evaluation of various aspects of diversity. The simplest indicator of α-diversity (species richness) is the total number of taxa (W), but its value depends on the sample size and number of samples. Nevertheless, indicator W can be suitable as SD index in cases the size and number of samples is the same for every sampling station, as it was in this study (fig. 1).

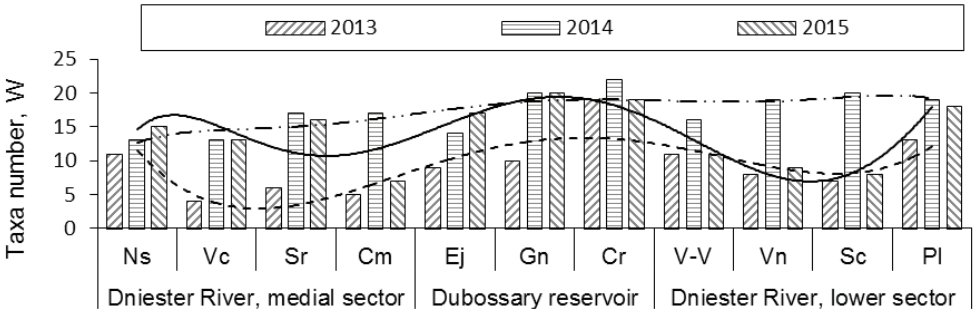

Figure 1. The species richness of zooplankton (in 100 liters of water) along the Dniester River longitudinal profile: Ns – Naslavcea, Vc – Valcinet, Sr – Soroca, Cm – Camenca, Ej – Erjovo, Gn – Goiani, Cr – Cocieri, V-V – Vadul lui Voda, Vn – Varnita, Sc – Suclea, Pl – Palanca

The differences and similarities along a range of habitat can be assessed using β indexes: β-diversity or β-similarity. One of the common approaches to the assessment of β-diversity is a comparison of species composition in different communities: the smaller common species → the higher β-diversity → the lower β-similarity. The obtained lists of zooplankton taxa have been compared, and Sorensen similarity coefficient (Cs) has been calculated for: 1) the Dniester River medial sector and the Dubossary reservoir; 2) the Dubossary reservoir and the lower sector; 3) the medial and the lower sectors of the river (Table 1).

Table 1

Similarity matrix of the Dniester River different sectors based on zooplankton communities

Year/ sector	2013			2014			2015		
	1*	2	3	1	2	3	1	2	3
1		0.368	0.238		0.400	0.474		0.426	0.456
2	0.368		0.458	0.400		0.609	0.426		0.464
3	0.238	0.458		0.474	0.609		0.456	0.464	

*1 – Dniester River medial sector, 2 – Dubossary reservoir, 3 – Dniester River lower sector

Conclusions

The total taxonomic spectrum of the Dniester River fluvial zooplankton (sampling 2013 – 2015) is represented by 92 taxa and 6 larval stages of copepods (nauplii and copepodids of suborders *Cyclopoida*, *Calanoida* and *Harpacticoida*). The significant variability of species richness has been recorded during these years, caused by the different habitat factors. The growing season of 2013 is characterized by the most reduced composition of zooplankton (43 taxa). The most favourable for zooplankton communities was 2014 (63 taxa). The highest variability of zooplankton structure along the Dniester River longitudinal profile was recorded in 2015 (Fig. 1). Pollution and eutrophication of water bodies and water courses leads to a simplification of the structure of aquatic communities that is reflected in the reduction of their diversity (Alimov, 1995). In this respect it should be noted two sites of the Dniester River with significant anthropogenic impact on the habitat: Soroca and Suclea. In both cases, the load on the ecosystem is caused by discharges untreated wastewaters (urban zone Soroca) or insufficiently treated wastewaters (urban zone Bender - Tiraspol).

Two types of water ecosystems can be determined on the studied zone of the Dniester River: lotic habitat in the sectors Naslavcea - Camenca and Vadul lui Voda – Palanca, and relatively lentic habitat in the Dubossary reservoir where flow velocity decreases to 0.1 m/s. The spatial heterogeneity increases the species diversity. One would expect that the similarity coefficient will decrease along the spatial gradient of the river and will be higher for neighboring sectors, as it was registered in 2013 (Table 1). But this trend is not always an unambiguous for compared stations, if a water body includes different types of ecosystems, that it is demonstrated in the similarity matrix for the sampling of 2014 and 2015.

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ENDANGERED SPECIES OF STURGEON REQUIRE ACTIVE PROTECTION – RESTITUTION STERLET POPULATION IN THE DNIESTR

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Currently, most species and populations sturgeon is threatened with extinction. The main causes of decline in the populations of these fish are anthropogenic changes in water systems under the influence of their buildings and too intensive exploitation of sturgeon. A clear example is the fate of the Baltic sturgeon population of Atlantic sturgeon *Acipenser oxyrinchus* Mitch., Which in the second half of the twentieth century, completely disappeared (Kolman et al. 2014). In similarly disadvantaged populations are sturgeon of Black Sea basin, which in the 80s of the twentieth century were the source of significant quantities of meat and caviar (Tretyak et al., 2010 Demchenko, Demchenko 2014).

In the Dniester basin the presence of 5 species of sturgeon were recorded: Bieluga *Huso huso* L., Russian sturgeon *Acipenser gueldenstaedti* Brandt, sterlet *Acipenser stellatus* Pallas, sterlet *Acipenser ruthenus* L. and Ship sturgeon *Acipenser nudiventris* Lovetsky. Representatives of migratory species of sturgeon occurred from the Black Sea to the rivers and seeped up beating some cases more than 1000 km. The most popular species in the pool Dniester was always semimigratory sterlet. This species performed on the entire length of the river from salted limans to the mountainous sections of the mainstream of the Dniester River and its major tributaries (Khudij 2014). From the upper streams of the upper tributaries of the Dniester sterlet infiltrated to the Bug where the local population were formed. This population existed in the river at the beginning of the twentieth century (Wilkosz 1904).

Sterlet ability to create local population enabled the survival of the species after the construction of dams Dniester, a result of which there are two reservoirs: Dniester and Dubossary, and the Dniester Basin has been divided into three isolated zones: the upper, middle and lower.

One of the largest natural populations of sterlet in Ukraine remained in the system Upper Dniester – Dniester Dam Reservoir. This was due to two factors: in the dam reservoir good nutrition conditions were available, and the open upper part of the Dniester River and its tributaries guaranteed a favourable way of migration to the spawning grounds of maturing individuals.

The results of comparative studies of different sterlets populations showed genetic heterogeneity of the species. In particular it was found a clear genetic distinction

of sterlets from the upper Dniester against the remaining population (Fopp-Bayat et al. 2015). It should be noted that in the upper pool Dniester never carried restocking material coming from the other populations. Therefore, in order to maintain proper structure of Dniester sterlet population to rebuild the population in the lower parts of the river basin stocking material coming from local spawners should be used if this is not possible that from the upper Dniester.

In the years 2011- 2013 was implemented a joint Polish-Ukrainian project, whose aim was to develop and implement technology stocking material of Dniester population of sterlet. As a result of the project in Fish Farm "Ishkhan" in Baniliv-(circuit. Chernivtsi) was founded certified herd of the upper-dniester sterlet and then conducted a successful artificial reproduction of these fish (Kolman et al. 2012). Hatching and fry was rearing in the basins in recirculation systems.

Part of sterlet fry were released into the Dniester and from the others they have created three herds, which were on-growing in the basins RAS at the Institute of Inland Fisheries, in the laboratory of Chernivtsi University and in the ponds of F.F. "Ishkhan" (Kolman et al. 2014).

In the spring of 2016 years we conducted the first trial of reproduction of this fish in the Inland Fisheries Institute in Olsztyn. Regardless of the unsatisfactory results of the first reproduction it should be recognized that the process introduce of upper-dniester population of sterlet in aquaculture was started, as guaranteed in the future, reliable source of stocking material for future work on the reconstruction of the natural populations of this species. Well-functioning herd spawners in aquaculture will enable in the future also develop breeding sterlets for consumption. Meat from this fishes has a high taste qualities and high nutritional properties, in particular of a high content of essential fatty acids and amino acids (Khudij et al. 2014 - Archives).

This all supports the appropriateness of ongoing work on the restitution of the lost population starlet and restoration of the number of still existing and the parallel development of commercial production of these fish. Both directions of activity are mutually supportive which will ensure a well-deserved return sterlet on our tables and in our rivers.

QUALITY OF DNIESTER RIVER ACCORDING TO ZOOPLANKTON INDICES DURING 2012-2015

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Human activity influence at some degree all aquatic ecosystems. In the majority of cases this impact is reflected in qualitative and quantitative changes in the composition of major hydrobiont communities. It is very important, therefore, to monitor the ecological status of aquatic ecosystems. Different groups of hydrobionts can serve as a criterion for assessing the ecological status of aquatic ecosystems. The role of zooplankton communities as indicators of water pollution level is very high, due to their sensitivity to environmental conditions. In order to estimate the quality of quatic ecosystems, according to zooplankton communities, the saprobic system particularly the saprobic index according to Pantle and Buck, modified by Marvan and Dziuban is used.

The focus of this research was to analyse data on zooplankton communities from 2012 to 2015. Samples were collected seasonally during the vegetative period. Sample collection and analysis were made in the laboratory of Hydrobiology and Ecotoxicology, using traditional hydrobiological methods. Classification of the Dniester river water quality was made in accordance with the "Regulation on Environmental Quality requirements for surface water" (2013). In all analyzed years, according to saprobic parameters, the Dniester river belongs generally to a-oligosaprob, but with predominance of b-mezosaprobic zones. Due to the influence of anthropogenic factors the greatest pollution level was revealed at the stations Otaci-Soroca, and Sucleia-Palanca, with saprobity values within 2.00 to 3.25. The multiannual aspect was seen, this being reflected by a decrease in saprobity values from 2012 (1.82) to 2015 (1.66). A seasonal evolution was also observed, with an increase in all values during summer. This was caused by a raise in water temperature, that favored the development of zooplankton. According to zooplankton parameters the water quality in the Dniester ecosystem during studied period was characterized as moderately polluted, classified as class II-III in 2012 and I-II 2013-2015.

Evaluation of the ecological state of the natural water bodies with the use of indicator zooplankton organisms shall be taken into consideration in complex with other hygrobiological and hydrochemical parameters. Currently in the Republic of Moldova the parameters of zooplankton communities are not included in the list of the regulatory parameters and the requirements for water quality of natural water bodies and numeric values.

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GENETIC DIVERSITY OF *COBITIS ELONGATOIDES* INFERRED BY CYTOCHROME B (CYT B) GENE ANALYSIS

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Cobitis is a Palearctic genus of ray-finned fish in the Cobitidae family, also known as spined loaches. The classification within Cobitidae family is still disputed, the number of recognized species varies according to the number of morphological traits considered. With the development of the molecular markers and methods, within the *Cobitis* genus, more than 80 species were identified. The most common species for Danube and Dniester River Basins are *Cobitis taenia*, *Cobitis tanaitica*, *Cobitis elongatoides* and belongs to the *Cobitis taenia* hybrid complex. These species have a particular type of reproduction (gynogenesis) that leads to an asexual lineage (diploid, triploid and rarely tetraploid individuals). *Cobitis elongatoides* was exclusively the maternal ancestor of all the *C. elongatoides-tanaitica* hybrids, while the hybridization process was reciprocal within the *C. elongatoides-taenia* complex. *Cobitis elongatoides*, commonly named spined loach, is native to Danube basin, upper Elbe and Odra drainages, and also Dniester River. The aim of this study is to highlight the variability and phylogenetic relationships between the *Cobitis elongatoides* individuals from different river basins analyzing the molecular data provided by the mitochondrial marker cytochrome b gene. Total DNA extraction for the captured individuals from Prut and Dniester Rivers was performed using phenol chloroform isoamyl alcohol protocol. In order to amplify the cytochrome b gene, the L15267 and H15891 primers were used. The amplicons were successfully sequenced using CEQ 8000 Genetic Analysis System (Beckman Coulter). Genetic diversity within and between hydrological basins was assessed in Arlequin (v 3.5) software, computing general molecular indices. Our data reveal a high similarity between *C. elongatoides* individuals and *C. elongatorides* x *C. tanaitica* hybrids that belong to different tributaries of the Danube river basin, pointing that *C. elongatoides* is the maternal ancestor of all *C. elongatorides* x *C. tanaitica* hybrids.

RESULTS OF THE FIRST EXPERIMENT ON DOMESTIKATION OF THE TENCH (TINCA TINCA, L., 1758) IN PONDS OF THE NOVOSIBIRSK REGION

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One of options of fish production increase in the reservoirs should consider introductions of additional fish cultures. Now in Russia there are no selected flocks, there are no economc agents (except those where USRIF researchers conduct studies), which posess domesticated maternal reproductive tench flocks, suitable for exploitation. In world practice of fishery serious scientific methodical base for carrying out a comparative assessment of methods of tench flocks operation is not yet created. Maslova (1998) considered that at present there are no biologically and economically fundamented methods of tench reproduction. Animal domestication is considered as selection directed to the change the biology of a species under the influence of artificial selection in the necessary direction. It can be increases in productivity, satisfaction of esthetic aspect of the species, strengthening certain properties of animals, features etc.

The first stage in this work is the opportunity to obtain progeny and development of technology of animal feeding, peculiarities of maintenance. In work with fishes it most often means to develop technologies of species reproduction in artificial conditions in ponds.

The purpose of this work was to create initial brood flocks of tench and to establish biological features of artificial reproduction taking into account the terms of spawning and to study the qualities of producers.

For further cultivation in system of fish-breeding economy the brood flock of tench (*Tinca tinca*, L., 1758) has been caught in Konobishka river of Toguchinsky district of the Novosibirsk region, and then it was moved to the cage line of SLR „Kulon", where it was kept for 2 months at the water temperature of 20-22^{O}C. The fishes were fed 3 times a day with shredded grain of wheat with addition of 20% of peas.

The caught females of a tench had the following sizes: body weight at the age of 3 years constituted 254±10.75 g, at 4, 5, 6 year-old fishes it constituted 435, 648 and 721 g according. Absolute length of fishes increased from 25.6 cm at the age of 2 y.o., to 34.68 cm at 6 complete years. The study of relative sizes of tench body of four age groupes has shown that in females of 6-year-old in comparison with 2-year-old females the index of head, the body height and width andf the coefficient body girth significantly increase.

At the same time there is a decrease in hydrodinamicity value and of relative sizes of head from 2.94% to 2.7%.

Thus, with the age in tench females the relative body length decreases and the height index increases. The body becomes wider due to increase in height and width of a body, its girth increases. These signs in fishes are most often connected with increase in amount of eggs with age in fish body of fishes.

The study of dimensional and age structure of male flock of tench at the age of 2+ - 7+ has revealed that with increase of age and increase in body weight by 69.9%, also increase the head length by 30.04%, the body girth by 36.8%, whereas the thickness of the body grows with 54,43%.

In the caught flock, prepared for domestication, in females fishes of 4 and 5 years old age prevailed, in males – of 3 and 4 years prevailed and constituted 34.5%, 34.56% and 30.4%, 26.1%, respectively.

Such structure will allow to use the selected fishes during 3-4 years. For example, in the works on carp selection it is recommend to maintain the fish producers from age of 7-8 years. Use of fishes of more advanced ages is inefficient since the body weight of females increases, and the mass of sexual products decreases.

Females and males of tench have been settled separately on a floor in pools with the flowage of 0,5 l/min. Water temperature in pools was on average around 23 - 25 ^{o}C during 20 days till increasing of temperature in a reservoir to 25 ^{o}C. Then females and males were injected with hypophysis suspension twice in 12 hours in females. The dose of 5.5 mg/kg of female mass has been taken as basis: Ist injection – 0.5 mg/kg; the IInd injection – 5.0 mg/kg. The hypophysis has been dissolved in novocaine solution. To males the hypophysial injection has been delivered once during the 2nd injection to females.

As result from females weighing 670 g and 429 g 60 g and 47 g of eggs have been received. From females weighing 238-275 g we did not manage to receive eggs. After have not received eggs from females in 24 hours after the first injection the females stood 12 more hours in water temperature 26 ^{o}C, but still did not manage to obtain eggs.

The received eggs were placed in the Weiss incubatory device and incubated within 3 days at a temperature of 25 ^{o}C during daytime and 15 ^{o}C at night.

Egg loss for incubation has constituted up to 38%. Larvae have been released in pond after 3 days of growth in pools. By September their weight has reached 1.3 g.

ON BENTHIC MACROINVERTEBRATES OF THE LAKE BELEU

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Lake Beleu is a shallow relict (5000-6000 years old), largest natural lake in Moldova with high quantity of suspended matter and muddy bottom. The lake is located near the Danube Delta and belongs to the *Lower Prut Lakes Ramsar Site (no. 1029. 19,152 ha. 45°42'N 028°11'E).* The water level fluctuates, depending on hydrological situation in the Danube and Prut Rivers. The average length - 5 km, width – 2 km, while depth range from 0.5 up to 2 m, a surface area about 6.3 km^2. Beleu lake is a shallow water body, therefore one of the natural factors affecting the formation of lake benthofauna is the increased temperature during summer. For example, in the outflow channel of the lake very high water temperature was registered on 21 July 2014- 31.2^{0}C.

In Beleu lake the samples were collected in the channel, which makes the link between the Prut River and lake, and directly from the lake. Benthic invertebrates have been sampled applying standardized methods (Petersen grab, dredge and hand sampling). The investigated substrates were very different: the remains of the large shells of *Unionidae* and other molluscs, sand, silty sand, silt, tree roots, stands of macrophytes. It should be noted that reophylic conditions in the channel and limnophylic in the lake itself contribute to the formation of a great variety of living conditions for many species of benthic invertebrates. During 2014-2016 more than 90 species of benthic macroinvertebrates were identified in Lake Beleu, which belong to the following groups: Nematoda, Oligochaeta, Hirudinea, Crustacea, Chironomidae, Ephemeroptera Trichoptera, Odonata, Heteroptera, Coleoptera, Gastropoda, Bivalvia and other groups, the highest number of these being chironomids and gastropods.

Species found were: Nematoda; Oligochaeta: *Aulodrilus sp, Branchiura sowerbyi* (Beddard, 1892), *Eiseniella tetraedra* (Savigny, 1826), *Limnodrilus hoffmeisteri* (Claparede, 1862), *Nais* spec. none, *Ophidonais serpentina* (Müller, 1773), *Psammoryctides barbatus* (Grube 1861), *Stylaria lacustris* (Linnaeus, 1767), *Tubifex sp.div, Tubifex tubifex* (Müller, 1774); Chironomidae: *Chironomus plumosus* (Linnaeus, 1758), *Chironomus sp., Cladotanytarsus mancus* (Walker, 1856), *Coryoneura celeripes* (Winnertz, 1852), *Cricotopus sylvestris* (Fabricius, 1794), *C. gr. algarum* (Kieffer, 1911), *Cryptochironomus defectus* (Keiffer, 1913), *Limnochironomus nervosus* (Staeger, 1839), *Micropsectra praecox* (Wiedemann, 1818), *Orthocladius sp, Parachironomus pararostratus* (Harnisch, 1923), *Polypedilum convictum* (Walker, 1856), *Syndiamesa nivosa* (Goetghebuer, 1928), *Tanypus punctipennis* (Meigen, 1818), *T. vilipennis* (Kieffer, 1918);

Crustacea: *Chaetogammarus sp, Dikerogammarus villosus* (Sowinski, 1894), *Pontogammarus crassus* (Sars, 1894), *P. robustoides* (Sars, 1894), *Jaera sarsi* (Valkanov, 1936), *Asellus aquaticus* (L., 1758), *Limnomysis benedeni* (Czerniavsky, 1882), *Paramysis kessleri* (Grimm, 1875), *P. lacustris* (Czerniavsky, 1882); Ephemeroptera: *Baetis sp, Caenis horaria* (L., 1761), *Cloeon dipterum* (L, 1761), *Cloeon sp*, *Heptagenia coerulans* (Rostock, 1877); Trichoptera: *Ecnomus tenellus* (Rambur, 1842), *Hydropsyche sp, Leptoceridae*; Gastropoda: *Armiger crista* (L., 1758)* (shell), *Bithynia tentaculata* (L, 1758), *Ferrissia fragilis* (Tryon, 1863), *Lithoglyphus naticoides* (Pfeiffer 1828), *Lymnaea auricularia* (L, 1758), *L. fragilis* (L, 1758), *L. ovata* (Drap., 1805), *L. peregra* (Müller, 1774), *Lymnaea sp*, *L. stagnalis* (L, 1758), *Physa acuta* (Drap., 1805), *Planorbarius corneus* (L., 1758), *Planorbis planorbis* (L, 1758), *Valvata piscinalis* (Müller, 1774), *V. pulchella* (Studer, 1820), *Viviparus contectus* (Millet, 1813), *V. viviparus* (L 1758); Bivalvia: *Anodonta anatina* (L, 1758), *A. cygnaea* (L. 1758), *A. piscinalis* (Nilsson, 1823), *Dreissena bugensis* (Andrusov, 1897), *D. polymorpha* (Pallas, 1771), *Pisidium casertanum* (Poli, 1791), *P. personatum* (Malin, 1855), *Sinanodonta woodiana* (Lea, 1834), *Unio tumidus* (Retzius, 1788), *Sphaerium nitidum* (Clessin, 1876), *S. rivicola* (Lamarck, 1818)* (shell), *Musculium lacustre* (Muller, 1774); other groups: *Bryozoa, Spongilla lacustris* (L, 1759), *Glossiphonia complanata* (L, 1758), *Haemopis sanguisuga* (L, 1758), *Agrion splendes* (Harris, 1782), *Coenagrion sp, Gomphus vulgatissimus* (L, 1758), *Sympetrum sp*, *Platicnemis pennipes* (Pallas, 1771), *Corixa sp, Microvelia sp., Plea minutissima* (Leach, 1817), *Ranatra linearis* (L, 1758), *Berosus sp* (larvae), *Peltodytes sp* (larvae), *Ilybius sp* (larvae), *Haliplidae* (larvae), *Anopheles sp, Tipulidae*.

The highest value of abundance of total zoobenthos was registered at 28.05.2015 and was 12880 ind/m^2, out of which 4640 ind/m^2 consisted of *C. sylvestris* (Fabricius, 1794). The highest value of total biomass was 210,056 g/m^2, out of which 188,94 g/m^2 consisted of mollusks.

Beleu lake is one with the highest biodiversity of the *Lower Prut Lakes Ramsar Site*, with over 90 invertebrate taxa recorded during 2014-2016, including a rare species for Moldova, *Paramysis kessleri* (Grimm, 1875). The presence of alien species was also revealed: *B. sowerbyi* (Beddard, 1892), *F. fragilis* (Tryon, 1863), *S. woodiana* (Lea, 1834). Among these, *S. woodiana* has a high adaptive capacity, e.g. by penetrating into the substrate at depths of 40-50 cm in the case of unfavorable conditions, thus reducing their real abundance in samples. This peculiarity makes it extremely difficult to find this species in samples collected, as usually, by Petersen grab and dredge on silty substrates - the typical habitats of this mollusk and provides benefits under the conditions of climate change in comparison to autochthonous species. Thus, on July 2014 in Beleu lake was discovered only one juvenile individual of *S. woodiana,* which was sampled by hand, usually have been collected manually at least 1-3 ind./m^2. The research was carried within the following projects: 11.817.08.13F, 11.817.08.15A, MIS ETC 1150, MIS ETC 1676.

THE NORTH AMERICAN BLUE CRAB, *CALLINECTES SAPIDUS* RATHBUN, 1896 (PORTUNIDAE / DECAPODA) HAS A TENDENCY TO BECOME A COMMON SPECIES IN ROMANIAN WATERS

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In a previous paper (Petrescu, Papadopol and Nikolaev, 2000) the capture of a specimen of blue crab, female, near Mangalia city on 08/10/1999 was communicated in a seines fishing from 7-8 m depth. Some time ago the identification of a male specimen was reported in the coastal waters on 23 of August (Gomoiu and Skolka, 1998).

The size of of the carapace of these specimens were close to the maximum dimensions: 90/209 mm (Fincher et al., 1987; Galil et al., 2002), close to the size of specimens captured in Romania: 85/196 mm for the male captured in August 1988 and 80/186 mm for female specimen from October 1999 (Petrescu, Papadopol and Nikolaev, 2000).

It is noted that on 09.11. 2002, near Cape Aurora, also in the southern area, a male specimen of 98/223mm, weight 642,4gr, a giant of the species, more than the maximum dimensions cited in literature, was captured during fisheries with gillnets. The right chela as summed up a length of 213 mm and the left chela 206 mm. (Papadopol et al., 2003).

Foto Iorgu Petrescu

A new exemplary was reported in 2003, captured living, by an autonomous diver on 23 August. It was kept in captivity for several months in the Aquarium of Constanta.

The specimen, a male, had the next dimensions: the carapace: 191 mm, the right chela: 102 mm, and the left chela: 99 mm.

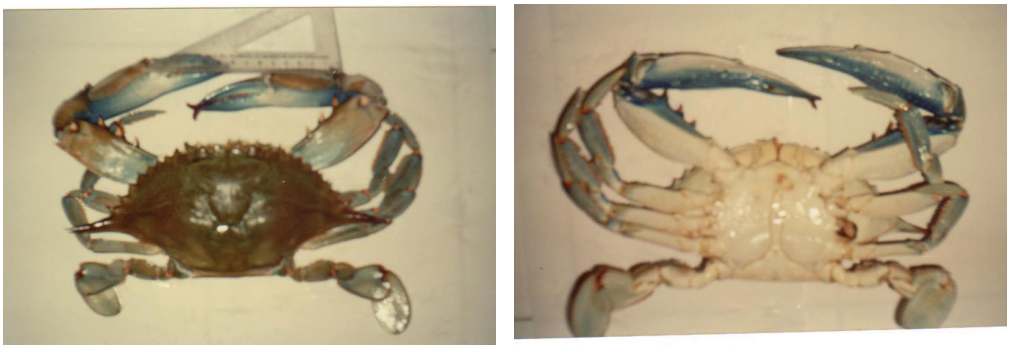

Foto Angelica Curlisca

Besides these catches in 2003-2007, during summer the waves have brought to the shore a carapace and pereopods fragments, which confirm the presence of the blue crabs in the area. Beyond signaling and identification of some large size adult specimens in the area, migrated from a nucleus of Bulgarian population (Tsvetkov and Marinov, 1986; Petrescu, Papadopol and Nikolaev, 2000; Radu, 2002), there is a suspicion of the occurrence of young specimens, in the Cape Aurora (personal communication, dr.ing. Viorel Dumitrescu- 2015). This fact must still be verified.

Based on these reports, lined on a long time, approx. 8-9 years, the presence of adults, and a possible appearance of juvenile specimens lead to the idea of the adaptation of this species to local conditions in southern Romanian seaside and therefore possible integration of the species in coastal communities.

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LEVEL OF CD, CU AND SE IN FISH FROM STÂNCA - COSTESTI RESERVOIR

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Stânca–Costești reservoir is a protected area (SPA) situated in the North-Eastern Romania. It is one of the biggest water accumulations in Romania (the second one after the Iron Gates I), and the biggest one on the Prut River.

The fish from the lake represent a major food resource for the local people and not only, have they being commercialized even in Iasi markets. Heavy metals are accumulated by aquatic organisms by a variety of methods, including respiration, absorption or ingestion. Fish are good indicators of the accumulation of metals in the environment.

Heavy metal pollution is the main topic addressed in this paper due to the toxicity of these elements for the aquatic organisms.

The metal analyzes were conducted with the GF-HR-CS-AAS contrAA600 - Analytik Jena, Germany. These methods allowed us to quantify the metal content of samples in the range interval of 10 $ng*g^{-1}$ - 0.5 $\mu g*g^{-1}$.

According to our study results, focused on four fish species (*Abramis brama, Stizostedion lucioperca, Hypophthalmichthys nobilis* and *Aspius aspius)* copper was accumulated in the highest concentration in the gut (3.13 $mg{\cdot}kg^{-1}$) and in the intestinal content (2.374 $mg{\cdot}kg^{-1}$) for avat, in liver (56.138 $mg{\cdot}kg^{-1}$) for bighead carp, in liver (0.879 $mg{\cdot}kg^{-1}$) and in femel gonads (0.870 $mg{\cdot}kg^{-1}$) for pearch and in intestine (3.551 $mg{\cdot}kg^{-1}$) and femel gonads (3.007 $mg{\cdot}kg^{-1}$) for bream. Cadmium was accumulated in the highest concentration in the intestinal contents (0.071 $mg{\cdot}kg^{-1}$) and in intestine (0.055 $mg{\cdot}kg^{-1}$) for avat, in kidney (1.419 $mg{\cdot}kg^{-1}$) and liver (1.027 $mg{\cdot}kg^{-1}$) for bighead carp, in liver (0.328 $mg{\cdot}kg^{-1}$) for pearch and in intestine (0.194 $mg{\cdot}kg^{-1}$) for pearch. Selenium has accumulated in the highest concentration in the tail fin (2.486 $mg{\cdot}kg^{-1}$) for avat, in bone (1.678 $mg{\cdot}kg^{-1}$) for bighead carp, in stomacal content (2.468 $mg{\cdot}kg^{-1}$) for pearch and in bone (2.642 $mg{\cdot}kg^{-1}$) for bream.

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MOLECULAR PHYLOGENY OF *SCARDINIUS* GENERA INFERRED BY CYTOCHROME C OXIDASE I (COI) GENE ANALYSIS

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Scardinius is a genus of ray-finned fish in the Cyprinidae family commonly called rudds. The name "rudd" without any further qualifiers is used for particular species, especially the common rudd (*Scardinius erythrophthalmus*), a cyprinid fish native to Europe and middle Asia, with the areal from Western Europe to the Caspian and Aral Sea basins. A member of the minnow family, the fish prefer mainly in still or slowly moving, nutrient-rich and well vegetated waters. The genera comprises 10 species (*S.erythrophthalmus, S. hesperedicus, S. knezevici, S. plotizza, S. dergle, S. acarnicus, S. elmaliensis, S. graecus, S. racovitzai* and *S. scardafa)*, more than half of them being rated on IUCN Red List from Near Threatened (NT) to Critically Endangered (CE).

The classification of cyprinids has always been controversial, the number of recognized families varies depending on the author and the number of morphological traits considered and because the morphological traits are usually subjected to homoplasy, the systematics sometimes comes in contradiction with the molecular data. All these facts lead to the idea that the monophyletic groups described are probably misinterpreted.

The aim of this study is to present the phylogenetic relationships within the *Scardinius* genera based on the COI gene molecular data. Total DNA was isolated for the species from Romania (*S. erythrophthalmus* and *S. racovitzai*) using different protocols according to the sample type. COI gene amplification was performed using the FISH F1 and FISH R1 primers. The amplicons were verified using gel electrophoresis and sequenced using CEQ 8000 Genetic Analysis System (Beckman Coulter). The GenBank sequences for *Scardinius* genera species COI gene dataset and *Carassius carassius* as outgroup were used. The sequences were aligned using ClustalW method from MEGA 7 software and the phylogenetic trees were constructed using BEAST v1.8 (Bayesian Evolutionary Analysis Sampling Trees). Within the *Scardinius* group, our analyses support most of the recognized species, indicating that *S. erythrophthalmus* species is not clustered in a monophyletic clade, appearing to be paraphyletic.

WETHER INVASIVE BIVALVES CAN CONTROL PHYTOPLANKTON DEVELOPMENT UNDER ELEVATED TEMPERATURES

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Climatic models predict temperature increase in the surface of temperate waterbodies by 2.3-5.3°C (IPCC, 2007; 2014). Global climate change promotes a spread of warm water alien bivalves, some species of which have wide distribution and still are extending their range in Europe and worldwide and substantially influence indirectly or directly aquatic communities (Karatayev et al., 2007; Früh, Stoll & Haase, 2012). Bivalves from genus *Deissena* often dominated in many water systems which they invade. Due to great number and filtering activity *Dreissena* removes very efficiently both inorganic and organic particles, including phytoplankton, particles from water column and greatly increases water clarity. Many studies suggest that elevated temperatures can lead to increased phytoplankton production and more frequent and intense blooms of cyanobacteria (Magnuson et al., 1997; Bates et al., 2008; Kosten et al., 2012). Studies of biota in cooling reservoirs with the addition of temperature loading equal to those assumed by climatic models are represented as a whole lake experiment to predict consequences of enhanced temperatures on aquatic communities.

To check abilities of *Dreissena* and zooplankton to control development of phytoplankton we carried out investigation in three cooling reservoirs. Lake Beloe (Belarus) is cooling reservoir of Beriozovskaya Power Plant has very low number of any bivalves and has not *Dreussena*. Lake Lukomlskoe (Belarus) is cooling reservoir of Lukomlskaya Power Plant and its biota includes population of *D.polymorpha* with biomasses about 180 g/m^2. Kuchurgan Reservoir is cooling reservoir of Moldova Power Plant and has abundant populations of *D.polymorpha* and *D.bugensis* biomasses of which reach about 600 g/m^2 and more. Temperatures in Lake Lukomlskoe reached 28.9°C in other two watebodies reached 30°C and more. In Belorussian lakes maximal temperatures were observed only in some of water areas while in Kuchurgan Reservoir the water was warm all over the surface. Thus the last was the warmest waterbody.

Phytoplankton biomasses were dominated by: in Lake Beloe green (*Micrasterias*, *Scenedesmus*), diatoms (*Cyclotella*), Euglenophyta (*Trachelomonas*) and blue-greens (*Anabaena*, *Merismopedia*, *Microcystis*) algae; in Lake Lukomlskoe diatoms (espe-

cially *Fragilaria crotonensis,* second species - *Cyclotella*); in Kuchurgan Reservoir Dinophyta (*Glenodinium gymnodinium*, *Peridinium cinctum*), diatoms (*Melosira granulata*, *Nitzschia palea*, *Synedra ulna*), green (*Pandorina morum*, *Monoraphidium komarkovae*, *Crucigenia tetrapedia*, *Scenedesmus quadricauda*), blue-greens (*Oscillatoria planctonica*, *Aphanizomenon flos-aquae*, *Anabaena spiroides*). In Kuchurgan Reservoir blue-green algae were most abundant in number. In the pelagial of the coldest Lake Lukomlskoe the crustacean zooplankton was presented by 6 species of copepods and by 12 species of cladocerans including 3 species of *Daphnia*. In the warmer cooling reservoirs only 4 species of crustaceans were observed in Lake Beloe and 2 species in Kucurgan Reservoir. The last were dominated previously by the rotifers.

Calculations show that in Lake Beloe zooplankton presented in water column per m^2 can filtrate only about 0.5 ± 0.4 L of water. Such low filtration activity resulted in lowest water transparency which is 0.65 m and total phytoplankton biomass consisted 9.1 mg per L. In Lake Lukomlskoe zooplankton and *Dreissena* have the same filtration capacity 7.1 ± 1.9 and about 7 L per m^2 per day correspondently. This lake has the greatest transparency about 3 m and the lowest phytoplankton biomass – 2.12 mg per L. In the Kuchurgan Reservoir, the filtration rate of zooplankton including that of numerous herbivorous rotifers was 4.8 ± 5.1 L per m^2 per day and the highest filtration rate was provided by *Dreissena* – about 24 L per m^2. Nevertheless, in this reservoir the greatest biomass of phytoplankton (32.2 mg per L per day) and domination on the number of cyanobacteria was observed. In such high phytoplankton biomass was contributed by mostly large-bodied *Dinophyta* but biomasses of another alga groups were found in higher abundance than in other studied reservoirs.

Thus in the warmest reservoirs a sharp decrease in the number and ability of crustacean species and abundance as well as accordingly of the filtration activity was observed. Our previous investigations (Feniova et al., 2013) showed that in the warmest Polish cooling reservoir (Konin Lake cooling system) number and abundance of crustaceans sharply decreased in comparison with the colder lake. In the Lake Beloe zooplankton had the lowest filtration rates, high phytoplankton biomass and lowest transparency. In the Kuciurgan Reservoir total filtration rate of zooplankton and *Dressena* was higher than in other reservoirs but phytoplankton was dominated by cyanobacteria and had the highest biomass. So, we can anticipate that temperature increase to 30°C under climate warming might result in the decrease of zooplankton abundance in temperate lakes, that might lead to the loss of phytoplankton control by zooplankton feeders. Plentiful dreissena development not always compensates the decrease in filtration activity of zooplankton at temperature 30°C.

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DATA REGARDING BENTHIC INVERTEBRATES POPULATIONS AS POSSIBLE FOOD RESOURCES FOR THE ICHTHYOFAUNA INHABITING THE MIDDLE SECTOR OF THE SIRET RIVER

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The study below was done based on several data obtained by researching the benthic and fish populations from middle sector of the Siret River.

The Siret River Basin has a total area of 44,835 km^2, 726 km length and an average flow rate of 235 m^3 / s, being the largest in Romania. The Siret River springs in Ukraine, in the Carpaţii Păduroşi and after entering in the east - northeast part of the Romanian territory it collects a series of tributaries on the eastern slopes of the Carpathians.

The Siret River is divided into three distinct sectors – based on physical, geographical and hydrological characteristics:

- Upper Siret (upstream sector) - up to entering the river on our country at Văscăuţi, with an average slope of 7 m / km;
- Middle Siret (middle sector) – up to the confluence with Putna River, consists of the plateau of the river, with an average slope of 0.5 m / km;
- Lower Siret (downstream sector) – or plain sector, downstream of Putna shedding, where slopes of the river decrease on 0.23 m / km.

The aim of the study was to highlight the structure of benthic invertebrate populations in the studied area and to see the way they can be a source of food for fish fauna in the middle sector of the river.

The benthos sampling and the fish catchment were done some years ago, upstream and downstream of Cosmeşti village. Benthos samplings were done in prevernal, vernal, summer, autumn and hibernal seasons. Quantitative samples were taken from four sites covered about 30 km long on natural hard substrate (rocks, boulders, rock fragments).

A list with main identified taxa will be presented in the paper. Data regarding specific diversity of invertebrate's populations and percent composition in studied sites will be analyzed. A seasonal qualitative composition will be done, too. Some synecological indices as abundance and frequency variation of main taxa are calculated. Analyzing the Dzuba indices (WD %) it stands out that Diptera Chironomidae - larvae

and Oligochaeta dominate the benthic biocoenosis, and other groups (Nematoda, Hirudinea, Gasteropoda, Lamellibranchiata, Ostracoda, Cladocera, Copepoda, Amphipoda, Collembola, Ephemeroptera) have representatives in all sites.

The ichthyofauna samples were providing from eight fishing sites, upstream and downstream of Cosmesti on both sides of the Siret River, respectively the south part of Movileni Lake.

The number and location of fishing stations were made in such a way that overlap with benthos areas sampling, knowing that the dynamics and the distribution of fish populations are much wider than those of the benthic populations.

A total of 565 individuals were collected in the fish captures with a total biomass of 3666, 3 grams.

Fish belonging to 17 species were identified in the samples along the studied zone; 11 species belong to Order Cypriniformes (10 from Cyprinidae family and 1 from Cobitidae family) and 6 species are from Order Perciformes (1 - Centrarchidae, 2 – Percidae, 2- Gobiidae and 1 – Odontobatidae).

The representatives of 15 species are the native ones and 2 are nonindigenous, invasive species (*Lepomis gibbosus* and *Perccottus glenii* – both of them being collected from the area downstream of Furcenii Vechi, in Movileni Lake). Four species of the encountered fish are listed in The Annex II of the EU Habitats Directive (92/43/EEC), as species of communitarian interest for Romania and coded on Natura 2000 programme: *Aspius aspius* – 1130, *Romanogobio kesslerii* – 2511/6143, *Barbus barbus* – 5085 and *Cobitis taenia* – 1149.

In the paper a list of taxonomic structure of fish populations recorded in the middle sector of the Siret River during the research and the distribution of these in the different sites of fishing will be presented. Variation in the number of individuals and biomass per sampling sites could reveal the environmental conditions and the quality of food resources along the studied sector of the river.

The frequency of the species in all eight fishing sites will be analyzed in order to highlight which species is considered constant, characteristic or accessory?

Considerations regarding the fish behavior and the trophic regime for each species will try to create a picture of the potential food which is the benthic invertebrate populations in the middle sector of the Siret River.

Presentation of local threats, of natural or anthropogenic origin may reveal possible changes that may occur either in the benthic biocoenosis, or in the pelagic ones.

MULTIVARIATE ANALYSIS IN WATER SAMPLES USING INDUCTIVELY COUPLED PLASMA - MASS SPECTROMETRY (ICP-MS)

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The aim of this study is to present the function of the Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), and the advantages in the multi-element analysis in comparison with other atomic spectroscopy instruments together with the results obtained in several trace elements in water samples of the Kavala area in order to explain their quality according to the council directive 98/83/EC.

Using ICP-MS almost all the elements of periodic table can be measured from Li to U and simultaneously up to 35 elements in a sample within 3-4 min and with precision plus or minus 1-2% in a large scale from ppm to ppt, ppq. The analyst has the option of various programs of analysis: quantitative analysis, semi quantitative analysis, isotopic analysis and isotopic ratio.

Its key applications are in the following areas: environmental, water, foods, semiconductors, metal alloys, clinical, pharmaceutical, consumer goods, forensic, geological, archeological, chemical, hydrocarbons, oils, nuclear, academic/research.

Advanced hyphenated techniques allow the coupling of the ICP-MS with Laser Ablation (LA) to create a unique non-catastrophic system for direct solid sampling without dissolution, virtually in any material, that minimizes sample preparation time.

We acknowledge the Erasmus+ program between the Technological Educational Institute of Eastern Macedonia and Thrace (TEI EMT), Kavala, Greece (2014-2016) and Dunărea de Jos University of Galati and the Erasmus program between TEI EMT, Kavala, Greece (2016-2018) and University of the Academy of Science of Moldova, Institute of Chemistry.

DYNAMICS OF CYTOCHROME B AND MHC CLASS II GENES OF CARASSIUS GIBELIO SPECIES CORRELATED WITH THE SPECIFIC LIFE ENVIRONMENT

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The invasiveness presented in the history of *Carassius gibelio* species as well as the current economic and ecological importance is still making this species an important object of study. The mobility degree of fish is determined by physicochemical parameters of the aquatic environment and by the interconnectivity of watershed. The gene flow and the genetic diversity of populations are directly correlated by this mobility degree. A geographical isolation of a population leaves their marks on the genetic fund and can dictate certain development directions of individuals in order to allow their adaptation to the new environmental conditions.

Due to the presence of specific pathogens in different aquatic habitats and the presence or absence of gene flow between populations, the responsible immunity genes for individuals may be modified, defining different haplotypes between populations from specific environments.

The aim of this study was to highlight the differences between *Carassius gibelio* individuals sampled among the Danube basin, from various aquatic habitats.

Using a genetic approach, we had analyzed *Carassius gibelio* samples collected from the Bistrița River and a nearby lake and also samples from different Romanian lakes and rivers. For this study we analyzed one mitochondrial gene (cytochrome b) and one nuclear gene (MHC class II).

All sequences were aligned using ClustaW method in MEGA 7 software. Phylogenetic trees were constructed using SeaView 4, the optimum substitution model was identified using jModelTest 2.1.4. and the visualization of the trees was performed in FigTreev.1.4. software. The mapping of MHC class II gene revealed the differences between individuals originating from different aquatic environments, as punctual mutations and block insertions of nucleotides. The phylogenetic tree obtained by analyzing the cytochrome b sequences of individuals from Danube basin is showing a common ancestor and also a specific clustering of the majority individuals from the Bistrița River.

TROPHICITY ASSESSMENT OF THE DNIESTER RIVER BASED ON MICROBIOLOGICAL PARAMETERS

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The study of the microbiological parameters of bacterioplankton in different types of aquatic ecosystems is one of the mail directions in the applied researches. Water samples were collected seasonally during 2015 at 11 stations of the Dniester River and Dubossary reservoir: Naslavcea, Valcinet, Soroca, Camenca (medial sector of the river - 12 samples), Erjovo, Goiani, Cocieri (Dubossary reservoir - 9 samples), Vadul lui Voda, Varnita, Suclea, Palanca (lower sector of the Dniester River - 12 samples). The trophic category of monitored ecosystems was appreciated based on such microbiological parameters as bacterial production and destruction, total number of bacteria, number of saprophytes and some physiological groups of microorganisms involved in cycles of nitrogen, phosphorus and carbon. Sampling and analysis of water samples was carried out by methods accepted in hydrobiology (Gak, 1975; Ambrazene, 1984; Kopylov and Kosolapov, 2008; Water Quality Monitoring and assessment of ecological status of aquatic ecosystems, 2015 etc.).

The following results were obtained:

- A large range of values has been revealed for such microbiological parameters as total number of bacteria (Ntot – from 0.6 to 8.0 million cells / ml) and number of saprophytes (Nsapr – from 0.1 to 62.0 thousand cells / ml). Under the investigated period, the highest values of these parameters were recorded for two stations of the Dniester River (Fig. 1):

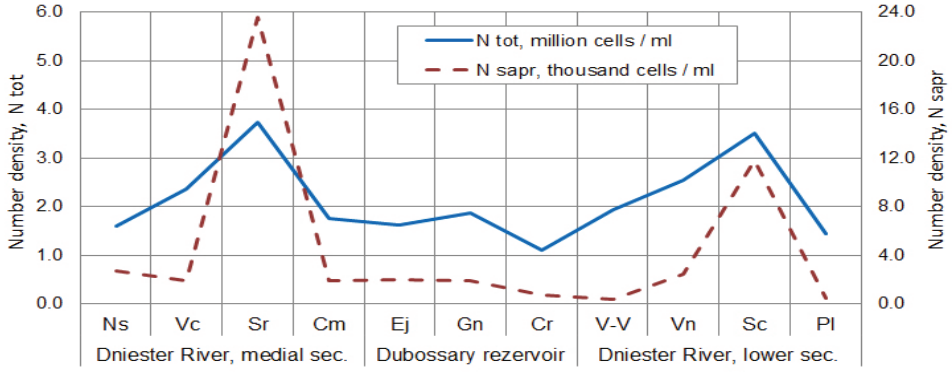

Fig.1. Dynamics of season average for the total number of bacteria (Ntot) and number of saprophytes (Nsapr) in the Dniester River and Dubossary reservoir: Ns - Naslavcea, Vc - Valcinet, Sr - Soroca, Cm - Camenca, Ej - Erjovo, Gn - Goiani, Cr - Cocieri, VV - Vadul lui Voda, Vn - Varnita, Sc - Suclea, Pl - Palanca (2015)

- In the temporal aspect, a significant increase of microbial mass has been mentioned from spring to summer due to the weather factors such as rise in water temperature, rainwater surface runoff, summer floods etc.

- A wide range of variability was recorded for the physiological characteristics (production and destruction) of bacterioplankton communities, with growth of these parameters downstream of urban and rural areas that are caused by anthropogenic factors. The range of parameter values is the follows: 0.08 - 5.47 cal. / L / 24 h (production) and 0 - 26.6 cal. / L / 24 h (destruction).

- The numerical density of microorganisms, involved in the circulation of phosphorus, nitrogen and carbon, was analysed in relation to lotic and lentic ecosystems of the Dniester River that have been studied. The density of ammonifying microorganisms varied from 0.2 to 35.0 thousand cells / ml, amylolytic bacteria - from 0.03 to 3.2 thousand cells / ml, and bacteria involved in mineralization of phosphorus - from 0.21 to 25.0 thousand cells / ml. The seasonal upward trend of the quantitative values for these groups of microorganisms was also registered in summer, along with increase of bacterial mass downstream of urban and rural areas.

- Based on the total number of bacteria (Ntot) in 60 % of cases, the Dniester River is a mesotrophic water body, in 32 % - eutrophic, in 8 % - polytrophic. According to an estimate based on the number of saprophytes (Nsapr), Dniester River is a mesotrophic water body in 47 % of cases, in 29 % - eutrophic, in 12 % - oligotrophic, in 8 % - polytrophic, in 4 % - hypertrophic. The percentage share for the Dubossary reservoir trophicity is shown in Fig. 2.

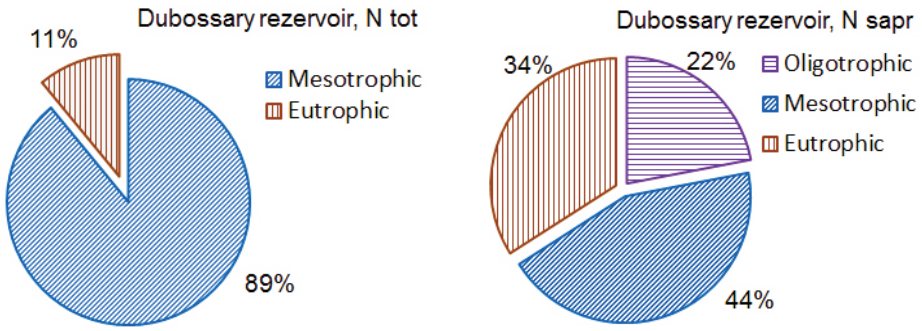

Fig.2. Percentage share of the Dubossary reservoir trophicity for the vegetation period of 2015, based on microbiological parameters

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LEECH FAUNA (CLITELLATA: EUHIRUDINEA) OF ROMANIA: CHECK-LIST AND NEW INFORMATION ON THE TAXONOMY, ECOLOGY AND DISTRIBUTION

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Leeches (Annelida: Clitellata: Euhirudinea) of Romania were studied on the basis of published records and results of recent surveys conducted by the author. The objectives of this study were to summarize recent taxonomic information and to update the checklist of leeches using material collected from 2014 to 2016. Altogether, 28 species, representing 15 genera, 5 families, and 2 orders, are reported from Romania.

A detailed description of the distributions of rare species and characterization of localities from which they are reported are presented. Plausible modes of dispersal and propagation of species in South-eastern Europe are discussed.

Most leeches in Romania are thermophilic freshwater species inhabiting stagnant as well as running waters, a few species are considered to be amphibious and only one species is marine. Leeches are common in eutrophic waters and often serve as indicators of pollution (Cristea, 1979).

The first systematic and anatomical-histological research of leeches from Romania was conducted by Scriban (1904). He mentions 12 species belonging to 10 genera from waters surrounding city of Iași, from running mountain streams of Moldova and from stagnant lakes of Dobrogea. Further leeches from Romania were added, including the following species: *Trocheta subviridis* Dutrochet, 1817 by Scriban (1910), *Piscicola respirans* Troschel, 1850 by Epure (1945), *Dina lineata* (O.F. Müller, 1774) by Epure (1947), *Erpobdella monostriata* (Gedroyć, 1916) by Pawłowski (1948), ?*Piscicola fasciata* Kollar, 1842 by Popescu-Gorj & Costea (1961), *Trocheta bykowskii* Gedroyć, 1913 by Motaș *et al*. (1961), *Erpobdella nigricollis* (Brandes, 1900) by Manoleli (1971), *Theromyzon maculosum* (Rathke, 1862) and *Erpobdella testacea* (Savigny, 1822) by Manoleli (1974), *Dina apathyi* Gedroyć, 1916 and *Dina stschegolewi* (Lukin et Epstein, 1960) by Cristea (1975), *Pontobdella muricata* (Linnaeus, 1758) and *Archaeobdella esmonti* Grimm, 1876 by Cristea & Manoleli (1977), *Limnatis nilotica* (Savigny, 1822) by Cristea (1979). In 1972 Manoleli described a new species, *Limnatis bacescui*, from a small creek in Dobrogea and in 1998 Manoleli, Klemm & Sârbu described another species, *Haemopis caeca*, from a sulphidic lake in the Movile Cave.

Although some of leeches are common and well described their study in the territory of Romania has been neglected for a long time.

Thus all previous reports of *Hirudo medicinalis* Linné, 1758 in Romania are questionable as recent monitoring conducted in 2014–2016 revealed only specimens belonging to *Hirudo verbana* Carena, 1820.

The largest European leech species used as a bait of *Silurus glanis* (Linnaeus, 1758) turned out to belong to *Trocheta danastrica* Stschegolew, 1938. Older records of this species refer to as *Trocheta bykowskii*. Specimens encountered in hipocrenal habitats were ascribed to *Trocheta cylindrica* Örley, 1886.

In the previous Carpathian records, the preoccupied name *Erpobdella monostriata* (Gedroyć, 1916) has been employed instead of the correct designation *Erpobdella vilnensis* (Liskiewicz, 1925). *Erpobdella vilnensis* was found in Carpathian streams and small rivers with rocky bottom.

PHYTOPLANKTON SPECIES – INDICATORSI OF WATER QUALITY IN DUBASARI RESERVOIR

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Planktonic algae play an important role in biological evaluation of water quality, taking an active part in its purification. Based on algae species - indicators of saprobity the water quality was determined in various sectors of the Dubasari lake. In 2015 in the composition of phytoplankton from Dubasari lake 62 species from 6 taxonomic groups were registered: Cyanophyta-3, Bacillariophyta -33, Chlorophyta-18, Euglenophyta-6, Chrisophyta-1 and Pyrrophyta-1. In phytoplankton composition the most frequent species were: *Oscillatoria lacustris, Synechocystis aquatilis, Cyclotella Kuetzingiana., Cymatopleura solea, Navicula cryptocephala, Nitzschia acicularis, Nitzschia sigmoidea, Rhoicosphenia curvata, Synedra ulna, Euglena polymorpha, Monoraphidium contortum, Scenedesmus quadricauda.* In Dubăsari lake the phytoplankton was more diverse in the middle and lower sectors, with the share of species from groups Chlorophyta and Euglenophyta. In the middle and lower sectors, species of groups Desmediales and Pyrrophyta have been identified, these have being not recorded in the upper sector. Development of phytoplankton in Dubasari reservoir depends largely on the content of nutrients and the amount of nutritive elements, that come with water from the middle sector of the Dniester river.

From the total of 62 species of algae identified in Dubasari lake 36 are indicators of water saprobity. Most of them – 58% are β-mesosaprobe species, of which more frequent are: *Cocconeis placentula, Cyclitella kuetzingiana, Cymbella ventricosa, Gomphonema olivaceum, Nitzschia sigmoidea, Rhoicosphenia curvata*, *Synedra ulna, Scenedesmus quadricauda*.

14% belong to -mesosaprobe species, to which belong: *Hantzschia amphioxys, Nitzschia acicularis, Navicula cryptocephala*, *Euglena polymorpha*. The - -mesosaprobe species constituted 11% of indicator species, of which: *Amphora ovalis, Asterionella formosa, Fragilaria capucina*. 12% belong to -mesosaprobe species *Cymatopleura solea, Navicula hungarica* and -oligosaprobe: *Cyclotella comta, Dinobrion sertularia*. The - -mesosaprobe *Navicula gracilis* and -xenosaprobe *Fragillaria virescens* constituted 6% of the total number of indicator species (Fig.1.).

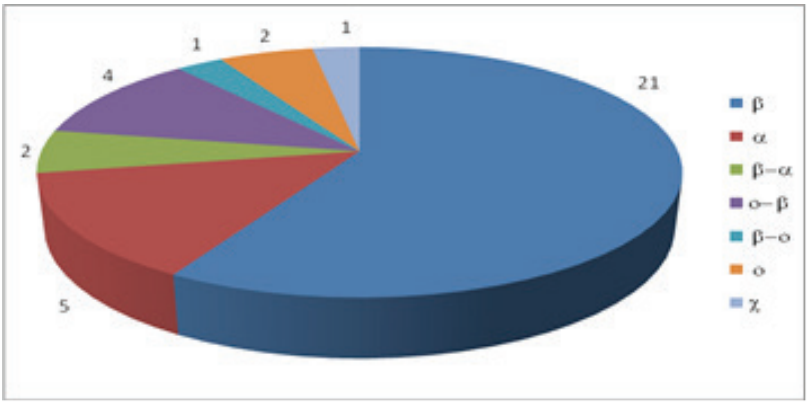

Figure 1. Distribution of indicator species from phytoplankton composition in Dubăsari reservoir in saprobity zones in 2015

In Dubasari reservoir the saprobic index values vary between 1.74 to 1.97 in spring, 1,75- 2,01 in summer and between 1.83-1.93 in autumn. In all seasons the dominance of the species with preference for β-mesosaprobe zone was observed. Saprobic index values fall within the β-mesosaprobe area and refers to water quality of class II-III (good-moderately polluted).

Acknowledgement: The study was performed in the frame of institutional project 15.817.02.27A and bilateral project Republic of Moldova-Belarus 15.820.18.02.06/B.

STRUCTURE AND FUNCTIONNING OF PHYTOPLANKTON IN NISTRU RIVER

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During 2015 in Dniester river the phytoplankton was represented by 67 species and varieties of planktonic algae from 6 taxonomic groups: *Cyanophyta* – 4, *Bacillariophyta* – 34, *Euglenophyta* – 4, *Chlorophyta* – 22, *Chrysophyta-1* and *Pyrrophyta* – *2*. The most frequent were the green and diatomean aldae, of which dominant were: *Monoraphidium contortum, Scenedesmus quadricauda, Gomphonema olivaceum, Cocconeis placentula, Navicula cryptocephala, Nitzschia acicularis, Nitzschia sigmoidea*.

In medial sector of Nistru river during the investigations the values of phytoplankton number oscillated between 1,56-12,661 mln cel./l, and of biomass between 1,504-6,919 g/m^3. In spring period the number values in medium sector oscillated between 1,56 -5,29 mln cel./l, with the biomass from 2,24 to 6,24 g/m^3, with the highest number in Naslavcea and Otaci stations. The values of phytoplankton number in summer period varied between 1,497-7,43 mln cel./l, with biomass of 1,967-6,064 g/m^3. Hagher values were registered at Otaci and Soroca stations. In autumn period the values of number and biomass of planktonic algae were higher than in spring and summer, varying between 2,23-12,661 mln cel./l, with biomass of 0,95-6,919 g/m^3, being higher at Soroca (fig.1). In this period, the high ratio of species from *Cyanophyta* group (8,933 mln cel./l) was observed: *Oscillatoria lacustris* and *Synechocistys aquatilis*.

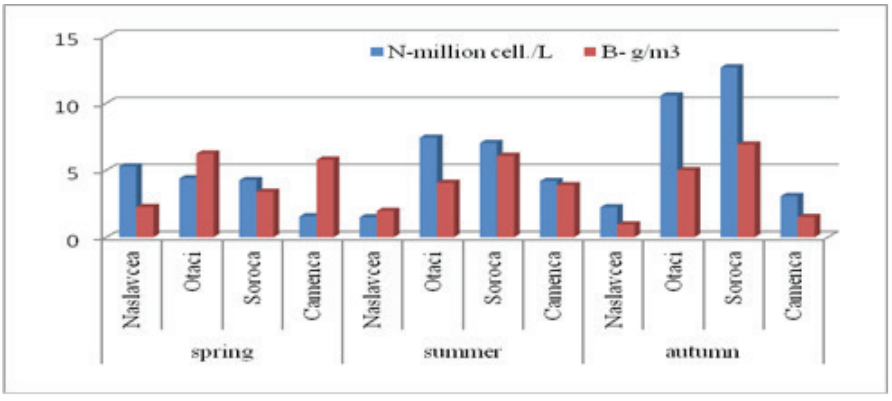

Fig. 1. Seasonal dynamics of number (N -mln cel./l) and biomass (B -g/m^3) of phytoplankton in medium sector of Nistru river in 2015

In lower sectorul of Nistru river there increased values of phytoplankton number were registered– between 1,16-18,46 mln cel./l and of biomass between 1,11-9,17 g/m^3. In vernal period the phytoplankton number oscillated between 1,16-7,82 mln cel./l with biomass 1,11-9,17 g/m^3, being higher at Palanca station with the dominance of species from *Cyanophyta* (5,599 mln cel./l) and *Bacillariophyta* (8,372 g/m^3) groups. În summer period the highest values of phytoplankton number (6,228-17,995 mln cel./l) and of biomass (2,114-6,173 g/m^3) have been registered. At Vadul-lui-Voda (16,266 mln cel./l) and Varniţa (9,066 mln cel./l) station the increased number was caused by the intense development of species from *Cyanophyta* group: *Oscillatoria lacustris* and *Synechocistys aquatilis*. În autumn period the number varied from 6,03 to 18,46 mln cel./l, being higher at Palanca station caused by intense development of cyanophita algae (15,265 mln cel./l). The biomass of planktonic algae in autumn period registered lower values than in spring and summer periods. The biomass values oscillated between 1,308- 4,794 g/m^3, being higher only at Palanca station (fig. 2.).

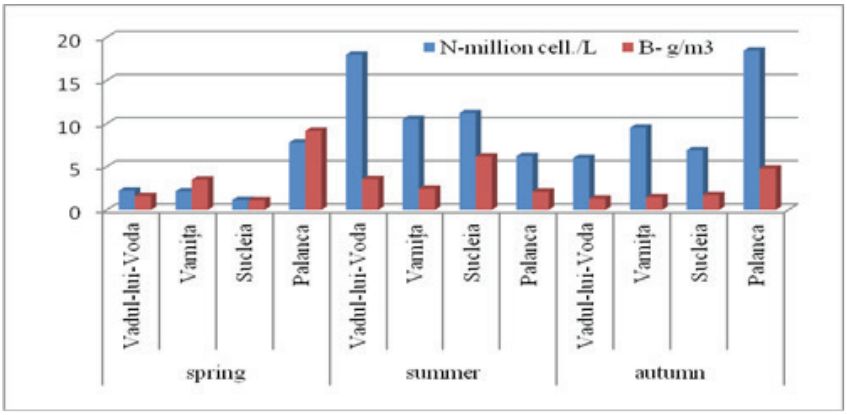

Fig.2. Seasonal dynamics of number (N -mln cel./l) and biomass (B -g/m^3) of phytoplankton in lower sector of Nistru river in 2015

A tendency of decreasing of phytoplankton biomass from spring to autumn was established. Across the river the maximal values of biomass did not exceed the limits of trophicity category "eutrophic" and lowest values fell within the category "mesotrophic".

Of the total number of algae species that have been identified (67 species and varieties) 43 are indicator species of water saprobity. During 2015 there was recorded the share of -mesosaprobe species, which constituted 60%, the most frequently encountered were: *Cocconeis placentula, Cyclotella Kuetzingiana, Cymbella lanceolata, Diatoma vulgare v.vulgare*.

Analysis of saprobity index values in the medial and lower sectors of Nistru river allow us to find significant differences in the level of pollution of the river. In medial Nistru the saprobity index values ranged from 1.4 to 2.207 and in lower between 1.84 to 2.46 and fall within classes II and III of water quality (good-moderately polluted).

Acknowledgement: The study was performed in the frame of institutional project 15.817.02.27A and bilateral Republic of Moldova-Belarus 15.820.18.02.06/B

SPREADING OF *PERCCOTTUS GLENII* DYBOWSKI 1877 (PERCIFORMES, ODONTOBUTIDAE) IN ROMANIAN BASIN OF THE RIVER SIRET

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Perccottus glenii is an East-Asiatic fish species encountered in Asia: Tugur (Sea of Okhotsk) and Amur southward to Yangtze and Fujian. In Amur, it is historically known from the middle and lower Amur (from Tygda Rive down to the estuary) with tributaries Zeya, Sungari, Ussuri and the Khanka Lake basin. It is also reported from Shilka in the upper Amur where it is introduced (Bogutskaya et al., 2008). This species is introduced in Europe (Kottelat & Freyhof, 2007), being a new alien invasive species in the European inland waters.

As an alien invasive species *Perccottus glenii* is a voracious predatory fish, and it is considered a serious threat to aquatic fauna wherever it occurs. In small water bodies it is capable to extirpate almost all other fish species and amphibian larvae. This is the reason why most of the studies monitor this fish species.

Perccottus glenii was introduced in Latvia (Plikss, 2002; Pupiņa & Pupiņš, 2012), Poland (Solarz, 2005; Grabowska et al., 2010), Russia (Bogutskaya & Naseka, 2002), Hungary (Bartley, 2006), Slovakia (Lusk et al., 2004; Bartley, 2006), Romania (Nalbant et al., 2004; Covaciu-Marcov et al., 2011), Bulgaria (Uzunova & Zlatanova, 2007), Moldova (Mosu, 2007), Croatia (Ćaleta et al., 2010).

The aim of this study is to highlight the distribution of *Perccottus glenii* in Romania, based on the data obtained in our researches which were carried out in the period 2001-2015 in the basin of the River Siret. Our research aimed to investigate the structure of the fish communities in this river basin.

Perccottus glenii was found for the first time in Romania in 2001 in the River Suceava near Dornesti (Nalbant et al., 2004). Later it was found on the main course of the River Siret both upstream and downstream the confluence between Suceava and Siret.

Since 2001 its spreading area has extended rapidly due to its low ecological requirements, being recorded in some other tributaries of the River Siret.

In 2005, *Perccottus glenii* was found in the Romanian sector of the Danube, (at the Iron Gates) and in the Danube Delta (Popa et al., 2006; Reshetnikov, 2010; Năstase, 2008).

After 2005, the presence of this fish species was further mentioned in Romania in the basin of River Mureș (Copilaș-Ciocianu & Pârvulescu, 2011).

MOLECULAR ASSESSMENT OF PERCCOTTUS GLENII INVASIVITY

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Identifying routes of invasion is a critical management strategy in controlling the spread of fish invasive species. This is challenging, however, in the absence of direct evidence. Therefore, indirect methodologies are used to infer possible invasion sources and routes, such as genetic and morphological data from populations from invasive ranges and putative source areas.

During 2003 and 2014, 51 *Perccottus glenii* individuals were collected from three locations across Danube River basin: Silvia channel, Mures River, Romania (2009); Tiszafüred, Hungary, Tisza River (2013) and Siret River, Romania (2014). The collected specimens were stored in 98% ethanol. A small fragment of dorsal muscle tissue was subject to genomic DNA extraction using phenol–chloroform-isoamyl alcohol (25:24:1) extraction protocol. Amplicons of 1150bp for mitochondrial gene cytochrome b (cytb) and 890bp mitochondrial control region were amplified by PCR using a new designed specific primers pair. The PCR products were purified using QIAquick PCR Purification Kit (Qiagen) and sequenced on a CEQ8000 Genetic Analysis System (Beckman Coulter).

A cytb gene dataset was build using sequences from 51 Amur Sleepers from Europe combined with another 61 Asian haplotypes sequences from Xu et al. (2014) study and 4 from Thacker et al. (2005) study. Cytb gene dataset aligned with three outgroup species (Odontobutis obscura; O. potamophila and O. platycephala) was subject to jModelTest v.2, nucleotide substitution model being selected by Bayesian information criteria. The phylogenetic relationships within European and Asian Amur Sleepers were reconstructed using the ML method in PhyML v.3 software, and tested under 1000 bootstraps replications.

The aim of the present study was to assess the native area and the invasivity of European Amur sleepers using two mitochondrial markers. In order to evaluate the invasiveness features, their genetic diversity across the native area in comparison with the genetic diversity within invasive areas, were computed.

ACTIVITY OF THE ARTEMIA LEACH POPULATION (BRANCHIOPODA) IN HYPERSALINE LAKES OF THE ALTAI TERRITORY (THE EXAMPLE OF LAKE BIG YAROVOE)

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Artemia Leach which is in hypersaline lakes belongs to parthenogenetic populations, despite the presence of rare males in the community structure. For a long-term research period according to a monitoring program of the salt lakes of the Altai territory a clear predominance of females was observed in the lake. The highest percentage of males (10,2) was observed in 2007, during the other years that value did not exceed 5%.

In 2014, males were observed in the samples of the period of August to October, their number was low (0.1 thousand samp/m^3). In 2015, males were not registered in the samples (see table). The sex ratio is not related to the characteristics of the population but characterizes each of the three or four generations as a result of the current abiotic and biotic factors.

Table – Mean values of Artemia production characteristics in Lake Big Yarovoe, 2014-2015.

Month	Sex ratio (female:male), %	Fecundity, samp./species	Female number, %		
			with cysts	with subitan eggs	with nauplii
2014 г.					
June	100:0				
July	100:0	121,8±11,8	40,0	46,7	13,3
August	99,1:0,9	29,1±2,7	45,8	45,8	8,3
September	98,2:1,8	58,9±5,8	80,0	20,0	0
2015 г.					
June	100	27,6±2,3	28,0	76,0	0,0
July	100	21,6±2,1	16,0	72,0	28,0
August	100	16,0±1,4	66,7	30,0	13,3
September	100	40,4±4,4	72,0	20,0	0,0

In 2014-2015, females of brine shrimps shed thin-shell or subitan eggs, thick-shell diapausing eggs or cysts, or bore living nauplii (viviparity). Since August, the proportion of females parturiating with cysts increased (45.8 %). In autumn cysts were

mainly observed in females' ovisacs in 2014 – 80.0 % and in 2015 – 72.0 %; subitan eggs were observed in the period of 2014 and 2015 at 20.0 %. Individual fecundity of females varied in wide range, in 2014 the range fluctuated from 29.1 to 121.8 samp./species, in 2015 – from 16.0 to 40.4 samp./species, the highest fecundity was observed in September (see table).

While analyzing the correlation of the occurrence of one or another reproduction method with abiotic factors and sex ratio, affirmative and negative relations were identified. The proportion of viviparity is associated with abiotic factors (temperature and water salinity) and has a negative correlation with fecundity, i.e. number of nauplii in a female's ovisac is less than number of thin-shell eggs. Reproduction by subitan eggs and cyst-bearing correlate not only with abiotic factors but also with sex ratio. The increase of cyst reproduction proportion is accompanied by a decrease in the number of males and an increase of water salinity against reducing its temperature.

The size of nobilous Artemia females and, to a greater extent, the ratio of their maximum and minimum lengths are important indicators characterizing the reproductive status of the population in a given year. The number of clutches within the life cycle of Artemia in 2014 ranged from 3 (July) to 9 (August) and in 2015 from 3 (August) to 8 (September).

Volume evaluation of potential yield of brine shrimps Artemia (cyst stage) in the hyperhaline lake Big Yarovoe is made on the basis of monitoring studies conducted from April to September. During hydrobiological studies the reservoir biota was considered, i.e. its structure, main factors influencing the development of the shrimp population, as well as the numerical characteristics of all development stages of shrimps and Artemia (cyst stage).

The total water area of lake Big Yarovoe is 65.0 km^2, a mean depth – 4.6 m, "residential" area of shrimps – 8.0 m and comprised 520.0 $mln.m^3$. The "residential" area of cysts with account of the productive 2-meter layer was 130.0 $mln.m^3$.

The store of Artemia (cyst stage) in 2014-2015 was 887.0 and 1014.6 t, respectively. The volume of their potential yield with 60% of taking out amounted 500.0 t in 2014 and 500.0 t in 2015.

RESEARCH REGARDING THE STRUCTURE OF BENTHIC MACROINVERTEBRATES COMMUNITIES IN MURES LOWER GORGE (ROMANIA)

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The River Mures is the longest inland river in Romania, being located in the central-west part of Romania. It springs from Hasmasu Mare Mountains at an elevation of 1406 m and it flows in the River Tisa, following the east–west direction.

Throughout its runway the River Mures is placed about 150-170 m below the neighboring interfluves. It has a large alluvial bed, of 95-139 m width. The hydrographic system of the River Mures has a density of 0.39km / sqkm. The high frequency of the confluence zones results in a high solid descharge in the river bed.

The climate in the basin of River Mures is temperate-continental, with abundant rainfall during autumn and spring, sometimes accompanied by floods. In geological terms, the basin of River Mures has two different sections: the gorge section and the plain section.

The structure of the freshwater benthic macroinvertebrate communities is an excellent, effective tool often used for water quality assessment, as well as an important indicator of water pollution extent.

The study was carried out in Mures lower gorge, during the year 2011. The biological material was sampled from 18 sampling sites placed on 15 tributaries of the River Mures. An amount of 20,485 individuals belonging to 14 taxonomic groups of benthic macroinvertebrate has been processed. Six of the taxonomic groups have been identified in all of the sampling sites, having a frequency of 100 % (Amphipoda, Ephemeroptera, Plecoptera, Trichoptera, Diptera, Coleoptera).

Two of the taxonomic groups have recorded the highest relative abundance in 14 of the sampling sites: Amphipoda 92.28% in Valea Tiganului, and Ephemeroptera 39.18% in Valea Craciuneasca. In the rest of the sampling sites, the highest relative abundance has been recorded by dipterans (58.18% in Troas, downstream Temesesti; 58.40% in Valea Almasului, downstream Cerbia village). The increasing of the relative abundance of some of the dipteran groups in some of the sampling sites placed downstream human settlements suggests the decrease of water quality as a consequence of anthropic influences.

IDENTIFICATION OF FISH TOLERANCE – NEW DIRECTION IN AQUACULTURE

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In the conditions of environment instability and pollution, and climate change, the research and identification of chemical compound patterns of accumulation, their optimal and toxic limits, as well as assessment of the influence of hydrochemical and hydrobiological parameter fluctuation on fish contribute significantly to the solving of problems of fundamental character. These are related to the determination of hydrobiont tolerance, assessment of chemical element circuit, migration and flow in food chains, aiming to elaborate and implement the biotechnologies in order to restore and increase the fishery productivity, fish product quality, and also the methodology of aquatic ecosystem monitoring and sustainable exploitation.

During the last decades a range of investigations have been carried out on accumulation, migration and influence of microelements – metals on the production-destruction processes in aquatic ecosystems and cyprinids and percids development (Zubcov E., 2000; Zubcov N., 2011). Some procedures of microelement application as stimulators of fish resistance and for improvement of trophic base in aquatic ecosystems used for fish culture were worked out (Zubcov et al., 1998; Zubcov et al., 2011). The obvious negative changes of the Dniester and Prut river ecosystems are caused by anthropogenic impact on their hydrological parameters. The situation is aggravated by the climate change, which influenced the diversity and bioproductivity of above mentioned rivers, they being, particularly, cross-border water streams.

It is absolutely necessary an international collaboration between researchers and specialists in order to diminish the negative consequences, restore the fish diversity, increase the aquaculture productivity and exploit the aquatic resources in a sustainable manner. These investigations should be guided towards the large scale implementation of new methodologies and biotechnologies, designed for fish diversity restoration, including the breeding of rare fish species by application of their artificial reproduction, usage of biological stimulators of fish resistance, fish reintroduction in river and lake ecosystems by their stoking with larvae and fry, taking in account the physical and geographical conditions and the state of aquatic environment.

Section IV
FOREST MANAGEMENT

MAPPING CRITICAL LEVELS AND AIR POLLUTION EFFECTS FOR VEGETATION IN THE REPUBLIC OF MOLDOVA

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For several decades, acid deposition has had a major impact on forest ecosystems of the Northern Hemisphere, particular in areas having substrates with low base content. During the last 20-25 years, the deposition of sulphate ($S0_4$) has decreased in many areas Europe [1]. However, the nitrogen (N) deposition (nitrate ($N0_3$) and ammonium (NH_4)) remains high. Subsequent oxidation of NH_4 increases the acid load for terrestrial and aquatic ecosystems. Although $S0_4$ deposition and associated H^+ deposition have decreased, many ecosystems still receive high loadings of acidity.

According to the data provided by the European EMEP Monitoring Center, depositions of ammonia on the territory of the Republic of Moldova are 136-240 and 85-148 mg/m2 depending on the EMEP grid cell under survey. In the years 90th of the last century, the values of oxidized and reduced nitrogen stood at 7-30 kg/ha.

Acidification, eutrophication are base effects affecting vegetation forest ecosystems. Assessing of integrated index of eutrophication of the ecosystems was based on critical loads concept (which has been elaborated to assess air pollution reduction strategies, becoming a modern method for the estimation of potential harmful effects of atmospheric pollutants on ecosystems) [2]. Critical loads are defined as "a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge" (UN-ECE, 1996).

Critical loads for nutrients for the territory of the Republic of Moldova in EMEP 50x50 grid cells have been calculated by the following: CLnut(N)= Ni + Nu +Nle (acc) / (1 - fde), where: $\mathbf{N_i}$ - Annual rate of nitrogen immobilization in root zone ; $\mathbf{N_u}$ - Annual rate of nitrogen uptake by vegetation harvesting.

Critical load of nutrient Clnut(N) – as integrated index of eutrophication of the ecosystems

Type of vegetation	Nitrogen immobilization, **eq/ha/an**	Nitrogen uptake	Acceptable leaching of nitrogen (eq/m3)	Denitrification rate 0,1-0,2	Critical load of nutrient, **eq** N **/ha/an**
	$\mathbf{N_i}$	$\mathbf{N_u}$	$\mathbf{N_{le(acc)}}$	$\mathbf{f_{de}}$	**Clnut(N)**
Northern region					
conifers	107	174	59,6	0,1	**340,5**
deciduous	107	597	59,6	0,1	**763,5- 818,9**
Center region					
conifers	71	174	48,2	0,1	**293,1**
deciduous	71	597	48,2	0,1	**716,1-760,9**

Southern region					
conifers	71	174	48,8	0,1	**293,7**
deciduous	71	597	48,8- 94,2	0,1	**716,7- 762,1**

For all types of vegetation (semi- natural vegetation, forests), the annual averaged critical levels for NO_2 and SO_2 stand at 20 μg/m^3 and 30 μg/m^3 respectively. Critical levels for NH_3 for time period – annual mean and 24-hour mean stand at 8 μg/m^3 and 270 μg/m^3 respectively. Atmospheric air quality in rural areas as assessed by calculating the dispersion of pollutants from local sources. In the figure below is presented the calculation based on characteristic for sources of pollution (technological, meteorological, geographical location) data from Călărași area.

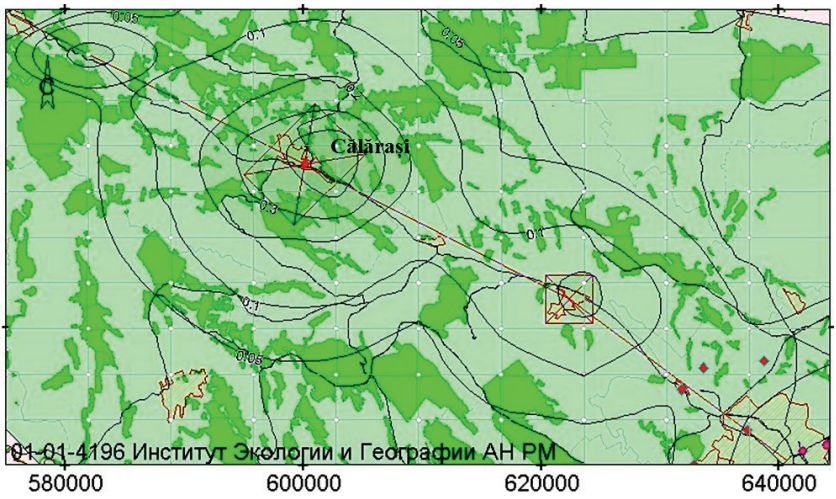

Fig. The isolines of nitrogen dioxide concentration for the most unfavorable conditions of pollution

According to the Program "Ecolog" calculations, dispersion NO_x emissions from local sources for protected areas the range vegetation are from 6.5 to 10 μg/m^3,that is ten times smaller than the critical value, which indicates a significant NO_x pollution on the environmental components studied. Ion exchange to environmental and forest vegetation including CL calculation of pollutants require a database by about 60 environmental indicators. If the nutrient cycle is modelled, as in the SAFE model, data are needed on litterfall rates, root turnover rates, including the nutrient contents in litter, and fine roots. Such data are highly dependent on tree species and site conditions, tape of soils. Compiling of such data allow us to perform mitigation of pollution at a higher level of knowledge.

1. Ulrich, B. (1994) Nutrient and acid/base budget of central European forest ecosystems. In: *Effects of Acid Rain on* Economic Commission for Europe (ECE), Miljorapport 15, Kopenhagen.

2. UN-ECE (2004) Manual on methodologies and criteria for Modelling and Mapping Critical Loads & Levels and Air Pollution Effects, Risks and Trends, Berlin http://www.umweltbundesamt.de

INTEGRATING CLIMATE CHANGE IN ENVIRONMENTAL ASSESSMENT IN THE REPUBLIC OF MOLDOVA

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The need for actions on climate change is widely recognized as an issue of global priority. Consideration of climate impacts early in the planning process of any new developments can contribute to a material extent to the global efforts in addressing climate change. Thus, by integrating climate mitigation, resilience and adaptation into new developments that may directly or indirectly impact upon the climate, or be impacted by the changing climate, may contribute to considering this issue in a preventive, and a more structured and efficient manner. The most appropriate planning instrument for such purpose is unquestionably the Environmental Assessment (EA), which has been developed and successfully applied worldwide, including in Moldova. Despite the fact that climate change is regarded as a national environmental policy priority, until present however, the climate change mitigation, resilience and adaptation are not systematically integrated into the EA system of Moldova.

The current national EA framework addresses climate change only superficially. The Law on Environmental Expert Review that focuses on small-scale projects does not stipulate any climate-related provisions, while the new Law on Environmental Impact Assessment (EIA) that focuses on new developments with potentially significant environmental impacts makes just a few general remarks in this regard. These relate mainly to the need for addressing impacts on the climate during the EIA process (articles 2 and 4), and the need for assessing among others also the baseline climate conditions (article 20). No other provisions on climate and climate change are provided by the law. Most importantly however, even though it addresses climate issues in basic terms, there is no clear guidance on which particular climate issues should be assessed and how to carry the assessment of such issues in the EIA process.

The revised European Union's (EU) EIA Directive 2014/52/EU, effective as of May 2014, requires assessment of climate change impacts, and provides the necessary guidance to systematically integrate climate change into the national EA frameworks. The Directive, compared to the previous one (2011/92/EU), makes clearer reference to the need to identify and assess the effects of new projects on climate, and it requires identification of climate factors that are more likely to be significantly affected. At the screening stage the Directive requires for specific considerations to be given to impacts of the new projects on climate, and their resilience to climate change. The scoping includes clearer requirements for assessing the climate impacts, and the EIA reports are required to provide more detailed information with regard to climate im-

pacts of the new projects and their vulnerability to climate change. The application of the new requirements are expected to result in a more detailed analysis of a larger amount of information at the earlier stages of the EIA process, which will allow for a more accurate climate impact prediction and mitigation.

The EIA Directive will need to be fully transposed in the legislation of the Member States by May 2017 and will become legally binding. In order to support the transition towards the new requirements, the European Commission (EC) has prepared comprehensive guiding documents for practitioners, authorities and other stakeholders across the EU that are involved in the EA process. Similar guiding documents have been prepared by the United Kingdom, the International Association for Impact Assessment (IAIA), and the Organization for Economic Cooperation and Development (OECD). Furthermore, various International Financial Institutions, in particular the World Bank (WB), have designed their own procedures for assessing climate change impacts and for identifying adaptation measures. It is expected that once the new Environmental and Social Framework (ESF) will be approved (sometimes during 2016), the WB will also prepare specific guidelines to support the practical application.

Moldova, as an EU Associated State has committed to harmonize its EA system with the EU requirements. It will, therefore, be extremely useful for the country to carefully consider the new climate requirements of the EIA Directive, as well as the relevant guiding documents, and develop the necessary mechanisms, taking account of the local specificities, for translating these climate-related provisions into the national EA system. The country's recently approved National Climate Change Adaptation Strategy until 2020 and the Action Plan also call for the need to integrate climate issues into the sectoral policies, including the EA. Similarly, Moldova's commitment to integrate climate change adaptation principles into sectoral policies made in the national Environmental Strategy supports furthermore this need. Lastly, and perhaps the most important commitment the country has made in this respect is the Intended National Determined Contribution approved at the Paris Conference of Parties 21 in Nov-Dec 2015.

All of the above only support the increasing need for integrating climate impacts in the national EA process, so that any climate impacts associated with new developments, or which can affect such developments, are considered at the early planning stages, and allow for relevant prevention, mitigation and adaptation measures be put in place. Altogether, this would strengthen the national system, increase resilience of the national economy to climate change, and would help Moldova positively contribute to the global efforts of addressing climate change.

ETHICAL DIMENSION OF ATTITUDES TOWARDS ANIMALS

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Moral attitude towards both domestic and wild animals has old philosophical foundations. In modern philosophy, the great German thinker Immanuel Kant recommends to have contact with wild animals who pose sense organs, and the French thinker Rene Descartes, who treated the world from a mechanical point of view, perceived animals as dumb machines. Also, Immanuel. Kant considered that a careful interaction with animals can have a good influence on the moral evolution of humans and also that we can judge a person`s heart by the way this person treats animals. Another philosopher of this era, Jeremi Bentham, mentioned in his work *Utilitarismul* that the moral obligation consists in taking care of animals.

Issues related to the moral attitude towards animals and their rights began to be approached only in the second half of the XX century. The great philosopher Albert Schweitzer considers that it is necessary to build a new humanity which can be ruled by a new ethics, real and inalienable one. In his opinion the respect for life incorporates the entire ethics of love in the highest and deepest sense, which constitutes the source of a constant renewal not only for each individual in particular, but for humanity in general. Following these ideas, the Australian philosopher Peter Singer who approached the problem of „animal rights" linked to the earth ethics of the American A. Leopold who enlarges the society`s limits by including into it the soils and water, the plants and animals, which change the human`s role and transform him from the society`s conquered into a member equal to him. The earth`s ethics has become the philosophy underlying the movement that demands to be a moral attitude towards animals, and their rights to be respected.

In the opinion of P. Singer, the attitude of most people towards animals is founded on a wrong idea according to which animals are inferior just because they belong to a different species. This attitude is called by him „speciism", based on "humans are special" arguments, which evolves from humans' interest in avoiding pain. But the speciism is amoral because neglecting the animal`s interests by making the suffer is also amoral. That is why humans have to pose a moral attitude toward animals, and they don`t have to produce pain to animals.

Another representative of this theory, the American philosopher Tom Regan, uses the ethic argument according to which animals possess an inherent value which he calls inherent value and he proves that these beings have the moral right to a treatment with respect. Animals, in his opinion must not be traded as simple tools in order to

gain certain purposes on the grounds that they are „subjects with souls" and that they possess an inherent value. For T. Regan these subjects have perceptions of the senses, beliefs, desires, motives, memory, senses of the future. So T. Regan bases his conception on the transfers of human rights on animals. He proves that all mature mammals pose self-conscience and are subjects of life and on the virtue of this cause they have the right to live.

Thus, one of the most controversial problems on the ecological ethics consist in the approach of the matters related to the fact if animals can have moral rights as well as humans and what their place should be. Animal rights targets the complete change of our attitude towards the non-humans who require that humans give up the idea that the exploitation of other species is something natural and inevitable. Such an approach must be interpreted as a violation of the morals.

The ideas of P. Singer and T. Regan have become a guide for the organizations and social movements who have begun a fight to defend the animals, which have a huge impact on the animal's destiny, although these actions are not comparable to the huge proportions of the murder and mutilation of animals for food, for scientific research and for teaching purposes. We can conclude that the ecological ethic tries to extend the morals which is limited to the relations between the human beings to the relations between the human beings and other organisms. The existence of the inherent value indicates the fact that animals are not predestined to be manipulated by humans, but for other purposes which mostly are not understood by him. The existence of animals is much more indispensable than their importance to humans. We consider that through the ecological ethics it can be imposed a moratorium on the attitude towards animals as things and resources. In this context, man has no right to decide on positions rationality question about the value or the right to life of one or another animal species. He must take care of all species in order not to prejudice natural biodiversity.

If postmodern society will not conceive such purposes as categorical imperative, it will not be able to overcome the modern ecological crisis. Animal protection policy must be based on the understanding that the multiplicity of species of both domestic and wild animals must be kept proceeding because of their intrinsic value. In our opinion, such an approach can help building more efficient relationships with the environment in general and its components, based in particular on ethical but not only on economic values and on the principle of utility.

REPRODUCTIVE SUCCESS OF COMMON NEWT POPULATION (*TRITURUS VULGARIS*) IN THE CENTRAL FOREST ("CODRII" SCIENTIFIC RESERVE)

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It is known that one of the decisive factors of the survival of any animal species (including the newt that we monitored), it is the ability to reproduce or, in other words, so-called *reproductive success*. Regardless of what type of measurement methodology we apply, reproductive success remains one of the essential biological parameters and its degree of manifestation depends on several biological and ecological factors, as follow:

– the prolificacy of species;
– density of breeding eggs deposited in the reproduction basin;
– the microclimate conditions of the breeding basin;
– predators actions over larval population;
– spatial and nutritional competition of newt larvae slashed with other symbiotic species of amphibians.

In this research we aimed at assessing the environmental status and the prospects of species survival, and it is based on relevant data of the biotic potential (i.e. individual prolificacy or population prolificacy) of individuals, their ability to achieve reproduction, and reproductive success obtained in those ecosystems or other environmental conditions. Usually, biotic potential is determined by prolificacy (which varies both at the individual and at the population, depending on the environmental status of individuals and/or populations) and reproductive success – by the number of offspring produced by a female in each reproduction season (*absolute individual reproductive success*) or the number of followers of the population over the total number of eggs laid by all the females of this population (*the relative population reproductive success).* In both cases the index of reproductive success provides important data to assess species' capacity to perpetuate. Therefore, one of the ultimate objectives of our research was to evaluate the reproductive population success of the species *Triturus vulgaris* in the ecosystems of Central forest highlands. As a model for this research, we chose a breeding population from the basin area „Crossroads Ciuciuleni". According to obtained data during the period of 2007-2010, the relative reproductive success of examined population of *common newt* is considered rather high and measured at 3.2 to 4,1%. During this research period, our annual calculations showed that 34-45 female (average 39) reproduced and laid eggs in three different and time defined stages: the density

of deposited eggs for the entire reproductive period makes 29-49 eggs/m^2. Taking into account the number of breeding females, the average prolificacy of female, the number of ovopositations and other quantitative parameters of reproductive success, we calculated the total number of eggs laid annually by females ranges between 5700 to 8400. It was established that the average hatch rate of embryo is 89.3%, and thereafter, the mortality of larvae at different stages of development rate reaches 13.3%; as a result, the number of offspring who successfully complete metamorphic process was 3.6 % in 2007, 4.1 % in 2009 and 3.2% in 2010, or respectively 205, 344, 163 followers, the last one representing, in fact, an absolutely reproductive success of the examined population. The individual reproductive success, as shown, is six followers to a female in 2007, eight followers to a female in 2008 and four followers to a female in 2010.

According to our results, we conclude that the reproductive success of *T. vulgaris* is slightly lower than of notched newt (i.e. 4.4 to 5.3 % or 9 to 10 descendants at a female), but still quite high compared to the reproductive success of other native species of amphibian populations (equal to 1.3-2.1%), which, once again, confirms our previous inferences about the high degree of longevity and optimal and relatively constant number, and, therefore, of good ecological condition of examined population and habitats.

Common newt has developed during its evolution a suite of complex and specific behavior, the successful implementation of which depends on certain environmental endogenous and exogenous factors as well as on ecological plasticity of expression thereof in various ambient conditions that, eventually, ensure some reproductive success for its populations, which largely depend on population perpetuation in time and space.

Early and long reproduction, selectivity of reproductive stations territorialism and behavior of male courtship to attract females, the care for offspring, differentiation among populations of larvae after growth pace and development, the use of ecological specific niches - are indispensable elements of reproductive strategy of the common newt, which enabled it to reach an optimal reproductive success (5-7 followers per a female or 3.2 to 4.1 % of the total number of laid eggs), meant to ensure the survival of the species in the existing conditions of monitored ecosystems.

COURSE SYLLABUS "THE IMPACT OF CLIMATE CHANGE ON FOREST"

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This research consisted in designing of basic, advanced and specialized syllabuses for the course "The impact of climate change on forest" in context of the International Project 543946 TEMPUS-1-2013-1-ES-TEMPUS-JPHES "Support for Vocational Training in Sustainable Forestry — SUSFOR" 2013–2016. To attain this objective we first describe some of the emerging international issues relating to the impact of climate change on forest. Then we assess the Lifelong learning (LLL) system in different regions of the world. Also, we analyze degree curriculums and syllabuses from faculties of environment and natural resources. Finally, we propose the *basic module* "The impact of climate change on forest" to develop management practices to enhance forest carbon sequestration for the mitigation of climate change. The target group consists of land owners and everyone – from those who are in employment and seek self –fulfillment in learning to those in phases of 'non-paid' work, those who wish to use education to re-engineer their lives and their careers to people in their third age (to foster talent and more accommodating to weak learners); companies' workers, anybody interested, forest owners, forest trainers, forest workers, vocational students.

Graduates on the impact of climate change on forest should be able to understand the contribution of deforestation and forest degradation to climate change and how to organize the management of forest resources for multiple uses and multiple values. The main objectives of the course are to provide to the students the most relevant conceptual bases of the impact of climate change on forest. Part of the program is devoted to forestry management responses to climate change. It covers all relevant aspects which are applied to sustainable forest management. It is intended that, once completed the course, the student has assimilated the theoretical and methodological bases which enable himself to access and understand the new discoveries and developments during a Lifelong learning (LLL) system to improve knowledge and skills of adults in the academic discipline of forestry. Students who pass the curse must achieve knowledge of: likely interactions of climate change impacts on forestry; examples of beneficial or stressful climate change effects on forest ecosystems; variations in observed and projected climate changes and intensity of changes for regions around the country; how changes in precipitation patterns, snow cover, and stream flows have been occurring around the country and are expected to continue changing during this century; the drivers of deforestation and forest degradation and solutions to reverse deforestation and forest degradation; how temperature and precipitation changes

may affect vegetation and wildlife habitat ranges; how to mitigate and adapt to climate change through sustainable forest management. The *advanced module* in comparison will focus more on the forest governance and climate-change mitigation with a target group of foresters and agricultural entrepreneurs who want to receive the higher qualifications. Graduates on that module should be able: to observe the reality of climate change; to manage forests as a complex adaptive system; to adapt forest governance for climate –change mitigation; to understand connections between climate change, water and food security; to take decisions as forest policy-makers for integrating climate change into national forest programmes in support of sustainable forest management; and to create a dialog among different stakeholders in context of climate change and ecosystem services. In addition, students understand the demands and needs of interdisciplinary co-operation in forest governance and climate-change mitigation. The *specialized module* will particularly emphasize the role of wildlife in a changing climate. Target group will consist on entrepreneurs who want to gain more knowledge on a particular wildlife-climate topic. Students of this module must have skills to organize the management of wildlife resources for multiple uses and multiple values in a changing climate. Successful entrepreneurs must be able to communicate with the full spectrum of forest users and those who value wildlife resources. They must be able to propose management solutions that are compatible with the biological and ecological processes of the forest and wildlife in a changing climate yet are sensitive to the cultural, social and economic forces that shape forest policies. Although climate change has already been observed and monitored over several decades, there are not many long-term studies on how the phenomenon is affecting wildlife. There is growing evidence; however, that climate change significantly exacerbates other major human-induced pressures such as encroachment, deforestation, forest degradation, land-use change, pollution and overexploitation of wildlife resources. Methodology for all mentioned modules comprise lectures, seminars, laboratories (in the forest) and guided activities. Evaluation will consist on grading system and grading weight of lectures, seminars, report after laboratories based on the field inquiry, an essay and exam by the end of the course. In the end we would like to emphasize that approaching the issues of climate change requires a wide array of expertise, innovative ideas and understanding of the scientific facts. Education for sustainable development, is a new vision for education that aims to "integrate the principles, values, and practices of sustainable development into all aspects of education and learning with a goal to encourage individuals in all countries and contexts to understand the complexities and synergies of the global problems we face, including climate change, disaster risk reduction, biodiversity loss, poverty reduction, and sustainable consumption.

SHORT ROTATION ENERGY CROPS PROMOTED BY THE STATE FORESTRY ENTERPRISE „TELENESTI"

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Moldova almost entirely depends on imported energy and, thus, cannot fully ensure its energetic security. One of the ways to reduce such dependence is the intensification of woody crops production. Biomass energy produced by fast growing species has a promising potential for some areas and may contribute to access important amount of bioenergy for local population (e.g. fuelwood, timber for households need etc.).

Main indicators of an energy plantation imply high caloric properties and biomass production per a hectare during a short period of time. Such crops should be carefully selected based on their compatibility to specific local conditions. In some cases, biomass harvesting can happen just after two years a plantation was established, and a life time of such plantation can be 25-30 years.

Moldova has many areas that are either not put into proper economic/agricultural use or abandoned, including lands located in the valleys of rivers and water ponds, which can offer suitable conditions for fast-growing poplar and willow or other species. There is an important portion of land that is degraded (circa 800 thousand ha, of which 120 thousand highly eroded), which can also be targeted by those who want to establish forest vegetation, including based on fast-growing species.

Assisted by FLEG project, the state forestry enterprise (SFE) Telenesti launched in 2014 a sustainable bioenergy campaign and created two primary plantations (so-called "mother plantations") based on 'poplar' forest reproductive material provided by the neighboring Romania. A total of 4000 one-year seedlings of fast-growing hybrids/clones of poplar (cultivar type I-45/51, Sacrau 79, Toropogritzki, I-69/55) were planted in the nursery, and this material was already tested and homologated in Romania where conditions are very similar to those of Moldova (see Table 1).

In 2015-2016, two pilot plantations were established outside the nursery - one covering 0,72 ha on state land administered by the SFE Glodeni in Falesti district, and the other one covering 0,48 ha on private land administered by Revic-Grup LTD in Ungheni district.

SFE Telenesti organized several workshops by inviting state forest owners, local public authorities, private agents, where it presented preliminary results, shared thoughts and collected opinions. A guidebook and other informative materials were developed and the website operated.

Though SFE Telenesti nursery is rather obsolete in terms of machinery and technical provision, it is active in promoting a diversified forestry. It still produces seedlings of circa 30 species of trees and shrubs mainly for state forest entities, but they also cooperate with other stakeholders across the country. It will continue to work on diversifying the sources of income in order to ensure economic and social sustainability of the company as well as maintain managed forest resources at a rational level of use.

Short-rotation forestry (SFR) can be regarded as a way to contribute to meet local people's need in wood and to produce more benefits to local communities as Moldova's population uses much more wood as primary energy than the forestry sector can supply.

In the conditions of high pressure on forests, SFE Telenesti wants to reduce dependence on logging by offering ideas for developing non-timber forest activities or other forms of economic but nature-friendly incentives, such as energy projects or diversified nursery production.

Another advantage of the SFR business is the creation of jobs (and income for families) and increased opportunities for advanced energy projects, such as locally handled heating schemes or small-scale thermal incentives (e.g. for public infrastructures, houses etc.).

Moldova has already set several 'energetic' objectives, such as 10% increase in biofuels use and up to 20% of renewable energy from the total share of energy by 2020. Energy plantations can also contribute to reduce from greenhouse gas (GHG) effect and, thus, to climate change impacts.

Table 1.

Comparative descriptive characteristics of four short rotation cycle poplar clones for bioenergy production to be operated by FE Telenesti within the ENPI East FLEG II during 2015-2016

Name	Origin / selection	Admission / Omologation	Growth performance			Wood	Vegetation	Resistance
			Diameter	Height	Volume			
Clone I-69/55 "Lux" (*Populus deltoides* Bartr. cv. «Lux» ex I-69/55)	Hybrid obtained in 1955 by Research Unit for Wood Production Outside Forests[1], Casale Monferrato, Italy	Romania, 1976; widely used in Shandong Province, China	7-year trees can reach an average of 22,4 cm	7-year trees can reach an average of 19,7 cm. In sites with high qualitative soil, annual growth is more than 2,5 cm	7-year tree can reach an average of 0,335 m^3	Soft, homogenous, mean density of 300 kg/m^3. Cellulose 52%	Early It grows well in various habitats in Danube Delta; heavy winds, clay soils	Tolerant to floods[2] (according to data from Romania, China)
Hybrid Clone I-45/51	Same location (Italia) as above, created in 1951	Romania, 1976	25-years trees can reach an average of 43,4cm	25-years trees can reach an average of 33,4m	25-year tree can perform 2,147m^3	Mean density 380 kg/m^3. Cellulose 49%		Sensitive to some diseases (Cryptogamic agents[3])
Clone Sacrau-79 (*P. x euroamericana)*	Wettstein, Austria	Romania, 1972	21-year tree can reach on average 49,2m	21-year tree can reach on average 31,9m	21-year tree can perform 2,43 m^3	Mean density 333 kg/m^3. Cellulose 49%		Moderate resistant to some diseases (Cryptogamic agents)
Clone Toropogritzki[4] (*P. x canadensis*)	Nizhny-Dneprovsk, Ukraine	Admission for production in Romania, 1993	In Romania, lower Siret river 11-year trees performed on average 32,3 cm in diameter and 21,1 m in height; at 21-year reached on average 47,3m in diameter and 3,?2m.			Homogenous, relatively white, mean density of 267 kg/m^3. Cellulose 52%		Very resistance to foliar disease and natural infections

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[2] Ecophysiologically, in the beginning of flooding it showed high level of photosynthesis, a high free water content and water use efficiency at reduced leaf conductances and leaf water potentials (Kebing Du, Lin Xu, Hua Wu, Bingkun Tu, Bo Zheng; 2012).

[3] These are leaf (and shout tip) parasites: *Melampsora* (*M. alli-populina* Kleb. and *M. larici-populina* Kleb.), *Marssonina brunnea* (Ell. et Ev.) Magn.

[4] The cone proved high preservation rate and a survival rate over 90% with a high resistance in Romania ("Poplars and willows culture and utilization during 2008 – 2011", Romania, Country Report. FAO, Bucharest, 2012)

ASSESSMENT OF LOST REVENUES FROM ILLEGAL FOREST PRACTICES

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Moldova's natural resources are scarce and sensitive to changes in environment. An inefficient policy of financing the sectors and institutions managing the natural resources is applied at the national level of public finances. This can lead to depletion of nature resources and forestry institutions and, that is the most dangerous, decrease harvesting versus regeneration.

Results of studies in the frame of ENPI FLEG activities in Moldova are presented here.

The forestry legislative framework covers practically all fields of activities in the forest sector including the competences of the central and local public authorities. Though, there are gaps, weaknesses in the legislation related to some important issues as insufficient elucidating of biodiversity conservation aspects and forest ecosystems' adaptability to climate change.

Unsustainable forestry practices are heavy for environment and costly for economy. In this regard, assessment of revenues losses from such practices is quite important.

Total area of logging in Agency "Moldsilva" increased 1.4 times during 1993-2014, and the area of major harvest – 8.2 times. The total volume of timber logging done by Agency "Moldsilva" increased 2.6 times during 1993-2014 with major harvest increased 5 times.

Cutting area as the result of open tenders has decreased 2.2 times during 2010-2014 due to including (by forestry entities) for tenders the parcels in low inaccessible areas, poor development of infrastructure for forestry services, technical and organizational weaknesses of potential beneficiaries, conflicts of interest and lack of mechanisms to control the application / participation in forest auctions, and probably due to a growth of the shadow wood market.

Volume of timber harvested on the basis of authorizations in forests under mayoralties grows in general (it increased up to 12.6 times in 2009-2014) although there was a significant decrease of such logging in 2014. However strict accountability is absent in that field.

About 60% of wood volumes are harvested in the Central Region (the main forest area), while considerable amounts are taken in South (the forest-steppe and steppe zones) – near 19%.

Estimative consumption of firewood in households exceeds felling more than for 415000 m^3 (near 67% of the total volume of legal logging including the volumes produced with tenders and authorizations in mayoralties) in 2011. That testifies to illegal / unknown origin of that wood. That amount of "unknown" wood is adjusted through taking into account use of woody biomass from orchards and vineyards and other ag-

ricultural wastes. The corrections per regions – North, Center and South are as 21.8, 25.4 and 19.5% correspondingly.

There is a significant volume of illegal logging in forests managed by Agency "Moldsilva" reaching a peak in 2011-2012 (more than 3300 of m^3). Data of revisions of 1991-1996 and 2010 show the operational control reveals a small portion of illegal logging. According to data of State Ecological Inspectorate number of the controlled objects is been reducing during 2009-2014 and number of the determined violations decreases, with a reverse trend in the South.

Payments of Agency's enterprises to the state budget have trend of increasing during 2005-2014 that corresponds to the trend of increasing the legal logging. For example, logging amounted 588.200 m^3 of wood in 2014, and 66822.600 MDL were paid in the country budget. Calculations show that each 1 m^3 of harvested wood brings 111.9 MDL to the budget. Taxes have their permanent part (not dependent on the volume of cuttings) and a variable part (VAT takes near 62% here), and size of the latter depends directly on the amount of legal cutting.

The amount of unpaid taxes for illegal wood was estimated for 2014 as 35.4 million of MDL (76.2%) that are not received in the state budget and 11 million of MDL (23.8%) lost by local budgets. Distribution of forest lands and wood transportation determine, maybe, territorial differences in distribution of share between the real felling and consuming, and unpaid taxes.

A part of the budget losses is remunerated through payments of fines and compensations for damage caused by illegal logging. On the whole, number of the inflicted fines had increased 3.7 times and the number of received fines – 2.4 times during 2009-2014, indicating a decrease in efficiency of control measures. Recovering through Court and remote reporting but also different qualities of the made documents explain that difference partly. Volume of recovery through fines and penalties for damages from illegal use of forest resources for the period 2009-2014 is about 5 million MDL. There is a trend of increase of amounts of such payments.

Estimation of losses due to inefficient use of hunting resources was derived summing: (1) the net economic deficiency of income (of hunting users) from the sale of licenses for hunting and (2) the deficiency from kill of the game animals by hunters. It was calculated issuing from the optimal population of wild boar (4000), expected to 2014 populations of roe (16000 of optimal 20000) and of red dear (600 of 2000) following the carrying capacity of habitats.

The total calculated deficiencies for 2014 are: direct losses from diminished number of the wild boar – 7 million MDL, indirect losses of hunters – 12,98 million MDL plus 28000 USD for probable trophies. Thus, financial damage and deficient income due to poaching and poor management are near 20 million MDL plus 28000 USD. Indirect losses from unsold licenses are 4.7 million MDL. A compensation to budget takes place due to control of poaching. It was 83100 MDL of the collected fines in 2014 while the inflicted amount of fines was 153.200 MDL.

It should be noted that all losses are considered as the missed (or potential) incomes or the loss of profit.

PARTICULARITIES OF CREATION OF THE ENVIRONMENT-STABILIZING NETWORK IN MOLDOVA

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Establishing the «environmental framework» has a special significance for current conditions of Moldova where «key areas of sustainable development» should be recognized as the highest category in the land planning practices.

The main idea for projecting and designing the environmental protection facilities is the need to restrict economic activities and protect (totally or partially) certain areas of geographic space for carrying out of some specific ecological functions. Such measures include (Dyakov & Doncheva, 2002):

preservation (biodiversity conservation of standard and unique natural systems);
regulation (maintenance of ecological balance); and
recovery of certain types of natural resources.

At the same time, it needs during organization of environmental protection facilities to take into considerations a general natural law that may be formulated (Hilmi, 1966) as "a separate system functioning in an environment with organization level below than the level of the given system is doomed to be "dissolved" in that environment".

Theory of the island biogeography comprises similar statements that changes in character of island biota take place due to isolation and lead to floral and faunal depletion, increase of density of some species and of their ecological niches, to a gradual decrease of species diversity (effect of insularization).

This circumstance has particular importance for Moldova with its' extremely high degree of land transformation due to economic development history and the low percentage of Protected Areas. Meanwhile, rate of species extinction depends directly on sizes of a Protected Area. The smaller size of these areas and higher the degree of their isolation, the more intensively so-called "faunal collapse" becomes apparent (Dyakov & Doncheva, 2002).

One of the ways to minimize effect of the "faunal collapse" is reduction of the isolation effect by decreasing the anthropogenic impacts upon surrounding landscapes, organization of ecological corridors and creation of buffer zones. An optimal buffer zone area may be calculated as (Sukhanov, 1993):

$$A_2 = \left[(1 - Z)^{-1/2} - 1\right] A_1$$

where " Z " is constant; " A_1 " and " A_2 " are squares of the Protected Area and its' buffer zone respectively. When Z = 0.25, A_2 is 2.16 times more than A_1. If Protected

Area has shape of a circle with a radius R_1, the buffer zone should have a shape of the ring with its' outer $R_2 = 1.78R_1$. If a Protected Area has the polygonal boundary, then the optimal value of its' buffer zone is calculated using the coordinates of angles of the polygon that approximates boundary of the Protected Area (Sukhanov, 1993).

The total calculated square of buffer zones of forest areas in the Republic of Moldova should take about 18% of the country. Combining the total forest area and total area of the buffer zones, we get an area equal to about 27% of the country surface, where some regulation of economic activities is necessary in order to provide the territory's ability to carry out the environment-stabilizing functions. This is another evidence that optimization of natural-economic balance is necessary in order to maintain the environmental sustainability of the country through increasing the share of the environment-stabilizing areas.

Besides, configurations of boundaries of Protected Areas are important and are to be taken into account. Theoretically, the optimal configuration is capable to ensure representativeness of natural systems, maintain biodiversity and necessary stability covering the least area. The most suitable shape is a circle, which, of all the geometric shapes of the same area, has the smallest perimeter. This reduces length of boundaries of protected areas and a number of points of contact with the adjacent natural and transformed landscapes. In addition, the circle shape minimizes the distance of moving within a territory that is important for migrations of various species (Sokolov et al., 1997).

The above mentioned factors should be taken into account during formation of the environment-stabilizing network that would provide a higher nature conservational benefits on the background of deficit of areas, which may be withdrawn from economic circulation in order to maintain the ecological balance of the territory of Moldova.

ECO-FOREST COMMUNICATION AND SOCIAL AWARENESS: FLEG-MOLDSILVA SUCCESFULL CASE STUDY

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Nowadays the topic of formation of ecological culture and awareness is of particular relevance for the Republic of Moldova. Effective awareness and communication programs should take into consideration the conservation context (meaning biodiversity and threats it is facing), societal context (society, culture, political and economic aspects) and implementation context (the large public as a whole and strategic objectives). It is also important to consider intellectual and spiritual development of each individual as part of key audiences.

Besides the very forest-technical activities, FLEG made also an effort to communication forestry issues with the target audiences and the large public. For this purpose, a communication platform was launched and a partnership between FLEG (through also Advertising company Antis-Media SRL) and Agency Moldsilva built since 2010. In 2011, as a result of this partnership, for the first time in the history of Moldsilva a Division of Public Participation and Information was established at Modlsilva's headquarter. When FLEG started to help Moldsilva improve its communication strategy in 2012, things change and more information was made available to the large public – and this was possible because most of activities have been implemented together with Modlsilva and its 25 forestry enterprises.

Of course, the website of Moldsilva (www.moldsilva.gov.md) was remodeled in 2012. In 2015, Antis-Media jointly with Modlsilva conducted a comparative analysis of website statistics and showed that: – 385300 visits were registered for the old site of Moldsilva covering 3-year period of 2009-2011, and 1305448 visits for the new site developed under assistance from FLEG and covering the following 3-year period of 2012-2014 were. This is almost 3 times higher than it was before FLEG implication.

Only in 2014-2015 a number of local and national-wide events were organized - such as Beech festivals, interactive lectures with children, dialogue platform with the public, contests for art fine schools and sport clubs, international day of children, international day of forests, Europe Days in Moldova, production of written and video-materials as well as attracting more mass-media experts/institutions to forests and forestry sector.

A comparative analysis of Moldsilva's website – in 2014 and 2015 – showed there is a distinct increase in number of visits in 2015. If in 2014 Moldsilva's website was visited 621789 times, in 2015 this number increased to 931603 visits - the difference of 309820 visits (33%) shows clear interest in forest topics and openness of forest institu-

tions. Half of top 10 news covered direct FLEG activities (among them wood flow, forest lease and forest benefits were the most popular topics).

Another comparative analysis for the recent 6-month period of January-June in 2016 has increased compared with the similar 6-month period of 2015, the minimum difference of visits between 2016 and 2015 was for the January – 927, and maximum difference between 2016 and 2015 was for June – 6590 (see Table 1).

Table 1. Statistics of users-visitors of Moldsilva's website for the period of 6 months of 2016 and 2015 along with trend/difference

	January	**February**	**March**	**April**	**May**	**June**
2015	12531	11623	12419	12766	13149	9339
2016	13458	15454	16387	16430	16932	15929
Trend	≤927	≤3831	≤3968	≤3664	≤3783	≤6590

Starting from 2014 under FLEG assistance, Moldsilva developed annual "Forest Knowledge and Communication Plan", which included dozens of activities and partners or participants. All these made Moldsilva develop a Communication Strategy of Agency Moldsilva for 2015- 2018, done in compliance with national legal requirements and under guidance from FLEG.

Also in 2015 for more effective communication with the large public, social platforms like Facebook and You-tube were involved as well as web-page (www.ecopresa.md), where social video spots were placed: "Children are the forests" a film about what are the forests through children's eyes and "Living with forests", both created by Antis-Media with support of Agency Moldsilva and Forest Research and Management Institute.

All these show the large public seemed to have started paying attention to forest problems. Wood flow (from origin to final beneficiaries, and its logging) and forest lease (a recent practice to make use of recreation and hunting) are always among the most sensitive issues.

As forests are not only trees and wood as it is commonly believed, they are much more than that, and this still needs to be brought to the large public. FLEG built a partnership to try to draw public attention to the current environmental situation, to raise the level of environmental awareness, and form an eco-culture; eventually, to instill love and respect for nature along with a responsible attitude.

IS WOOD HARVESTING PRACTICES IN MOLDOVA SUSTAINABLE?

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The FLEG I program has conducted in 2010-2011 an analytical study on real wood consumption in Moldova and the estimations for annual domestic wood consumption were rather different than previously thought. Thus, for 2010, the annual consumption of wood and other woody or agricultural organic biomass was estimated at approximately 1,4 million m^3, of which the consumption of only fuelwood was around 1 million m^3, the rest being organic biomass from agricultural fields. For comparison, the annual increment of Moldovan forests has an estimation of circa 1,2 million m^3, with a total volume of standing timber at 46 million m^3 and average annual growth at 3,3 m^3/year/ha (according to data from Agency Moldsilva).

The public opinion barometer, undertaken in parallel with the investigation on real wood consumption from domestic forest vegetation, showed that circa 80% of the population uses wood as primary source of energy (mainly heating and cooking and other needs) and only 3% of local population responded that they have used wood for commercial purposes.

Another study undertaken by FLEG during 2010-2011 on illegal logging magnitude has revealed around 16 thousand m^3 of wood believed to be illegally harvested (according to official data from Moldsilva and State Ecological Inspectorate), which is very low amount compared with the estimations of real wood consumption. However, calculations of this study showed an interesting trend for the period of 2010/2011per 1000 ha of land covered with forest vegetation – average of 12,8 m^3 in lands managed by Agency Moldsilva (circa 80% of all country's forest resources) and 225,5 m^3 in lands managed by local public authorities (circa 20% of country's forest resources).

An alarming sign that Moldovan forests face troubles because of poor management (an human factor) and impacts of changes in environment (droughts, pests, ice rains etc.) is just undeniable. Various data provided by Moldsilva and ICAS indicate on the fact that circa 70-70% of tree stands are of coppice (vegetative) origin, which, without doubt, is the result of a unsustainable, already traditional, use of forests. Nor the overwhelming use of forests as primarily a source of energy can be considered sustainable at all.

Recent prognosis of the possible impacts of climate change on Moldova's forest ecosystems (2014) have forecasted that large areas of stands will be dying out because of increased level of annual temperature and decreased level of precipitation. The most severely affected region seems to be Southern districts, where forest vegetation is the lowest in the country. One can also expect shifts in species composition and range, when species of broader ecological plasticity (and possible resistant to droughts and climate metamorphoses) would substitute the ones with lower capacity for adaptation.

Eventually, exotics might invade available habitats and produce irreversible changes to local biodiversity.

Taking into account that the natural oak-type forests count for approximately 40% of all forests, which almost matches non-native acacia plantations (circa 38% of all forest vegetation cover), it is vitally important to maintain a rational balance between existing natural formations and introduced species.

Those studies were not meant to blame Moldovan authorities, but rather to inform forestry institutions and the large public that illegal logging is a serious issue, and there is a problem that directly indicate the use of Moldovan forests is not sustainable. All results of FLEG studies were published and made available to the large public.

Moldovean authorities should take careful decision on the use of local forests in order to meet still increasing demands in forest products for communities and businesses, from one hand, and to maintain forest ecosystems viable to produce their multiple functions, from the other hand.

ECOLOGICAL FORESTRY – A LONG-TERM ECONOMIC OPTION FOR MOLDOVA

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In brief, the philosophy of "ecological forestry" is the close-to-nature approach to forest management at landscape spatial scales while forest ecosystems continue to provide wood products, non-timber forest products (NTFPs) and other ecosystem services. Forest science has always been seeking for ways to develop congruent practices. Natural models of stands development along with forest disturbances, as a result of interventions and applied practices, are of huge interest for forest practitioners.

The three pillars of the forest science – *ecological* (soil, water, biodiversity), *economic* (production, income, wood, NTFPs) and *social* (ownership, jobs, industry) dimensions, are the basic fundamentals of decision making process to ensure sustainability.

Humans have long before the first use of term "ecology" (Haeckel, 1866) undertaken exploitation activities of natural resources, including of forests, which initially had been utilized mainly for economic reasons without taking into account possible ecological consequences. Though traditional "industrial forestry" may seem to contrast with the "ecological forestry", the difference is not always clear.

In case of Moldova, with circa 80% of stands being of coppice (vegetative) provenance and the area of oak-type forests (circa 40%) almost matching plantations based mainly on introductions (circa 38%), the forestry practices may be regarded as unsustainable and neglectful of natural processes. However, established 'energy' plantations, mainly based on exotic species (such as acacia species, clones/hybrids of poplar, willow etc.) can reduce the pressure from so-called natural forests or more ecologically sensitive forests (mainly oak-type or mixed with other broad-leave species). To compare these two, i.e. traditional (industrial) and ecological forestry, one should count with what has been done in the past (including failings) and what is to become the new modern "era" in forestry. An example can be the historical inheritance tradition in 'forester profession', when parents worked for generation in forests and children inherit such important skills. Moldova has (as other countries across the world) many stories like this, and they should be highly appreciated when tackling "ecological forestry" as it owes a lot to previous generations of foresters.

The use of the term "forest functionality" or "multi-functionality" implies also that a forest produces a number of functions (ranging from pure economic as wood/timber to fresh air, clean water and spiritual ones). However, to fully ensure that range of important functions, forestry management should follow natural processes as far as possible. Human factor is extremely important as the success of an "ecological for-

estry" greatly depends on the understanding of such processes and their proper appliance in practice. Educational aspects based on comprehensive ecological approach to forest disciplines are important in creating skilled professionals and broad thinking specialists.

ENPI FLEG project helped Moldovan forestry institutions not only to improve the legal-normative framework, but also assisted them in training forestry staff and in establishing the National Forestry Consultancy Office, which has an objective to provide guidance and assistance to all stakeholders. Though normative framework contains well-founded instructions to forest biodiversity conservation and management, law enforcement associated with poor understanding of what an "ecological forestry" is still remain a huge problem.

From approximately 465 thousand ha of forest lands of Moldova (data of National Bureau of Statistics, 2016), circa 200 thousand are considered being of natural origin (at least for the last century or so), the rest being reforested or newly created, mainly on abandoned or degraded lands. The term "ecological forestry" is applicable to both types – natural (semi-natural, not untouched) and plantations.

It is extremely important to have a long-term vision and clear objectives for the future with regard to existing forests of Moldova. Ecological forestry is based on environmentally-friendly principles that heavily rely on natural processes rather than short-term practices or quick income. Both decision-makers and foresters should find a balance between short-term economic benefits and long-term economic benefits of the forest. It depends on case to case, but a sustainable forest ecosystem can provide more benefits in the future. It takes many years to create or maintain a forest, but it can take a jiffy to destroy it.

ROVE BEETLES PREDATORY OF THE *ONTHOLESTES* GANGLBAUER, 1895 GENUS (*COLEOPTERA, STAPHYLINIDAE, STAPHYLININAE*): THEIR IMPORTANCE AND DISTRIBUTION IN THE REPUBLIC OF MOLDOVA

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The predatory staphilinids from the fauna of our country as other beetles which are represented by predatory species, are an interest group for aplication of biological methods.

According to many authors (2-3), ontholestines group species have an accentuated potential in eating other insects, different as dimensions and biological stages. This was noticed by me personally in Cocieri community of Dubasari District during the summer of 2015. I was hunting on cattle dung heaps when I observed how a specimen from *Ontholestes* genus captured a fly and quickly retired in galleries.

The species existing in general list of stafilinds and which follows to be discussed in this paper are three in number: 1) *Ontholestes haroldi* (Eppelsheim, 1884), 2) *O. murinus* (Linnaeus, 1758) and 3) *O. tesselatus* (Geoffroy, 1785), taxonomic belongs to the *Ontholestes* genus from *Staphylininae* subfamily.

The importance of ontholestines species in nature: - contribute to decrease the insects pest density population and to the their appearance in mass through consumption of biological stages (egg, larva, pupa, adult) and/or coprophagous species, etc. For example, (Petrenco, 2013) tracked the behaviour of *Ontholestes murinus* species comparing to coprophgaous beetles from *Aphodius* genera (Scarabeidae: *Aphodiinae*). Capturing the coprophague beetle was manifested in 2 stages: in the time of flight and at the time of seating on substrate when the wings are easily semi-open.

For ontholestines „the favourite menu" are the sinantrop flies and aphids, the explication being the soft structure of the body; - the bodies of matures individuals and biological stages of development to the ontholestines through natural death, contribute in pedogenesis process like a positive factor for biocenose; - participate in the destruction of dead animals in a certain order, it is an phenomenon observed gradually by waves of appearance. The 3rd wave is represent by appearance of beetles including the species from *Ontholestes* genus. They fly on the body (in stage 3-9 months) after the appearance of flies from different genres (*Sarcophaga*, *Phormia*, *Eucalliphora*, *Calliphora* etc.) (1); - after Rehfous (2), the beetle *Ontholestes tesselatus* was observed and on the mushrooms species *Lactarius piperatus*, *Boletus luridus*, *Boletus scaber*, *Russula foetens, Hydnum imbricatum*. By trend to populate, itself manifests as predator, consuming the insects considered pest of mushrooms.

The distribution on the Republic of Moldova territory. From the examined material, the species *Ontholestes haroldi* was observed and colected in the following points: Lunca, Dubasari District, 31.05.2009 - 2 ♂♂ on grassland, cattle dung; Brinzeni, Edinet District 01.06.2010 - 4 ♂♂ forest, trap of soil, Barber typ; Lozova, Straseni District, 21.06.2011 - 5 ♂♂, 06.07.2011 - 1 ♂ natural reserve, forest, trap of soil, Barber typ (leg. I. Mihailov).

Ontholestes murinus. Molovata Noua, 26.06.2008 - 6 ♀♀ grassland, cattle dung; Cocieri, 28.06.2009 - 2 ♀♀ grassland, cattle dung; Vasilevca, 30.05.2009 - 1 ♀ cattle dung; Lunca (Dubasari District), 31.05.2009 - 2 ♀♀ cattle dung; Brinzeni, 14.08.2008 - 1 ♂, 24.08.2008 - 1 ♂, 03.09.2008 - 3 ♂♂, 13.09.2008 - 2 ♂♂, 21.07.2010 - 3 ♂♂, 20.08.2010 - 2 ♂♂, 30.08.2010 - 2 ♀♀ forest, trap of soil, Barber typ; Zabriceni (Edinet District), 21.07.2010 - 4 (1 ♂, 3 ♀♀) forest, trap of soil, Barber typ; Lozova, Straseni District, 21.06.2011 - 34 (17 ♂♂, 7 ♀♀), 06.07.2001 - 5 ♂♂ natural reserve, forest, trap of soil, Barber typ; Chitcani, Slobozia District, 01.07.2011 - 2 (1 ♂, 1 ♀) forestry strip; Balatina, Glodeni District, 24.07.2011 - 27 (5 ♂♂, 22 ♀♀) grassland, cattle dung (leg. I. Mihailov).

Ontholestes tesselatus. Tipova, Rezina District, 28.08.2010 - 1 ♂ canyon, cattle dung; Lozova, Straseni District, 21.06.2011 - 1 ♀ natural reserve, forest, trap of soil, Barber typ (leg. I. Mihailov).

In conclusion, I mention that these representatives of the genus *Ontholestes* are included in the general list of staphilinids. As evidence of confirming collection of specimensis the collection of the Museum within the laboratory Entomology and Apiculture, every species are stored after specifically requirements. The presence of ontholestines in the habitat of our country, constitute an example to direct contribution in the function and circuit entire ecosystem vitality. Presence of ontholestines in the habitat of our country, constitute as example to direct contribution in the functionality and the circuit of vitality of whole ecosystem.

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DEVELOPMENT AND LARVAL GROWTH RATE PARTICULARITIES OF SPECIES *TRITURUS VULGARIS* IN THE ECOSYSTEMS OF RESERVATION „CODRII"

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In result of analyzing the rhythm of growth and development of common newt larvae (*Triturus vulgaris*), as shown in Fig.1, we have established the following:

1. The growth rate of the species in the time between 1-35 day of ontogenesis (in the stages of development 1-4) it is one exponential, dimensional growth being 0.8 mm daily, this fact demonstrates the existence in the breeding stations of investigated water basins, as well as, favorable conditions in terms of food and the microclimate. No less important in this regard is the lack of competition trophic and spatial intra- handed between the larval populations of common newt with those of notched newt (*Triturus cristatus*), which is because they are first operating in vital sectors less deep aquatic habitat and submerged denser vegetation.

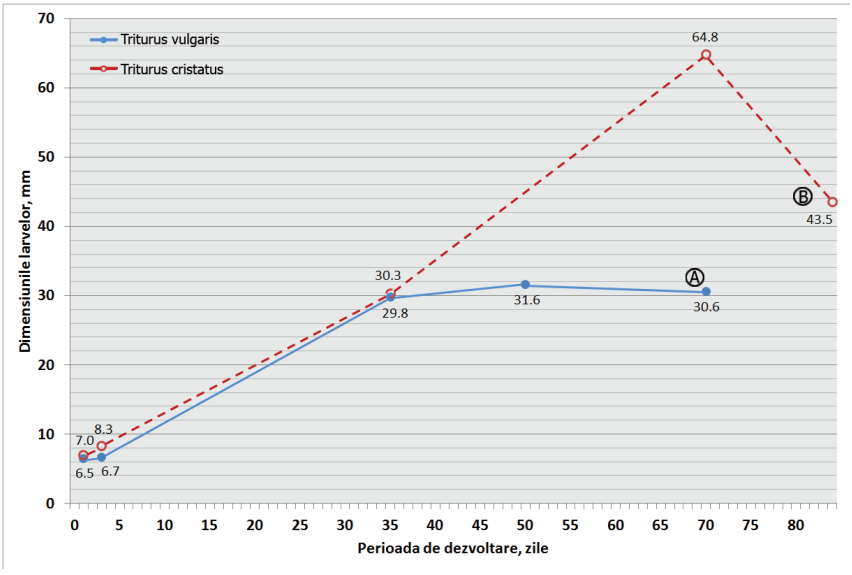

Fig. 1. The rythm of growth and development of common newt larval populations and notched newt (Reservation „Codrii „, lake „Crossroads Ciuciuleni").

Note : (**A**) common newt ; (**B**) notched newt

2. In the second period of ontogeny (from 35th until 70th day) is observed practically a halt in the growth rate (larvae size remaining in fact, almost the same), given as the common newt larvae enters the final stages of development pre-metamorphic and metamorphic which are accompanied by certain changes in anatomy and physiology requiring more energy and plastic resources. As a result, the larvae complete their ontogenetic process, turning into juvenile whose body dimensions are 30 mm.

Comparing the development and growth rhythm of common newt with the notched newt (see curves **A** and **B** in Fig. 1), we note that the larvae of notched newt have a similar rhythm to that of species studied by us only at the first ontogenetic stage (the day 1-35). Later, however, the growth of notched newt continually increases at the same exponentially mode (while the rhythm of common newt is stopped from its entry into the ontogeny final phase) reaches the maximum value at the 70th day of development: larvae it is characterized by the most advanced body size - about 65 mm. After this they also are entering and in to final stage of metamorphoses diminishing their sizes up to 43.5 mm (size of fresh metamorphosed individuals), but they are much bigger than those of common newt juveniles (equal to 30.0 mm).

No less important is the fact that the notched newt do not feel a spatial concurrency and essential nutrient from other amphibian species that spawn in the same aqvatic basin. This is because notched newt reproduces itself with *Triturus vulgaris* , *Hyla arborea* and *Rana dalmatina*, was adapted to the new conditions of individual reproduction through the following features :

— nuptial games of the notched newt take place predominantly during the day time. Species of *Triturus vulgaris* having a relatively low density and being smaller, can not resist the oppression over the space exercised by *Triturus cristatus*;

— Larvae of *Triturus cristatus*, the predators and in a more advanced stage of development, with larger legally not compete with food for the larvae of *Triturus vulgaris* because they consume other prey.

— Also, because the larvae of these two sympatric species have different ecological niches, this allows them to minimize competition from living space required for the successful implementation of ontogenetic development.

Thus, we see that the two syntopic species of local newts (*Triturus vulgaris* and *Triturus cristatus*), besides the presence of certain similarities, there are obvious differences in the ontogenetic rythm, allowing them to coexist successfully in one and the same natural habitat.

EVALUATION OF FOREST ECOSYSTEM SERVICES (FES) IN MOLDOVA

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The Moldova forest sector's direct economic contribution was relatively small at just 0.27% to GDP in 2010. Additionally, the forests provide critical habitats for biodiversity and other essential environmental benefits such as soil protection, water regulation and carbon sequestration. Most sector analyses highlight the underused potential of the forestry sector. In particular this refers to (a) carbon sequestration valued at $460000 in 2011, (b) ecotourism, which is valued at $7.9 million per annum and employing circa 1400 persons, (c) watershed management reducing soil erosion and water costs valued at an net present value of $27.8 million over 25 years, (d) flood disaster mitigation valued at $19.7 million, (e) wood energy, which could be worth circa $2.25 million annually (5000 ha, yields of 15m^3 per ha annually and current fuelwood prices), and also its contribution to emission reductions targets.

All this untapped potential of the forests in Moldova triggered the need for evaluating and communicating the total economic value of the forests. During 2014-2015, FLEG II Program conducted a study that identified and described the main FES that are beneficial to Moldovan people. It focused on several important economic sectors in the country that have cross-sectional linkages with forests, such as agriculture, water management, tourism, fishing, natural disaster risk and climate change mitigation. The sector approach was an important methodological aspect of the research as it aimed at processing and presenting information that are quantifiable and relevant for specific decision makers in each studied sector.

Several conclusions can be made and emphasized in order to give them the necessary importance as arguments for all those interested, mainly politicians and decision makers, in their attempt to uncover true values of forests and find mechanisms how to contribute to sustainable development in general. All conclusions below can be used as strong arguments in favour of sustainable ecosystem management and not in support of current business as usual practices.

FES generate considerable values: The value of ecosystem services in tourism, forestry, agriculture, water supply, climate change and disaster mitigation were estimated at just under $68.84 million in 2014.

FES play an appreciable role in the national economy and development: In 2014, the quantified value of ecosystem services (taking into consideration only few sectors) equated to some 0.85% of GDP. This figure is 3 times bigger than the official figure representing forest sector contribution to national economy at 0.3%.

FES values accrue to multiple sectors, at many different levels of scale: In 2014, both public sectors and private sector benefited from FES values. Thus, for eco-tourism sector a 20% of the value was earned by the national budget, while 65% (or $1.5 million) was earned by private companies. In agriculture sector, only 8% of the benefits were earned by the budget ($1.7 million), while the private sector earned 89%.

Values generated by FES have a substantial multiplier economic effect: The income, consumption, spending, employment and cost-savings generated by ecosystem services have wide-ranging and knock-on impacts on the economy. For example, only ecotourism sector generate a total income, investment and spending in the tourist sector at $2.9 million, including capital investment in excess of $0.5 million, as well as some 500 full-time job equivalents.

There remain untapped opportunities to increase the levels of revenues generated from FES: Eco-touristic visitors are, for example, willing to contribute almost $0.32 million a year more than they are currently being charged as entry fees. Another example is from agriculture, where due to pasture under usage (under the carrying capacity) there is an untapped potential of $0.6 million a year. Increased public investment and policy action is required to capture these potential revenue streams.

Continuing to grant FES a low policy and investment priority will incur long-term economic losses: Continuing to carry out "business as usual" practices may cost Moldova's economy and population more than $21.3 million in total, over the next 25 years.

Law enforcement in Moldova is the first step to sustainable forest ecosystem management: Our data reveal that if illegal logging will disappear, the value added to the economy by forestry sector and related industries may count for 30% of more income to the state budget from forestry, under the condition of not overexploiting the ecosystems and by implementing a long term sustainable ecosystem management in forestlands.

Well managed forest ecosystems may reduce significantly the damages produced by floods, soil erosion and landslides: If the upstream protection functions of the ecosystems of ecosystems serve to minimize the impact of disaster by 10% below what it would have been in the absence of the protective functions, then the ecosystems' value of flood and landslides control in terms of avoided damage costs equates to an average of $0.4 million a year.

FOREST DEPENDENCIES OF LOCAL COMMUNITIES IN MOLDOVA

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Forests of Moldova represent an important source of energy for local populations and habitat for biodiversity, and offer important environmental benefits (e.g. soil protection, water regulation and carbon sequestration). Forests provide other provisioning ecosystem services as well. There is a long tradition among rural population to collect forest resources ranging from the tree branches to flowers in the spring. Forest fruits are collected and sold by the forest administrators as well as by the community members. If forest administrators record the collection and sale of forest products and thus allow the economic effect of these transactions to be estimated easily, then no control of the collections from the rural population, which makes difficult to quantify the relationship between rural population and forest products.

FLEG II conducted a study in three sample communities (villages): Ciorasti in Nisporeni district, Borceag in Cahul district, and Alexandru cel Bun in Soroca district. These communities were selected as an accurate representation of the three main eco-regions (north, south and central) that represent different types of forest cover areas. We conducted survey in each community, by 50 households per a community (150 in total), using a common questionnaire. We also collected relevant information for each community, including condition and use of natural resources.

According to official data, main source of income in all communities is agriculture. Our data showed the main source of income for local population is remittances, followed by agriculture, and then the forest. This is rather impressive considering that forest vegetation covers circa 13% of the country. Interestingly, in Cioresti village (with the highest share of forest) forest income was greater than the average (18.2%), while share of agriculture was lower (32.5%). Forest products represented 8.1% of the income in Alexandru cel Bun and 7.3% in Borceag.

Nuts, primarily walnuts, are collected across the three sample villages, and represent the most valuable forest product (53% share in terms of value) as well as the most frequently collected product (17% in terms of frequency of total collection). The walnuts are used for personal consumption and are sold to businesses that specialize in the export. These businesses collect the nuts from the rural population in exchange for cash, then centralize and export them.

Wood resources (pole/logs, timber, fuelwood and tree branches) represent the largest share of total revenue in terms of frequency of collection (34% (of total collections),

and the second largest in terms of total value (42%) to the communities. Tree branches are used for livestock fodder and rural constructions. The main use of logs is for household needs. Fuelwood is the main source for heating and cooking for the majority of the rural areas. Officially, fuelwood sold by forest administrators represents a small portion of total wood consumed for heating, suggesting on a high dependence on illegal sources. Wood (fuelwood, timber, branches etc.) is bought by population from forest district units (i.e. Agency Moldsilva), which regulate harvesting and sale processes. However, members of community perceive this transaction as an income and not as expenditure, which supports the idea that illegal logging may be occurring. We may conclude illegal activities are driven mainly by the subsistence needs of local people. This brings attention to the scarcity of forest resources in Moldova and raises questions of their sustainable use.

Our results confirmed that in poor rural communities, the lower the household income is, the higher the dependence on the forest is. The Relative Forest Income (RFI) (measured as forest income divided by total income) varied between 1% and 35% across studied communities. Other activities, primarily agriculture, represent important and diverse sources of income. A high RFI indicates on a relative closeness to the forest as well as less diversified sources of income. A decrease in the RFI slope is related to general access to agricultural resources

According to our data, there is a high dependency on forest among rural population. Although the main income source is agriculture, the low elasticity of the RFI variation over income quintile shows that forest dependency is common to almost all households and is related to the resource availability rather than to the socio-economic characteristics of households.

The fact that wood resources, especially fuelwood, are the most valuable (with a notable exception of nuts) and frequent forest product shows that from a household perspective, the forest is used primarily to meet households' needs and secondarily as a resource to supplement their income. The use of other resources, including nuts and forest fruits (such as rosehip, strawberry, etc.) and whether linked to cash value (as nuts are) or not, is driven more by the tradition than the market or other socio-economic factors. Fuelwood is obtained from annual tree felling regardless of whether the state forest administration is paid for this activity or not. The fact that the respondents included the fuelwood into the net incomes (but officially all fuelwood can only be purchased from the market), made us conclude there are sources of wood other than the official ones, including possible illegal logging activities supported by the forestry personnel. Considering the magnitude of these phenomena it can be assumed that such harvesting practice must also be linked to tradition.

RADIOTELEMETRY STUDY OF DYNAMICS OF SPATIAL ACTIVITY IN RED DEER (CERVUS ELAPHUS) POPULATED IN THE RESERVE „PLAIUL FAGULUI“

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Radiotelemetry method of VHF (Very High Frequency) type enable to determine in the conditions of forest ecosystems the spatial activity of individuals marked in minimum visibility conditions and hidden way of life of animals, along with the possibility of visual study of specimens activity. The method is relatively inexpensive, information obtained has satisfactory precision for most studies, the duration of the device working is long, and the method applicable to any vertebrate species, the disadvantage being only linked to the heavy work in the field. In addition to the information on the position and movements of the animal, this method is also suitable for getting other data (Mech and Barber, 2002). The purpose of the researches was the study of adaptation of red deer released in the reserve from reproduction enclosures into local populations and spatial parameters of territorial activity in the accommodation process.

The red deer (*Cervus elaphus*) – three male individuals with the age between 3 and 7 years old were released from the reproduction enclosure "Telenești" in scientific reserve „Plaiul Fagului“ (plot 24), on two of which were mounted collars with transmitters HLPM-3140, produced by the company Wildlife Materials Inc., with a guaranteed activity period of 380 days. For the location of specimens receivers TRX-16S from the same company were used, mounted on directed antennas of type "channel modulator" using triangulation method. In determining a location for deer at least three directions of radio signal reception are required, the points spaced at 200-600 meters, depending on the distance to the object. The intersection of these lines indicate the location of the animal, with precision ranging between a few tens and sometimes up to 300-500 meters in the conditions of the Reserve "Plaiul Fagului". Radiotransmitter activity permitted the investigation of the marked individuals during February 2014 - February 2016, the collars' transmitter is still working.

The first red deer male with age of 7 years old was released on February, 13, 2014 and marked with the transmitter on channel 14. The other two males of 3 years old were released on the same plot 15 days later, one being marked on channel 13.

In the process of adaptation to the new conditions the males selected the feeding area (pl.18), at a distance of 700-800 m from the release place, where there was a supply of hay, concentrates and minerals. During this period the individuals were displaced solitary and exploited each an area of about 35-40 hectares with daytime movements up to 300-350 m. After a 3-4 week accommodation period it was observed

marked males' inclusion within local groups of red deer. At the same time, toward the vegetation period (March) spatial redeployment of these groups occurs with their fragmentation into smaller groups (3-4 individuals). In late March the male marked on channel 14 was located to the west, in a group of 4 individuals (2 females and 2 males) at a distance of about 2500 m (plots 27, 35, 36) from the "accommodation zone". This shift was registered in daytime activity period during 8 hours. In April in male on channel 14 it was reported a leaving from the seasonal activity zone of about 300-350 hectares in open ground (grove island), at a distance of 4500 meters, crossing an area with old orchards, fallow and cultivated lands, being recorded on the seasonal activity sector (pl. 27, 35, 36) after 7 days.

The second male marked on channel 13 moved during this period at the eastern extremity of the reserve in plots 6-8 at a distance of 1200-1600 m from „accommodation area", remaining here from April to September, on an area of about 300 ha. In April - May period of 2014-2015 the individuals had a diurnal sector of 60-80 ha with its increase in June to 100-120 ha. Also, by early summer, a trend of selection of preferred trophic areas was observed, mostly at the ecotone: forest edge and nearby orchards grown with acacia. For resting the males retire in shrubs from lower area of the slopes with northern exposure, moving inside the forest at 900-1400 m.

By autumn (years 2014, 2015) and the beginning of reproductive period the males retire in wet areas of the lakes (pl. 29, 24, 17, 18), where they have a diurnal activity within an area of about 100-150 ha. It was found that during mating season both males occupied sectors situated far away from activity areas of resident males. In the winter of 2014 - 2015 and 2015-2016 the males were found in feeding area: plots 16, 17, 18 (channel 13) and plots 24, 29 (channel 14) in ecotone zone limited by meadow from lake area, where the altitude do not exceed 180-200 m. it should be noted that in spring of 2015 the males remained longer time period in refuge areas (up to end of April) unlike the same period of the last year, when red deer dispersed towards areas with higher elevations (270-380m) within the forest. During the summer of 2015 the males also moved to northern (C.13) and southwestern extremities of the reserve (C.14), where they find trophic resources in the morning hours in areas of ecotone with agricultural fields.

In conclusion it must be mentioned that red deer males released in the reserve "Plaiul Fagului" used annually on average over the study years 2014-2016 an area of about 500-700 ha, using sectors of 200-400 hectares – larger in spring-summer (300-400ha) and smaller in winter (200-250 ha). The territory of diurnal activity ranged between 80 ha (autumn-winter) and 150 ha (spring-summer). During summer the males moved to northern (C.13) and southwestern extremities of the reserve (C.14), where they find trophic resources in the morning hours in areas of ecotone with agricultural fields.

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IMPACT OF CLIMATE CHANGE ON FORESTS OF THE REPUBLIC OF MOLDOVA

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Due to its geographical position, landscape and socio-economic specificity, Republic of Moldova is extremely vulnerable to climate change. This vulnerability manifests in numerous economic sectors, including forestry. Climatic change features have been identified by studying the trends and variability of the basic climatic indicators. The study of the mean annual temperatures and precipitations have revealed that between 1887 and 2013 the average annual temperature had increased by 1.01°C and the average annual precipitation had increased between 1891 and 2010 with 54.74 mm (MENR 2013).

Future evolution of temperature and precipitations, as they have been modeled by the National Climate Change Office (as part of the global climatic model developed as a part of the 5th part of the CMIP5) shows that by 2100 Moldova will confront with the most significant temperature increase during the summer, from +5,9°C in the North up to +6,1°C in the South. The warming may be higher during the winter, from +4.2°C in the South up to la +4,6°C in the North. The same projections envisaged that the level of annual average precipitations will diminish with an average of 9.9% in the North and 13.4 % in the South. By the end of XXI century, the winters will become more humid and summers will become dryer (MENR, 2013).

European forests are subject to multiple pressures and can suffer from a series of damages from biotic and abiotic sources (WB, 2015). Nevertheless, it is almost impossible to establish how much of the impact is attributable to recent anthropogenic climate changes and how much is attributable to other factors: natural climatic changes, management measures implemented in the past, etc. Furthermore, the impact of climate change, which will have a clear latitudinal effect through the increase of temperatures and drought in southern Europe, is already noticeable in the altitudinal gradient. Species at the lower altitudes of mountains in Europe are already suffering from decreased precipitation and increased temperature (MOTIVE and Trees4Future FP7). Therefore, the immediate effect that climate change signals is the shift in the range of suitability for forest tree species across Europe. (Hanewinkel et al., 2012; WB, 2012).

Climate change will influence the moisture conditions in forests through changes in both temperature and precipitation patterns (WB, 2012). As the temperature increases, water loss through evapo-transpiration increases, resulting in drier conditions. Higher temperatures also tend to decrease the efficiency of water use by plants (WB, 2012). The potential lack of summer precipitation with consequent droughts is the main constraint factor on forest growth and productivity.

Temperature increase and changes in precipitation are the main factors predisposing forests to various insect pests and fungal diseases (MENR, 2013). The changed conditions may also determine unpredictable evolutions of insects and fungi populations. The demand of water during the growing season is normally larger than the amount of rainfall. This indicates that if temperature increase is not coinciding with increased rainfall, water could limit growth to an even larger extent than today (MENR, 2013). The impact on individual tree species can be either negative or positive depending on the site conditions and regional climate changes (WB, 2012)

In the last decade, indicators regarding the possible effect of climate change on Moldovan forests become obvious: in 2007 severe drought affected more than 80% of the country. This phenomenon brought considerable prejudices on approximately 19,000 ha or 5.5% of the forest land in the country, especially in southern and central Moldova. The drought affected about 20 species both native and non-native: common oak, sessile oak, pubescent oak, ash, sycamore, black locust, birch, pine, black pine. The most affected species was the black locust, 71% of affected areas being covered with this species (MENR, 2016). The drought in 2007 will have long term effects, its consequences being visible for many years to come.

For the forestry sector the following identified risks are considered to be high priority (MENR 2013): i) negative consequences for species sensitive to temperature changes; ii) changes in the regeneration rate; iii) changes in species sensitivity to water shortages; iv) changes in individual tree density; v) changes in the phytosanitary conditions; vi) changes in species composition; vii) possible increase in tree mortality. There is one opportunity associated with climate impacts on forest sector: increase in biomass production.

The current and planned research includes topics related to seedlings adaptation, biotic and abiotic damages, biological diversity (especially genetic diversity), protection functions of the forests as well as adapting forestry techniques and operations. Measures at forest stand level (regeneration, forest operations, harvesting) aim to reduce the risks of negative abiotic (fire, winds, drought) and biotic negative effects.

Building stabile and diversified forests should be a continuous measure, planned for improving forest stands stability by selecting correct species, origins and genotypes. Development and keeping diversified forests able to adapt to climate changes is a significant challenge and will need measures that include research in species selection, adaptive provenances as well as genetic research applied to native species.

STUDY OF STRUCTURE AND DIVERSITY OF THE COMMUNITIES OF SOME SMALL MAMMAL SPECIES IN "PLAIUL FAGULUI" RESERVE

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The structure of communities and ecological diversity represent the fundamental manifestations of species interaction. Diversity constitutes a peculiarity of the ecosystem itself, the main parameter of the evolution process being, at the same time, the factor that acts according to the principle of opposite connection. The importance of studying biodiversity resides in the possibility of clarifying the mechanisms of communities structure formation and ecosystems. Communities differ in number and species composition. According to the hypothesis of the edge effect there is a tendency of increase in species diversity and density of populations on the borders of communities. The theoretical maximum of diversity is recorded in places where biotopes are large enough and is a total length of their borders. The more heterogeneous the living conditions are within the limits of the biotopes or the linear parameters of the ecological niches, the greater the species number is in this biocenosis [2]. In the event of substantial deviations from the optimum conditions of existence within the limits of the biotope, the number of species is reduced and their number will increase in accordance with the rule of compensation. Thus, the number of individuals and the number of species are in an opposite relationship.

Investigations were conducted in "Plaiul Fagului" scientific reserve in various types of biotopes with different degree of heterogeneity [1]. Determination of specific composition and abundance of species of terrestrial vertebrates was performed using standard methods of relative assessment of the number - trap-nights. The following parameters were recorded in the captured animals: species, sex, age, physiological state and reproductive performance. The index of Patton edge effect [3] was calculated according to the formula: $EI = T + P / 2A\pi$, where TP - total surface area plus the length of the internal linear boundary of this area, A - surface and $\pi = 3.14$. The diversity of communities was determined using the Simpson index.

Of great importance for communities of mammals are the climatic conditions. In 2015 it was a deficit of rainfall and temperatures exceeded the annual average. The reserve "Plaiul Fagului" is situated in the geobotanical district of durmast, oak and beech forests, in the center of Moldova and falls in the leafy woods category [1]. The investigations were carried out in two sectors. The first sector, with an area of 8.97 km^2, was located in the eastern part of the reservation, on a slope to the northeast, and the second - in the south, with an area of 9.42 km^2, which included areas of for-

est, ecotone and meadow. Natural and anthropogenic conditions have influenced the differentiated formation and distribution of existing vegetation, which, in turn, determines a high variety of mammal species. The presence of some species of mammals was recorded, of which the following are characteristic: *Talpa europaea L., Sorex araneus L. Dryomys nitedula Pallas, Apodemus agrarius Pallas, A. flavicollis Melchior, Clethrionomys glareolus Schreber, Sus scrofa L., Capreolus capreolus L. , Cervus elaphus L., Vulpes vulpes L., Mustela putorius L.* Examples of rare species are: *Lutra Lutra L., Felis silvestris Schreber, Martes martes L.* Species of small mammals are in the depression phase of the herd. The coefficient of catching constituted 2% in the ecotone and 10% in the sector №1 forest. In sector №2 this coefficient constituted 3.3% and 6% respectively. The dominant species was *A. flavicollis* with 100% - in №1forest sector, the share of males being 100% and 66.6% respectively in №2 sector, where the females were dominant. Out of 21 species of the ord. Rodentia, depending on the habitat, it was established that the largest number of species (33.3%) was recorded in the meadow, and the lowest number (4.8%) – in the ecotone. Comparing the values of the edge effect index for both sectors, it has been established that the ecotone values are higher for the №2 sector (1.88) compared with the №1 sector (1.63). This is explained by a larger diversity of flora and the length of internal linear borders of the №2 sector. The relationship between the number of species and the habitat area offers the possibility of appreciating the specific diversity with the help of the index of specific diversity concentration. This index is maximal in the forest ecosystem (0.88) and is minimal in the meadow ecosystem (0.66) and has intermediate values in the ecotone (0.79). It was found a positive correlation between the diversity index and the index of aridity in the forest ecosystem (r = 0.98) and the ecotone (r = 0.97) and a negative correlation in the meadow ecosystem (r = - 0.96). This is explained by the impact of stronger droughts in the meadow. As a result of the catastrophic drought the diversity of small mammals community diminished, which was anyway minimal in spring (0.143) to autumn (0.083) in the meadow while in the ecotone and in the forest the growth was insignificant. Analyzing the structure of communities of small mammals in "Plaiul Fagului" scientific reserve in autumn, we determined that the dominant species in the ecotone is *A.agrarius*, while in the forest – it is *C. glareolus*, followed by *A.flavicollis*. It was determined that the carrying capacity of the habitat was maximal in the forest ecosystem (7.78) and minimal (3.53) in the meadow.

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EVOLUTION OF *STEREONYCHUS FRAXINI* IN ASH WOODS FROM THE REPUBLIC OF MOLDOVA IN 2015

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Stereonychus fraxini – ash weevil, is an insect pest species widespread in the southern and central Europe, northern Africa and Asia Minor, taxonomical affiliated to Insecta class, Pterygota subclass, Coleoptera order, Curculionidae family. Ash weevil is an important insect pest that defoliate the tree and shrubs species from the olive family Oleaceae: *Olea* sp., *Fraxinus* spp., *Phillyrea latifolia*, *Syringa vulgaris.* The *S. fraxini* is a serious defoliating forest pest that cause damage in both active stages (larva and adult). During the last years, its populations (breeding coefficient) have increased and produced mass defoliation of *Fraxinus* spp. trees, which caused important economic damages.

In the Republic of Moldova ash weevil hibernate as adults in soil, bark cracks and under the moss on the trunk. Per year, ash weevil develops two generations that usually overlap one another (overlapping period being from 15 to 30 days).

The first generation of *S. fraxini* develops during the last 10-day period of April until June (in mature ash wood it emerges approximately one week later). Staggered adult emergence coincides with the beginning of ash bud swelling. The second generation is hibernating and usually lasts from May until April of the next year.

The weevil adults are actively in sunny days, when they can be observed on the top of terminal buds, sucking sap bud or perforating tree leaves (avoiding the thick nervures). When the weather becomes cold and rainy, the adults hide under various shelters. In the first life days, the adults need a supplementary feeding for to maturation the sexual organs.

Depending on abiotic factors, the breeding period is very long (until 30 days). The female's prolificacy is maximum 17 eggs and oviposition is staggered, the eggs being laid by one or grouped by 2-5 less 11. These female laid the eggs under the scales buds and / or in the leaves main veins. Embryonic development takes just a few days, the larval period last 10 - 14 days and the pupal up to a week.

The attack mode of this pest is diverse: from penetration and consummation of leaf primordia in overwintering buds by larvae; sucking sap of terminal buds – by adults; until consumption of the leave's bottom mesophyll, leaving untouched the upper epidermis by larvae and adults.

During of vegetation period of 2015 were fixed outbreaks of *S. fraxini* in all ash-wooded zones of the country, indifferent with pure or mixed composition (where common ash is a predominant wood species). According to detailed forest-pathological research materials in 2015 the surface of outbreaks of this pest covered 3685 ha,

which is by 2,2 times or with 44,53 % less than in previous year which was 8276 hectares. In 2015, the outbreaks of ash weevil has occupied an area of 811 hectares, while on a surface of 1070 hectares the outbreaks have expanded. Furthermore, on 4332 hectares the outbreaks were liquidated by using combating measures. Because in 2014 records of cocoons of *S. fraxini* were done only in two sample plots from five, we took for analysis the data from 2013.

In the result of achievement of analysis of stationary surveillance materials (the below table), is resulting that in 2015 density of ash weevil's cocoons are in the limit from zero to 14.1 cocoons on 0,125 m². Compared to data from 2013 and 2014 years this index decreased in all SPA (the sample permanent areas). Breeding coefficient in 2015 was equal to 0 or less than 1, showing a diminution of population of this pest.

The qualitative indices of the population of *Stereonychus fraxini* in the SPA in 2013-2015

The sample permanent areas	The cocoon density on 0,125 м²			Breeding coefficient	The viable cocoons (%)		The cocoons affected by entomophagous insects (%)		The cocoons affected by predatory insects (%)		Other cause (%)	
	2013	2014	2015		2013-2014	2015	2013-2014	2015	2013-2014	2015	2013-2014	2015
Codrii N. R.	20	7	1,3	0,2	52,4	53,8	7,2	23,1	19	0	21,4	23,1
Nisporeni	4,3	5,2	0	0	71,1	0	5,8	0	13,5	0	9,6	0
Hîncești	12,0	N.d.	3,4	0,28	58,3	20,6	16,7	79,4	25,0	0	0	0
Orhei	2,0	N.d.	0	0	0	0	50	0	50	0	0	0
Tighina	16,1	N.d.	14,1	0,88	74,5	47,5	10,6	14,2	10,6	33,3	4,3	5,0

If to compare the viability percentage of adults in SPA with previous years, it can firmly conclude that the index is decrease significantly, excluding SPA from Codrii Natural Reserve where the index is almost the same as in 2014. In the same time, in 2015 the index of the cocoons affected by entomophagous insects in all SPA was in increase, oscillated between 14,2 and 79,4 %, the highest index being fixed in SPA Hîncești – 79,4 %. During the vegetation period of 2015 in SPA Nisporeni and Orhei were not fixed any cocoons of *S. fraxini*. Cocoons affected by predators (33,3 % out of 100 %) were just recording in the SPA Bender.

Averages of defoliation caused by ash weevil in the reporting year was lower than in 2013 and 2014. The degree of defoliation reached 37 % in SPA Bender, 17 % in Hîncesti SPA, in the other sample permanent areas defoliation values did not exceed 5-10 %.

Proceeding from the analysis of weather conditions, forest-pathological detailed research materials, pest population indices and defoliation degree of ash forests caused by the *S. fraxini* in 2013 - 2015 allow us to make the following conclusions:

- In the SPA studied were collected from 0,7 to 6,7 ex. / 0,125 m^2, which tell us that the degree of defoliation correlated between 3 and 23 %. The maximum density of viable adults was 8 ex / 0,125 m^2, which correspond to 27 % defoliation caused by ash weevil.

- Based on the forest-pathological detailed research materials carried out in 2015, only in SPA "Plaiul Fagului" was recorded a higher degree of defoliation caused by this pest (50-86 %).

- The expected level of defoliation in 2016 caused by ash weevil is between 10-30 %, and in some areas even to 50-90 %.

ROLE OF FOREST MANAGEMENT PLANNING ON SISUTAINABLE MANAGEMENT OF COMMUNITY FORESTS AND PASTURES

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The national forest fund of Moldova constitutes 13.2% of the country's territory (446,400 ha). Most of land covered with forests (81.7% or 328,700 ha) is in the state public property, the rest being held by municipalities (12.7% or 48,100 ha) and only 0.6% (2,500 ha) are privately owned. Although having yet a relatively insignificant share, private forests are increasing and compared to 2005 their area actually tripled.

According to actual records, there are about 130,000 ha of forests and other forest vegetation (forest plantations, trees and shrubby vegetation, gardening etc.) and about 330,000 thousand ha of pasturelands (gazing areas, hayfields) owned by the municipalities and/or individuals. In total, these two categories of holders manage about 460,000 hectares of forest and pastoral resources, or approximately 14% of the country's area. All these resources are, in most cases, handled with great deficiencies, drawing only about 10-20% of their potential.

Forest management planning (FMP) is the key tool in the implementation of the forest regime. It is both a science and a practice dealing with structural-functional organization and management of forests in accordance with the environmental, economic and social aspects of forestry. FMP is based on the concept of sustainable development, respecting the principle of continuity, functional effectiveness, preserving and improving biological diversity. The research directions and organization of work within the planning works are focused on: analysis of implementation of forest management planning; description of forest stands; measurements and graphical reporting; inventory of trees; forest typology, forest soil science; conducting technical interim and final receptions; I and II conferences of forest management planning; design works of forest management planning; development and publishing maps etc.

Another important link in the process of ensuring uniform management of community forests through the correct and appropriate technical regulations in this area is the National Forestry Consultancy Office (NFCO). It was established in 2015 under the assistance from FLEG within the Forest Research and Management Institute (FRMI). Its main task is to guide forest owners (state forestry entities, municipalities, private persons, etc.), provide advice, expertise, and technical, economic and legal assistance for sustainable management of owned natural resources. Over the last two years, NFCO provided consulting services to more than 300 beneficiaries from 22 administrative districts, municipalities and ATU Gagauzia.

According to Forest Code (clause 73), FMP activities are being financed by the state budget Forest Code. So far, only forest lands managed by Agency Moldsilva received support from the budget, while municipalities and private persons did not. This was partially solved using international support. Thus, over the last 10 years FRMI cooperated with various national and international programs (e.g. Japanese grant Development of community forests; Japanese grant Program to support communities for sustainable and integrated management of forests and carbon sequestration through afforestation; ENPI FLEG Program I and II; National Ecological Fund, Clima East Moldova) and implemented FMP woks in circa 22,000 ha of forests and other types of forest vegetation outside Moldsilva, making about 16% of the needs. Nonetheless, most communal forest resources still need to be evaluated quantitatively and qualitatively in order to assess their real environmental and socio-economic potential.

Pastoral resources of Moldova represent an unexploited local potential. At the current state and productivity, 1 ha of pasture can provide the fodder for 0.3 of cattle or 2 sheep on average. If well managed, the grasslands could support 1.5-2.0 cattle or 10-14 sheep per 1 ha. National legal and regulatory framework (Law on livestock; Government Decision no. 667 from 23.07.2010 on Regulation for grazing and mowing etc.) requires that local public authorities (LPAs) must have pastoral management plans and plans for maintenance, improvement and rational exploitation of public pastures. Such pastoral management plan should be a document containing technical, organizational, economic and financial measures for improving grassland management for at least 10 years.

Very limited financial and institutional capacities within LPAs make these legal provisions unfeasible because of lack of funds from local budgets. Since 2014, for the first time in national practice, FRMI (within Clima East Moldova project) has started the development of pastoral management plans for selected communities in Orhei National Park. A total of 18 communities and 4500 ha of pasturelands within benefited from this project. Pastoral management planning was undertaken for each pasture sector based on a detailed study of both vegetation and environmental conditions that influence and determine the type of vegetation and management intervention.

It is obvious that management plans (both forest and pastoral) represent an effective way of estimating the quantity and quality of local communal forest and pastoral resources by offering real possibility of capturing social benefits (ecological, socio-economic). It is also obvious that the current pace cannot ensure compliance with the cycle of 10 years of work and efforts must be actively implemented and supported by the state. Eventually, both forests and pasturelands require a certain level of constant investments; and if abandoned, these forests and pasturelands will quickly lose their ecological and socio-economic values, requiring much more investment and technical efforts for restoration.

TERRITORIAL BEHAVIOR STRATEGIES OF THE COMMON NEWT MALE (*TRITURUS VULGARIS L.*) IN THE ECOSYSTEMS OF CENTRAL FOREST

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The character carrying the reproductive behavior of the species of newts is often determined by adjustments to specific conditions living environment and peculiarities specio- specific and, therefore, can serve as taxonomic characters reliable and effective investigations related to the origin and ties phylogenetic of species from the order Caudata. Pre-trial stage of manifestation of behavior Suite itself, is the selection and protection of individual territories by males.

Common newt Males (*Triturus vulgaris*), unlike those of notched newt (*T. cristatus*), being of smaller size, which in large part determines its capabilities more modest impairments and lower resistance at relatively low temperatures during spring, leaving their forest habitats hibernation later. As a result, they enter the aquatic breeding ponds over 3-7 days since the first appearing of notched newt males. Meanwhile the territorial distribution of newt notched males virtually ended, which, moreover, determine the character of individual sectors of occupied by common newt. It was stated that within reproduction basins of these two syntonic species of newts there is still doesn't exist a strict separation breeding stations, which are usually spatially overlapped. Thus, from the 14th basins investigated the Reservation "Codrii" was not found any aquatic basins in which to reproduce only one of the two species, or the more stations for breeding within the 6 basins populated by these species (42.8% of ponds examined) be clearly separated spatially. However, the available space for aquatic breeding basins no. 5, 6 , 7, 8, 10, „Crossroads Ciuciuleni", which is 15.3 to 46.4 % of the total aquatic lakes , notched newt colonize up to 78%, common newt, therefore, strongly oppressed space. Another essential aspect of reproductive syntrophic of these two species of newts is the fact that common newt, in fact, exhibit opportunist territorial behavior, which is manifested by occupying territories peripheral and less accessible for *T. cristatus* on the smaller ground depth or vegetation more often, which is a serious impediment for males notched newt who have a waist larger body.

It was noted that the character of distribution of surface and configuration of occupied reproductive territories by common newt influences more the density and breeding population of notched newt, therefore, to mitigate this negative effect of Territorial suppressing the species *T. cristatus,* period and reproduction rate of the common newt is, to some extent, slightly „delayed".

Every male in the very first hours of its entry into water is choosing an individually territory with an area of between 0.4-1.2 m^2, which is marked on the perimeter by using „chemical markings" - persistent cloacal smelling secretions. During marking its individual territories males take some „tagging photo": trunk is bent down, head and cloaca directed to the waterline, taken position facilitates the pasting the cloaks with objects that are applied markings - branches on the bottom, plant stems submerged rocks, boulders on the bottom of lakes etc.. Applying a mark lasts 15-35 sec., but the whole process of application of the 8-14 marks - up to 30 minutes. It was observed that after the used character of protected space, males do not have favorite certain areas for stopping in the individual territory is most often determined by the places most suitable for hanging submerged objects or those with a greater view of field. Periodically, once in 1-3 minutes, males are moving diffuse in the individual territories; these movements are conditioned „*by seeking female*" and / or „*demonstration*" given the fact that the territory is occupied (addressed to a non- territorial males or to the others surrounding it).

Common newt males doesn't show antagonism and never attack the notched newt male (presumably due to the size stately thereof or that the species concerned is a fearsome predator of common newt), however, the emergence of another rival conspecific they are acting promptly initially "*by arching body*" and/or "*intimidation jumps*" carried out at 15-25 cm from the opponent, and even through direct attacks and strokes with nose in the trunk of intruder. Most often, however, these territorial conflicts are quickly completed (2-3 min.) and are limited to more ritualized „antagonistic demonstrations". Another deterrent effect it has on the opponent distant water jet containing cloaca pheromones, which is headed by the male resident intruder by frequent movements of the tail. As a result, the intruders leave, usually these protected territories and the male territorial excited yet powerful, fast moving, but diffusely, via its territory, imitating the "fakes" on an opponent who is already outside protected.

CONTRIBUTIONS TO THE KNOWLEDGE OF THE LEPIDOPTERA FAUNA (INSECTA) OF THE NATURE FOREST RESERVE "COBILENI"

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In the modern specialized literature there are few works on the fauna of Lepidoptera from different geographic regions of Moldova, which motivated us to study and monitor the current state of butterfly fauna in certain regions, such as reserve "Cobîleni".

The purpose of the work was to continue gathering data on knowledge and diversity of Lepidoptera fauna of the nature forest reserve "Cobîleni". The analyzed data completes the scientific information from the latest literature.

The reserve "Cobîleni" is a natural forest territory with an area of 33.5 ha. It belongs to the Susleni forest area, located in the Orhei district on the right bank of the Dniester River. This area does not have impressive size, but is marked by a great diversity of species of Lepidoptera and the number of specimens collected.

Entomological material that was used in the preparation of this work was collected in June-July of 2015. The Lepidoptera species were collected manually by "mowing" with entomological net, by using light trap with white and UV light and by the ordinary lamp. The species *Saturnia pyri* (Denis & Schiffermüller 1775) was collected using ordinary lamp under which was bedding a white cloth. The species *Macroglossum stellatarum* (Linnaeus 1758) was observed during the nutrition of adult butterfly on various flower plants. The collected material was identified using the most recently published taxonomical keys.

The Lepidoptera species found in "Cobîleni" belong to 9 families: Hesperiidae – 1 species, Pieridae – 4, Papilionidae – 1, Nymphalidae – 6, Lycaenidae – 5, Noctuidae – 20, Erebidae – 11, Saturniidae – 1 and Sphingidae – 8 species.

The species *Melitaea cinxia* (Linnaeus 1758) and *Pararge aegeria* (Linnaeus 1758) from Nymphalidae family and the species of the last four families mentioned above are cited for the first time in the fauna of "Cobîleni" reserve.

The species *Sphinx pinastri* (Linnaeus 1758) is new for the entomological fauna of the Republic of Moldova (in the systematic list is highlighted with the bold). In bibliographic sources is cited only once by E. Miller, N. Zubovschi and A. Ruscinschi in 1929, but the only specimen was collected in the vicinity of Hotin city, territory that does not belong at present to Republic of Moldova. However, this species is found in Ukrainian fauna but lacking in the Romanian. During the research were collected eight specimens of this species.

Below is indicated the systematic list of butterflies signaled from the reserve „Cobîleni" in June-July 2016.

Family Hesperiidae: *Erynnis tages* L.

Family Pieridae: *Leptidea morsei* Fent., ***Pieris napi L.***, ***P. brassicae L.***, *Colias alfacariensis* Ribbe.

Family Papilionidae: *Iphiclides podalirius* **L.**

Family Nymphalidae: *Pararge aegeria* **L.**, ***Melanargia galathea L., Maniola jurtina L.***, ***Polygonia c-album L.,*** *Mellicta aurelia* Nick., *Melitaea cinxia* **L.**

Family Lycaenidae: ***Satyrium spini F., Lycaena dispar Haw., Celastrina argiolus L., Plebejus argus L.***, ***Polyommatus icarus Rott.***

Family Noctuidae: *Tyta luctuosa* Den. & Schiff., *Heliothis viriplaca* Hufn., *Acontia trabealis* Scop., *Axylia putris* **L.**, *Calamia tridens* Hufn., *Trachea atriplicis* **L.**, *Xestia c-nigrum* **L.**, *Enargia abluta* Hub., *Noctua interposita* Hub., *N. fimbriata* Schr., *Diarsia brunnea* Den. & Schiff., *Cosmia diffinis* **L.**, *Lamprosticta culta* Den. & Schiff., *Euxoa obelisca* Den. & Schiff., *Oxicesta geographica* F., *Cucullia tanaceti* Den. & Schiff., *Hecatera cappa* Hub., *Mythimna l-album* **L.**, *Dypterygia scabriuscula* **L.**, *Deltote bankiana* F.

Family Saturniidae: *Saturnia pyri* Den. & Schiff.

Family Erebidae: *Euplagia quadripunctaria* Poda, *Amata phegea* L., *Scoliopteryx libatrix* L., *Calymma communimacula* Den. & Schiff., *Grammodes stolida* F., *Eublemma purpurina* Den. & Schiff., *Dysgonia algira* L., *Catocala fulminea* Scop., *Catocala electa* View., *Arctia festiva* Hufn., *Arctia villica* L.

Family Sphingidae: *Deilephila porcellus* L., *D. elpenor* L., ***Sphinx pinastri*** **L.**, *Sphinx ligustri* L., *Mimas tiliae* L., *Hyles hippophaes* Esp., *Macroglossum stellatarum* L., *Laothoe populi* L.

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RARE SPECIES OF PLANTS AND ANIMALS IDENTIFIED ON THE TERRITORY OF SOROCA AND STEFAN VODA DISTRICTS FROM MOLDOVA

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Assessment and rational use of biological diversity is one of the main concerns of our days, and its preservation is an essential condition for maintaining the ecological balance in nature and sustainable development of social – economic systems. The consequences of technical-scientific development of society, besides its obvious advantages, continues to intensify the diminishing of diversity of the vegetal and animal world, especially in conditions of socio-economic and political transition, having as effect a high number of species that have considerably diminished their number and areas. The scientific data show that during time the disappearance of numerous biological species was based on human actions more or less negative, following which the biosphere rapidly loses its ability to self-regulate [1.].

The main anthropic threat to the diversity of the living world is the destruction of natural habitats resulting from the exponential growth of human population, the demand for natural resources and enormous mass of polluting and degrading waste. Intensive use of farmland, pollution of water, atmosphere and soil, reduction of areas with natural vegetation caused worsening of living conditions and diminishing of distribution area of many plants and animals species. Other current threats faced by natural ecosystems are the unprecedented climate change and invasive species, significantly affecting the biodiversity. One of the most dangerous consequences of these phenomena (local, regional and hence global) is the irretrievable disappearance of a large number of biological species, many of which have not yet been discovered by the science. Thus, the socio-economic activity of the man causes biosphere collapse by reducing its elementary components - species, their communities and consequently of many ecosystems.

The Red Book of the Republic of Moldova serves as scientific support for developing measures and protection regimes of all species of plants and animals, as well as for proposals, amendments to laws and regulations on biodiversity, in order to improve environmental legislation in force and its harmonization with European Community

rules. It contributes to the necessary strengthening of Government, national institutions and organizations responsibilities in the field of implementation of international conventions provisions, to which Moldova is Part, as well as of the national Strategy and Action Plan on Biodiversity Conservation and to the realization of environmental education for the entire population of our country.

In this context two pilot districts – Soroca and Stefan Voda – were selected, both rich in biodiversity and having territories included in the two Ramsar cites. Moreover, these regions are different in terms of economic conditions.

In Soroca district 101 species with rarity status have been identified, of which 62 animal species and 39 plant species. Among them two secular trees. Of the 62 species of animals 6 are mammals, 10 - birds, 4 - reptiles, 8 - amphibians, 6 – fish and 28 - insects. The majority of rare species identified in the Soroca district area are endangered and vulnerable. Many of them are concentrated in forests and less in steppes, plains and water basins. Rare species were found in number of 1-2 on restricted surfaces. In all the studied areas many rare species are registered in the territories managed by Moldsilva Agency.

In Stefan Voda district 87 species with rarity status have been identified, of which 57 animal species (10 - mammals, 13 - birds, 4 - reptiles 2 - amphibians, 13 – fish and 15 - insects) and 30 plant species. Among them four secular trees.

Rare plants and animals from Stefan Voda district contain a considerable number of endangered and vulnerable species. Overall, it can be observed a state of vulnerability in rarity status of many species, even if they are near or far from natural areas protected by state from Lower Nistru zone. Most of species have been identified in protected areas along the Nistru river. The vulnerable potential of rare species is spread in water meadows, forests and meadows and less in steppes. On more humid habitats 1-3 individuals of rare species have been registered and 1-2 species in forests and steppes.

The diversity of plant species in these two districts is particularly high in forests (over 340 species), meadows (550 species) and steppe (over 480 species). Plant species are encountered in forests associated with meadows, steppes with meadows, riparian corridors, most of them concentrated in the Ramsar wetlands. Both districts contain about 69 rare species included in the Red Book, which inhabit different natural habitats.

Of the approximately 15300 known species of animals in Republic of Moldova, of which 219 were included in the third edition of the Red Book of Moldova, 119 species have been identified in Soroca and Stefan Voda districts. Most of species were identified in forest ecosystems, meadow and wetlands.

Many rare species are threatened with extinction or critically endangered at local, regional and global level (according to the categories and criteria of the IUCN Red List, Bern Convention and EU Habitats Directive lists).

In both districts many primary steppe ecosystems are reduced, fragmented and less preserved and typical steppe species are threatened with extinction within their natural spreading area. The species present in the meadow ecosystems, aquatic or wetland areas are also threatened, where there are significant concentrations of rare and endangered species, such as plant species *Trapa natans* and *Salvinia natans*, and some animal

species (*Myotis daubentoni, Nyctalus lasiopterus, Plecotus austriacus*) that are protected by the Bern Convention. Many rare and representative species are at the limit of their range, and according to IUCN classification are generally vulnerable, so it is necessary to ensure the rational management of their biodiversity. Many of species have reduced their populations and some have disappeared from their natural area, due to unregulated grazing and grubbing of steppe territories. Overall, rare species are in regression, also due to the penetration of invasive species, especially those ruderal, exotic trees and shrubs (*Acer negundo, Ailanthus altisima, Amorpha fruticosa*). The agricultural sector continues to be a major threat to the integrity of natural ecosystems, especially for rare and indicator species of forest, meadow and steppe habitats.

Implementation of rare species and their habitats conservation will be accomplished after an analysis of the legal framework at national and international level to ensure that the identification of rare species, of vulnerable habitats, of ecosystem goods and services is becoming a necessity in the plans and activities of district planning, in development plans and land use of settlements. The measures aimed to reduce the negative impact upon rare and endangered species are the biodiversity monitoring through the introduction of passports of species / habitats for landowners outside Protected Areas.

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References

1. Cartea Roșie a Republicii Moldova. Chișinău: Editura "Știința", 2015, 492 p.

ORGANIZING INSTITUTIONS

- Academy of Sciences of Moldova
- Institute of Zoology

PARTNER INSTITUTIONS

- Ministry of Environment of the Republic of Moldova
- European Union
- World Bank
- Global Environmental Facility
- United Nations Development Program
- International Union for Conservation of Nature
- World Wildlife Fund

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