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ACTUAL PROBLEMS OF PROTECTION AND SUSTAINABLE USE OF THE ANIMAL WORLD DIVERSITY

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The materials of International Conference of Zoologists **„Actual problems of protection and sustainable use of animal world diversity"** organized by the Institute of Zoology of the Academy of Sciences of Moldova in celebration of the 50th anniversary of its foundation are a generalization of the latest scientific researches in the country and abroad concerning the diversity of aquatic and terrestrial animal communities, molecular-genetic methods in systematics, phylogeny, phylogeography and ecology of animals, taxonomy and evolution of animals, structure and dynamics of animal populations from natural and anthropized ecosystems, population functioning and animal role in ecological equilibrium maintenance, biological control in regulation of pests number, invasive animal species, their ecological and socio-economic impact, protection of rare, endangered and vulnerable animal species under conditions of anthropogenic pressing intensification.

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

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CONTENT

READING ABOUT SPECIES CONCEPT IN BIOLOGY

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As one of the most important concepts which actions in the biological sciences, the term of species is considered the fundamental biological unit. There is a general agreement but also very much disagreement about this concept. Species are historical phenomena, and the term itself is a morphologic (of form and structure), geographic (of space) and historic (of time) entity. Since 1735 (first edition of *Systema Naturae* by Linné), all biologists used the binominal nomenclature: generic name and specific name. This means each species is placed within a single genus. Linné (1858) considered the species constancy along time by the identity of some features which are inherited by generations and which give the objective character of each species, defining them distinctly one another. But because because biologists have different ways of identifying species, they actually have different species concepts.

In the classical method of identifying species, this taxon was considered morphospecies - a group of organisms in which individuals are members (of the species) if they sufficiently conform to certain stable properties. On the other hand, morphological species is a population or group of populations that differ morphologically from other populations. Evolutionary or Darwinian species is similar to phylogenetic or cladistic one - a group of organisms that shares an ancestor; a lineage mentains its integrity with respect to other lineages both through time and space. Biological or isolation species is a set/group of actually or potentially interbreeding populations.

Definition of species influences and determines the specialist's entire reporting manner to the biological sciences and its current theories. Darwin (1859) admitted: "*I was struck how entirely vague and arbitrary is the distinction between species and varieties*". Later, with the acceptance of Darwin's natural selection idea, it was also accepted and argued that they were populations that evolved, not individuals. For sexually reproducing organisms, the term of "*species*" means a group of individuals that could potentially interbreed and produce fertile offspring of both sexes.

Some new currents of the first half of the 20th century exaggerated evolutionist outlook on species term and wanted to remove "*species*" with "*origin*" – a kind of evolutional line in which the limit between forms is not so clear. Racoviță (1929) asserted: "*…origins means that beings are coming one from another and it is not recommended to distinguish the species…*".

The modern evolutionary synthesis (1937 – 1947) appeared to unify ideas from different biological specialities: genetics, cytology, systematics, botany, morphology, ecology and paleontology. Reconcilliation of the genetic data with the evolutionist theory insists on the reproductive isolation – a species being considered to be *a complex of natural populations in which breeding takes place in a real or potential moment and which are reproductively isolated by other similar complexes of populations*. In its turn, the reproductive isolation machanisms are very complex but the species preserve their homogeneity and the barrier of the reproductive isolation functions even under particular circumstance (e.g. introgression phenomenon and fitness evaluation); isolation mechanisms are finally present and efficient. On the other hand, the geographical isolation becomes as much important as the reproductive one. Recently the cohesion concept of species appeared which is still in distinct a unity if the amount of hybridization is insufficient to completely mix their respective gene pools. This neo-Darwinian synthesis reconcilliated Mendelian genetics with gradual evolution by means of natural selection and explained changes in local populations as a broad scale changes or macroevolution.

Up to the actual knowledge, the term "*species*" is not useful when studying bacterial evolution. Microbiologists see genes as moving freely between even distantly related bacteria, with the entire bacterial domain being a single gene pool. Thus, for some beings (mostly plants) which reproduce asexually and microorganisms the species is defined as populations of organisms that have a high level of genetic similarity; the exact level of similarity used in such a definition is arbitrary. Therefore, what kind of definition a biologists uses is a pragmatic choice, depending on the particularities of the biologist's research.

However, if there are some critics to the biological outlook, this was made in order to try the perception improving on the species as an objective reality and not to abolish it; the failure of these attempts doesn't mean the abolition of the "*species*" term but the returning to the biological outlook on species, finally the only one which can assure the objectivity of the scientific approach in biology.

Most of the above outlook species concept coincide. Differences between them are more a matter of emphasis than of outright contradiction. Therefore we can say no species concept yet proposed is entirely objective, or can be applied in all cases without resorting to judgment. Given the complexity of life, some have argued that such an objective definition is in all likelihood impossible, and scientists should settle for the most practical definition.

ACHIEVEMENTS OF ROMANIA IN THE FIELD OF NATURE PROTECTION AND IMPLEMENTATION OF EUROPEAN UNION'S RULES CONCERNING THE BIODIVERSITY CONSERVATION (1990-2010)

Dan Munteanu

In Romania, the political changes from December 1989 have compelled new laws and regulations to be adopted, in all the social and economical areas, including the environment. A first and significant step was represented by the establishment of the Ministry of Environment as early as 1990, including its local agencies based in all counties of the country. A new law concerning Environment protection has been adopted in 1995 (*Law no. 137,* afterwards improved in 2005-2006). In the same time, special laws and regulations started to be elaborated concerning segments of the complex area of environmental protection: pollution, water quality, air quality, protected areas, and biodiversity conservation.

Accordingly, a first law of national importance was adopted in 2000: *Law no. 5/2000 on the national territory planning – Section III, Protected areas*. Before 1990, only a small number of protected areas at national scale had been established starting with 1930, but in time, in almost all the counties of Romania, local reserves have been founded, their number and surface being directly correlated to the environmental conditions in each case and to their natural heritage. The achievements at county level greatly depended on the ability of the local experts in preparing quality documentations and in convincing authorities about providing a protected regime for certain areas that host natural assets of a high scientific value. The Law no. 5 provides the centralised list of all reserves in the country (more than 800). At the same time, this law has acknowledged the status of 13 natural and national parks that were established, only theoretical, in 1990, based on documentations elaborated by the Forestry Research Institute.

Still in 2000 another important legislative regulation was emitted, the emergency ordinance no. 236 *on the regime of protected natural areas, conservation on natural habitats, of wild flora and fauna,* which was afterwards approved, with modifications, as Law no. 462/2001. This order was improved, a new order was issued in 2007 (no. 57/2007) and a new law in 2011 (law no.49/2011). All take into consideration the provision of international legislation and include lists of habitats and species (plants and animals, grouped in several categories) which need a special protection.

On the other hand, the borders of the natural and national parks and their internal zonation have been finally defined (in 2003), while one year afterwards (in 2004) the administrations of these parks have been established.

In the same time, several research institutes and non-governmental organisations have worked for preparing and submitting reports in the view of the foundation of new protected natural areas according to the regulation issued by the Ministry. After these documentations were analysed for their scientific content and were endorsed by the Commission for Nature Monuments Protection (belonging to the Romanian Academy), they were submitted to the Ministry of Environment. Based on this procedure, other four new legislative regulations have been adopted during the period 2004-2010 and number of natural protected areas has increased up to 952.

In the same time Romania has taken actions in order to adopt international regulations in the field of nature and biodiversity conservation. First of all Romania has adopted the main conventions in the field: world cultural and natural heritage (1990); wetlands - Ramsar (1991); biological diversity – Rio de Janeiro (1994); European wildlife and habitats – Bern (1993); international trade with wild species – CITES/ Washington (1994); migratory animals – Bonn (1979); migratory water birds – AEWA (2000); bats' protection (2000); dolphins' protection (2000); landscape conservation (2002).

Romania became a member of the European Union on January 1st, 2007. The *Birds Directive* and the *Habitats Directive* automatically enter in force in our country. As a consequence, the Ministry of Environment organized a large team of scientists and NGOs whose task was the elaboration of documentations to describe special protected areas (SPA, for birds) and sites of international importance (SCI, for habitats

and other animals than birds). We mention that these two types of protected area were adopted by the Romanian legislation just in 2000. As a result, 108 SPAs was legally established in 2007 and 273 SCIs was founded in 2008. They cover in all 18 % from the national territory (SPA – 12 %, SCI – 13,2 %, but some of them overlap). A lot of them already have their own custodians or administrators.

Another campaign for designation new SPAs and SCIs took place in 2010. About 40 SPAs and 120 SCIs were described and characterized. They will get a legal status in due course. We estimate that by the end of this process the total area of the sites included in the national ecological network Natura 2000 will cover about 25% from the Romanian territory, which means more than the average European level. According to the rules of the European Commission, the Natura 2000 sites should be continuously improved and updated.

In order to sustain the activity in the environment protection, the Government has organized a national programme (POS – Program Operațional Sectorial), which has five components; the fourth ″axis″ concerns protected areas and species. This is a way to promote scientific research, to elaborate management plans and to achieve practical activities within the protected areas, as 80% from the costs are supported from European financial sources. A lot of other efforts are done by the state administration to improve the level of environment protection.

It is also to mention the establishment of the National Environmental Guard, a body indebted to control the legality of actions and investments which could affect the environment quality. It has the right to apply penalties or to act in justice the enterprises or private people who do not comply with the law.

Following all the actions performed in the last decades, currently a proper legal framework exists for supporting the national strategy on nature conservation and biodiversity; however, many practical issues are far from being solved.

The first impediment when applying a coherent and effective strategy related to protected natural areas and Natura 2000 sites conservation and management is represented by the lack of direct financing from the state budget. As a consequence, alternative financing sources are sought for. Thus, the administrations of 23 national and natural parks (out of the 28) are financially supported by the National Forestry Authority (Regia Națională a Pădurilor), a financially-autonomous structure that does not depend on the state budget. Clearly, this situation is not the optimal one, but no other solution for sustaining the most important protected natural areas has been found yet. Five of the parks are financed by local (county) administrations and other structures. On the other side, the parks' administrations make continuous efforts to get non-reimbursable European funds, available through various financing instruments (including through ″POS″). In this way, it is possible to build headquarters for the administrations and information points, while equipment for field and laboratory research has been acquired. Also, educational and public awareness activities could be designed and implemented.

In the view of surveying and managing relatively-small natural protected areas lacking their own administrative structures, various institutions, local administrative units, and non-governmental organisations were given custody of these entities. The custody transfer methodology includes strict criteria, first of all the capacity of the interested party to complete the related tasks (based on its financial, material and human resources). On the other hand, the quality of custodian of a protected area provides opportunities of attracting financial resources, from internal or external sources. Lately, administrative frameworks have been established also for other natural protected areas except for parks, if they cover areas larger than 5,000 ha. The custodians and administrators are expected to elaborate the management plans for the areas they are administrating, and, following their approval by the Ministry of Environment to implement them by using internal resources, as well as national or international funds they are able to access.

The conservation regime of the natural protected areas of various categories as well as of the Nature 2000 sites is often the cause of conflicts between the respective areas administrations, or the environmental authorities, and the land owners. This aspect cannot be solved otherwise than by implementing a system of compensations addressing the owners that cannot take further advantages by exploiting their properties (first of all, this concerns the forests owners: private persons, associations of owners, local administrations). In fact, there are legal provisions and regulations on this subject, but their implementation is hindered by the same impediment: shortage of financial resources.

On the other hand, the accelerated economical development of the country exercises an increasing pressure – in many cases justified – on the environment. For instance, construction works require a large volume of building materials of natural origin: timber, sand and gravel, rocks for building or for cement production etc.; the exploitation of all these materials determines the deterioration of natural habitats. Localities and industrial companies are extending, as well as roads and highways, requiring larger and

larger areas. Touristic facilities, especially those in the mountain areas such as ski tracks require more and more ground, often on the expense of the forests. In the Dobrodja a great number of wind-generators were built, and it is clear they alter the natural landscape and affect natural biodiversity, especially migratory birds. According to the law, the investments within Natura 2000 sites and some types of natural protected areas are submitted to a specific authorization procedure. Unfortunately, too often the environmental agreements are issued based on impact studies of low quality, and sometimes under political pressure.

Concerning non-governmental organisations, they are very loud when it comes to declarations, but they hardly involve in concrete and responsible actions if these do not represent sources for funding. In general, civil society shows a poor involvement in environmental issues, situation that is reflected also in the ecological education level of the citizens living in Romania. The "green parties" that right after 1989 were very popular among the electorate have jeopardized their position given the lack of coherent programmes and of credible leaders; currently, they are not anymore represented in the Romanian parliament. The repeated modifications affecting the educational system have lead, among others, to a drastic decrease of the number of hours dedicated to teaching natural sciences in schools, decrease of the duration of study programmes in universities, including that of the PhD cycle (according to the Bologna system). As results one can mention an insufficient specific instruction of the graduates and a superficial approach and finalisation of doctoral theses. Computer and statistics have become overrated tools that are meant to compensate the lack of sufficient actual data that should represent the base for the evaluation of the status of the environment in protected or not-protected natural areas. That is why there is a deep need for specialists in the field of environmental protection and engineering. On the other hand, it is also true that work conditions and payment of the trained staff are not really attractive.

In summary, we conclude that after 1989 Romania has registered a real progress in the field of environmental protection, especially concerning natural protected areas and biodiversity. Nevertheless, this positive trend has shown a slower rate than many of us have expected, as a result of the orientation of the state authorities towards other priorities, and not to the environment.

THE PROTECTION AND SUSTAINABLE USE OF AQUATIC RESOURCES

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The use of aquatic resources by fisheries and aquaculture

Aquatic ecosystems in inland-, coastal-and marine areas, provide humans with resources for food, livelihood and recreation. They also perform many other important environmental functions, e.g. in relation to meteorological events, pollution etc., contributing to general human well-being. They are used by both capture fisheries and aquaculture as well as other competing sectors. For the two decades following 1950 world marine and inland capture fisheries production increased on average by as much as 6 percent per annum, trebling from 18 million tonnes in 1950 to 56 million tonnes in 1969. During the 1970s and 1980s, the average rate of increase declined to 2 percent per year, falling to almost zero in the 1990s. This levelling off of the total catch follows the general trend of most of the world's fishing areas, which have apparently reached their maximum potential for capture fisheries production, with the majority of stocks being fully exploited.

As the production from capture fisheries is levelling, the role of aquaculture in satisfying the increasing need for fish and aquatic products is continuously increasing. Based on FAO data, the proportional contribution of aquaculture to total food fisheries output increased from 3.9 percent in 1970 to 42.9 percent in 2008, indicating the important role it plays in supplying fish for human consumption. In 2008, global aquaculture production reached 52.5 million tonnes (excluding aquatic plants), growing at an annual rate of 8.4 percent. The need for nutritious and healthy aquatic food is further increasing. According to the forecast of FAO, about 150-160 million tons of aquatic products should be produced in aquaculture by 2030 in order to meet global demand of the world poulation that will reach about 8.3 billion by that time.

Challenges in the protection and sustainable use of aquatic resources

Even if the role of aquaculture in food fish supply will increases in the future capture fisheries will remain an important fish supplier especially in marine areas. About 95% of world marine production originates from coastal ecosystems, such as estuaries, marshes, shallow bays and wetlands, mangroves, coral reefs and

sea-grass beds. These play a major role in the life cycle of many marine organisms, including economically important fish species, by providing breeding, nursery and feeding grounds. The potentially negative impacts of fisheries on the environment include the followings. Overfishing and excessive fishing can reduce the spawning biomass of a fishery below desired levels such as maximum sustainable or economic yields. In the process of producing food, economic resources, employment, livelihood and recreation, fisheries have to potential to modify ecosystems because fishing may alter or affect: the target resource (especially if there is overfishing of the target resource); species associated with or dependent on the targeted resource (such as predators or prey); trophic relationships within the ecosystem in which the fishery operates; and habitats in which fishing occurs.

While aquaculture is the fastest growing food-producing sector that can utilize resources efficiently and environmentally friendly in well managed systems, aquaculture is increasingly confronted with issues of environmental protection due to its rapid development. Major environmental impacts of aquaculture have been associated mainly with high-input high-output intensive systems such as culture of salmonids in raceways and cages. Aquaculture effluents may cause pollution and eutrophication in natural waters surrounding the culture systems. Large-scale shrimp culture has resulted in physical degradation of coastal habitats, for example, through conversion of mangrove forests and destruction of wetlands, salinization of agricultural and drinking water supplies, and land subsidence due to groundwater abstraction. Using natural fish stocks to feed farmed fish is one of the greatest concerns regarding sustainable development of aquaculture. Aquaculture is the principle reason for the introduction of non-native species and the introduced species may eventually enter the natural ecosystem (either through purposeful release or accidental escape). Thus, non-native species in culture can adversely impact local resources through hybridization and loss of native stocks, predation and competition, transmission of disease, and changes in habitat. However, misapplication of husbandry and disease management chemicals, collection of seed from the wild (bycatch of non-target species occurring in the collection of wild seed) are also causing concern.

Sustainable development of fisheries and aquaculture

In order to conserve ecosystem structures and processes, fishing practices that involve excessive use of resources, or use of fishing gear in a manner or at a location that causes destruction of habitat, or the use of fishing methods that are themselves destructive, need to be stopped in the interest both of conserving the ecosystem and of ensuring optimal productivity in its use. Solving the problem of overfishing - and, thus, the impacts of overfishing on the environment is a longstanding regulatory challenge that requires fishers to have clear ethical and financial reasons to not overharvest in their efforts to fish. Additional data and research on the environmental impacts of fishing on the ecosystem can help managers and fishers, alike, to make more informed decisions regarding the impacts of fishing and, in particular, on species composition and the environment. When coupled with measures to avoid overharvesting, technologies to increase harvesting selectivity can similarly help to reduce bycatch and subsequent discarding.

Aquaculture can be a very productive use of resources, with the amount of food produced per hectare considerably higher than with arable farming or livestock rearing. Resource availability and use have allowed a more than three times faster sector growth compared with terrestrial farm animal meat production. The systems and technologies used in aquaculture has developed rapidly in the last fifty years. As a result of extensive research the use of antibiotics have been significantly reduced in intensive salmon production through vaccination and the use of fish meal and fish oil has also been reduced in the diet due to the replacement of animal protein by plant protein resources. Further solution of "the fish-eating-fish dilemma" could be to shift culture operations to herbivorous species such as tilapia, catfish, carp, oysters and clams which rely little, if at all, on supplementary feed. A greater understanding of complex interactions between nutrients, bacteria and cultured organisms, together with advances in hydrodynamics applied to pond and tank design, have enabled the development of closed systems. These have the advantage of isolating the aquaculture systems from natural aquatic systems, thus minimizing the risk of disease or genetic impacts on the external systems. The development of new type of integrated systems (such as: Combined extensive-intensive-systems, CIE; or Integrated Multi-Trophic Aquaculture Systems, IMTA) could also contribute to the protection of the environment and the sustainable use of resources. Developments in engineering, increase the possibilities for a progressive offshore expansion of aquaculture using robust cages. Culture-based capture fisheries involving the release of young fish into the wild to improve harvest (an operation also referred to as restocking, stock enhancement or ranching) have existed for a long time for freshwater and anadromous species (e.g. salmon). Sea ranching, however, has just made a start but its long-term viability is being assessed. Advances have also been made in capture-based aquaculture involving the growing/fattening of young fish (e.g. tuna) captured from the wild.

TERRESTRIAL VERTEBRATES

TERRITORIAL INTERSPECIFIC RELATIONSHIPS OF GENUS *SYLVIA* AND *PHYLLOSCOPUS* IN RECREATIONAL BIOTOPES IN MOLDOVA

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The territory of an individual or group of individuals is the space that this/those occupies, defines and defends it to purchase food, crossing a breeding cycle to rest (place of refuge and rest) (Botnarciuc, 1982). Birds are territorial animals, occupying and defending territories smaller or larger.

Breeding and nesting territory - is the space in which the coupling takes place, incubation and care of offspring, it is characteristic species of Passeriformes and includes nest, critical area and the territory itself, which includes feeding territory.

In the present paper we propose to recount interspecific territorial relationships of species of two genus belonging to the same family *Sylviidae*. We try to answer whether the species that have their niche in the same biotope compete or collaborate or cohabitation.

Observations were done in ecosystems with varying degrees of anthropic impact: a) natural - scientific reserve "Plaiul Fagului"; protected natural area "Trebujeni", "Codrii Tigheci"; b) recreational - parks outskirts (Botanical Garden, the park "La Izvor").

The observations were covered the period of the years 2006-2009, including the passage of spring and nesting period. We used transects and fixed points methods.

Disputed territories between Sylvia and Phylloscopus species is influenced by the preferences and conditions offered by biotope suitable or less suitable, which can be divided into two groups by type of habitat each species inhabits. The species of genus Sylvia and Phylloscopus present in the country the nesting territories are disputed between *Sylvia atricapilla*, *Sylvia borin* and *Phylloscopus collybita* - the first group and *Sylvia communis, Sylvia nisoria* less between the second groups.

In anthropogenic biotypes, where conditions for nesting are restricted, the distance between the nesting territories being smaller, were observed interspecific relationships of coexistence between species of genus *Sylvia* and *Phylloscopus*. Actualy in the recreational and urban biotopes *S. atricapilla* and *Phylloscopus collybita* recorded relatively high and stable densities.

Depending on the degree of overlap of nesting territories are grouped as follows:

- total overlap of species nesting territories;
- partial overlapping breeding territories by coexistence and friendly neighbourhood.

In the first type of interspecific territorial relationship was observed with a pair of Sylvia *curruca* and *Phylloscopus collybita* which nests were located in the same bush juniper (figure 1.a, May 2008, the park "La Izvor"). The diameter of bush was about 4.6 m, the nest of *Sylvia curruca* was at one end of the scrub and over the opposite edge the nest of *Phylloscopus collybita*.

In the middle a scrub was a tree of *Acer platanoides* height of about 9 m, which served as a post on the lookout for adult bird before entering on the nest with food. The result of the coexistence was successful of both pairs took flight by 5 chicken.

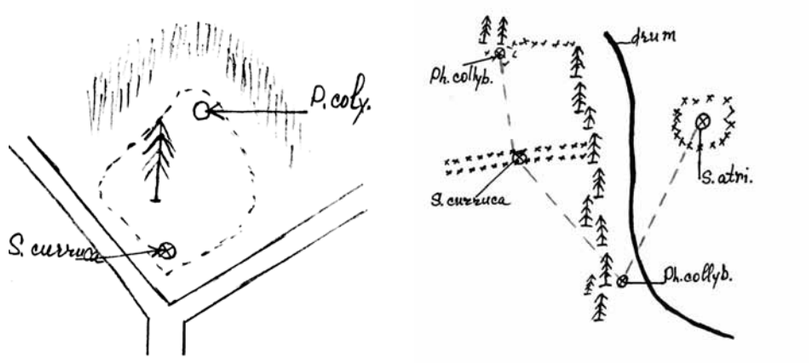
The second type of interspecific cohabitation relationship was observed in three pairs, namely by: *Ph.collybita, S. atricapilla and S. curruca* (figure 1.b). The nesting territories were in close vicinity to each other but feeding territories the overlapped. The nests were distributed on area with surface about 1260 m2. Distances between nests were: 16 m - between *P. collybita* and *S. curruca;* between *S. atricapilla* and *P. collybita* of 9m, and between and *S. atricapilla S.curruca* - 18 m. And the distance between the nests of two pairs of P.collybita (in the same area) was 64m.

Another type of interspecific cohabitation is cooperation in the cases of the potential danger with a significant role (predator near the nest appearance). In issuing the alarm signal by the female or male attacked shortly (2-3 min.) a pair soon comes, especially that nested in the immediate vicinity, with broadcasts of alarm signals characteristic of each. For example, in the cases a pair of *Ph. collybita*, in the emergence of a jay in critical nesting area, at the warning signs of adult was came a male of *Parus major, Passer domesticus, Erithacus rubecula* (in the cemetery of "St. Lazar"). Species help each other to intimidate and drive out predator or super-predator (observer).

References:

1. Botnariuc, N., Vădineanu, A., Ecologie, Bucureşti, 1982, 438p.

Fig. 1. Distribution of nests in the cases interspecific cohabitation relationship (a - total overlap b - partial overlap) (own drawing).



MORPHOLOGICAL DIFFERENTIATION BETWEEN *CIETHRIONOMYS RUFOCANUS* AND *CIETHRIONOMYS REX* FROM THE URALS AND FAR EAST

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In this work we studied intraspecific differentiation between *Cl. rufocanus* from the Urals and Far East and led interspecific comparisons *Cl. rufocanus* and *Cl. rex*, inhabits the Far East islands, based on dental characteristics.

The Ural samples included a grey red-backed voles from the Southern (N=20), Middle (N=28), Northern (N=8) and Polar (N=16) Urals. The Far East samples were from continental part (the Primorsky Kray (N=28)), and from the Islands – Shikotan (N=65) and Moneron (N=10). The studied *Cl. rex* is from the Shikotan Island (N=40).

To analyze the size and configuration of molars we apply linear measurements of the occlusal surface of the first lower molar (/m1), and morphotypes of the third upper molar (M3/) based on Rörig and Börner approach (Rörig, Börner, 1905). Measurements of /m1 surface are made in digital images taken with a Nikon Coolpix 5100 digital camera at constant 5.0× magnification of a Carl Zeiss C-2000 stereomicroscope, using the TPS program (Rohlf, 2001). To consider the age variability of molars we use the ontogenetic stages (we included 4-6 stages) based on the extent to which the occlusal surface is formed, the crown is worn, and the roots are differentiated (Fominykh et al., 2010).

ANOVA of dental characteristics reveals the significant differences between ontogenetic stages ($F(2;43)=8.10$; $p<0.000$). As a result, in following analysis we undertake between-population and interspecific comparisons within the ontogenetic stages of molars.

Comparisons of all populations from the Urals and Far East reveal the highly significant differences ($F(6;43)=22.15$; $p<0.000$). Thus, the largest molars are found in *Cl. rufocanus* from the Far East Islands - Shikotan and Moneron, while *Cl. rufocanus* from the continental part has the smaller /m1. Dental characteristics of the Ural grey red-backed voles are intermediate. Between-populations differences in /m1 characteristics are also found between the Far East *Cl.rufocanus* and *Cl.rex* ($F=13.46$; $p<0.000$). Those populations are significantly different in the M3/ morphotype frequencies ($I=29.87\text{-}90.78$; $df=2$; $p<0.000$).

We also address the problem of morphological differentiation between *Cl.rufocanus* and *Cl.rex* from the Shikotan. Significant differences between these species are revealed in morphotypic characteristics of M3/ ($I=90.78$; $df=2$; $p<0.000$) that confirms the results of the earlier researches (Kostenko, Allenova, 1978; Kaneko et al., 1998; Abramson et al., 2009). *Cl.rufocanus* has simple occlusal surface of M3/ with two deep reentrant angles on lingual side and two or three reentrant angels on buccal side; usually the three (rarely four) prominent salient angles are observed on lingual and buccal sides. *Cl.rex* has a complex M3/ shape

with three deep reentrant and four prominent salient angles on both lingual and buccal sides.

We also reveal the differences in a complex of measurements of /m1 within the ontogenetic stages 4-6 (F(2;44)=41.90-192.42; p=0.005-0.024). *Cl.rex* is characterized by simpler configuration of the anteroconid, as compared to in *Cl.rufocanus*. Thus, the first lower molar of *Cl.rex* is simpler, whereas the third upper molar is more complex than in *Cl.rufocanus*. Being morphologically similar to *Cl.rex*, *Cl.rufocanus* inhabits similar biotopes, but is characterized by more complex /m1 configuration and simpler M3/ morphotypes.

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More complex shape of the M3/ occlusal surface can indicated mainly feeds on robust plants (Kostenko, Allenova, 1978; Kaneko et al., 1998).

DATA ON ORIENTATION-EXPLORATORY BEHAVIOUR IN *APODEMUS SYLVATICUS* (RODENTIA, MURIDAE)

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The studies were performed in spring, summer and autumn during two years. The individuals of wood mouse (*Apodemus sylvaticus Linnaeaus, 1758*) were caught in forest shelter belts, in abandoned cherry orchards, in woods. The orientation – exploratory behaviour of adult animals were studied in open field (Hughes, 1978), by placing the individuals for 15 minutes in experimental conditions and fixing for every 3 minutes consecutively and in general for 15 minutes the following parameters: horizontal activity, vertical activity, durations of grooming and of freezing, emotionality and the latent period of exit from the portable cage in the open field. A total of 40 males and 22 females were tested.

The latent period of exit from the portable cage in the open field is the time during which the animal overcomes the natural caution and fear in order to satisfy his curiosity. Only 59% of females and 60% of males could overcome the fear and came out independently from the portable cage into the open field. Thus, the latent period in females constituted 85.93±9.11 seconds and in males – 100.13±17.1 seconds

The horizontal activity is the number of crossed squares, characterizing the locomotor activity and consisting of two components: the exploratory activity and emotional reaction to the new environment and the desire to escape. The summary (for 15 min.) horizontal activity and the dynamics of this parameter for every 3 minutes consecutively of animal stay in open field were studied. The summary horizontal activity in males was 431.13±33.4 sec. And in females – 449.23±41.28 sec., i.e. there was no difference between sexes in this parameter, which also was observed in other species (Munteanu, Cemirtan et al., 2009).

The dynamics of horizontal activity in wood mouse in open field was similar in both sexes (fig. 1, A): the highest values of locomotor activity (149.65±20.11 in males and 153.64±19.78 in females) were registered in the first 3 minutes, then occurred at first sharp (till 94.55±17.58 in males and 100.73±19.99 in females) decreasing in the 6th minute and gradual decrease in the 9th and 12th minutes, reaching minimum values at the end of the experiment (48.78±11.12 in males and 55.14±13.07 in males). Therefore, sexual differences of the dynamics of horizontal activity in this species also were not detected.

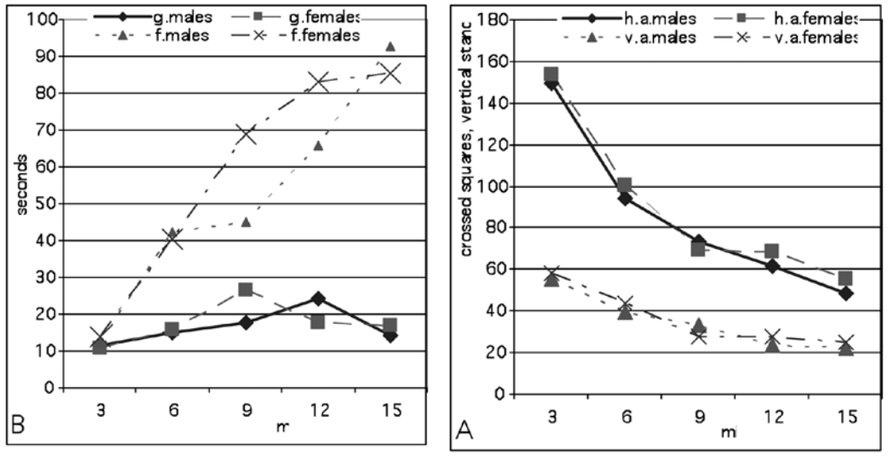
The high levels of locomotor activity in the first minutes of being in new environment proved the emotional reaction of the animals to the novelty, while the decreasing of this parameter proved a gradual habituation to it and the low value of the last minutes of the experiment - the adaptation to new conditions.

In vertical activity of *A. sylvaticus,* in opposite of other studied species (*Mus musculus, Mus spicilegus, Microtus arvalis, Apodemus uralensis)* (Munteanu, Cemirtan et al., 2009), two components were clearly revealed: the vertical posts and vertical jumps.

The summary indicators of exploratory activity in males (175.3±18.33) and females (183.8±20.1) were very close, i.e. also no sex differences were found for this parameter.

The dynamics of exploratory activity until the 9th minute of the experiment was similar in both sexes: the decreasing of the parameter from 55.4±9.11 to 39.75±7.1 and to 33.35±6.56 in males and from 58,45±9,78 to 43.45±8.35 and to 27.77±5.6 in females was registered. After the 9th minute in males was recorded further reduction of vertical activity: 23.78±4.48 (12th min.) and 22.5±4.15 (15th min.), while in females it remained practically on the level of 9th minute: 27.45±5.11 and 24.95±5.0, respectively (fig. 1, A).

Figure 1. *Horizontal and vertical activities (A), grooming and freezing (B) in A. sylvaticus males and females*



Vertical jumps are, most likely, associated to the emotional reaction of animals toward new environment. The summary activity of this parameter in males (117.87±20.11) is higher than in females (85.23±13.34) and the values of jumping activity in males every 3 minutes are higher than in females. Thus, the wood mouse in new conditions showed a high level of exploratory activity and of emotionality, and with time as in females and in males there was a gradual decrease in interest and getting used to the environment. The emotional reaction of males also remained virtually unchanged for 15 minutes, and in females its reduction by the end of the experiment was observed.

The duration of grooming in *A. sylvaticus* individuals was rather low. It gradually increased from 11.63±2.1 sec. to 24.08±3.01 sec. (12th minute) in males and from 10.68±1.9 sec. to 26.45±3.54 sec. (9th minute) in females, than decreased more to 14.28±2.3 sec. and 17.05±2.45 sec., respectively (fig.1, B). In other words, the dynamics of the index in both sexes are similar, only the females reached a maximum in the 9th minute, and the males - on the 12th minute.

Freezing is the period of inactivity, when after the running within the open field and studying the new environment, the animals rested quietly in a corner, sometimes even sleeping. The duration of freezing at the beginning of experiment was, naturally, very low: 12.5±1.5 sec. in males and 13.91±1.01 sec. in females, because in this time period the individuals explored actively the environment. As the decline of interest in new surrounding, the duration of freezing increased, reaching maximum values at the end of the experiment: 92.83±12.15 sec. in males and 85.54±7.14 sec. in females (fig.1, B). The dynamics of this parameter in representatives of both sexes were similar, as well as the summary time of freezing, which constituted 63.4±31.2 sec. in males and 290.95±32.11 sec. in females.

Thus, the behavioral strategy of wood mouse was largely similar to that of other previously studied species, although it had a number of the above-mentioned features.

BIBLIOGRAPHY

1. Hughes C.W. 1978. *Observer influence on automated open field activity*. Physiol. and Behaviorr. Vol. **20**, 4: 481-485.

2. Munteanu Andrei, Cemirtan Nelli, Savin Anatol, Nistreanu Victoria. Orientation – exploratory behaviour of the main rodent species inhabiting the agroecosystems. Oltenia Journal for Studies in Natural Sciences. T. XXV, 2009, p. 285-290.

3. Зорина Зоя., Полетаева И., Резникова Ж. 2002. *Основы этологии и генетики поведения*. Moskva: 157-160.

BIODIVERSITY AND NUMBER OF GAME ORNITHOFAUNA FROM STRASENI WETLAND SECTORS IN SPRING SEASON

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Straseni wetlands are an artificially created, enough large and stable ecosystem, being at present a nesting place for many species of migratory waterfowl. This ecosystem represent a water - swamp hunting area of approximately 65 hectares occupied by dense thickets of reed mace, cane, reed. Only a small area is represented by open water sectors in the form of channels extending from Byc river and floodplain lakes.

Aims. Actual characteristics of artificial wetlands of Straseni and counts of water birds and waders during spring migration. Identification of negative factors affecting the condition of wetland ecosystems hunting grounds. Development of biotechnical measures to improve the condition of these ecosystems.

Results. The studied ecosystem is divided in three sectors:

Sector A. It is a mirror of the open water area of about 10x20 m. The coastline is indented slightly, the depth does not exceed 1 m. This water microecosystem is part of artificial bog-water hunting grounds near the village Straseni. The water table around the perimeter is surrounded by fairly dense wall of cattail and bulrush. Food supply is rather large, which allows to nesting females to not leave the clutch for a long period of time. The dense vegetation provides great opportunities for the development of aquatic organisms included in the diet of waterfowl (the larvae of insects, various crustaceans, molluscs) (tab. 1).

Table 1. Total number of species individuals on sector A

No.	Species	Number of species individuals						
		24.03	26.03	01.04	07.04	08.04	Total	Mean
1	***Anasplatyrhynchos***	11	20	8	2	8	49	9,80
2	***A. acuta***	1	6	0	0	0	7	1,40
3	***A. penelope***	0	5	0	0	0	5	1,00
4	***A.clypeata***	1	3	2	0	0	6	1,20
5	***A. crecca***	2	0	0	0	0	2	0,40
6	***A. querquedula***	0	1	0	0	0	1	0,20
7	***Aythyaferina***	1	0	0	0	0	1	0,20
8	***Anasfuligula***	0	3	0	0	0	3	0,60
9	**Unidentified duck species**	6	9	22	6	4	47	9,40
10	**Unidentified goose species**	0	0	0	0	5	5	1,00

The rich fauna of aquatic invertebrates is favorable factor for inhabiting of large number of small fish species and their young, which also play an important role in the diet of waterfowl.

Sector B is an artificially created channel, which deviates from the right bank of Byc river and going deep into the reeds. Considering the channel and its riparian vegetation as a separate ecosystem, it can be observed a quite sharp change of dense thick and almost impenetrable thickets of reed, cane and reed mace on more sparse ones, as well as their adjacency to the open water areas. The result is a kind of nesting of various microzones of water surface of the channel with different degrees of overgrowth (eutrophication). This ecosystem is also attractive because of its feeding grounds for waterfowl (tab. 2).

Table 2. Total number of species individuals on sector B

No.	Species	Number of species individuals				
		25.03	02.04	09.04	Total	Mean
1	*Anas platyrhynchos*	10	25	4	39	13,00
2	*A. acuta*	3	0	0	3	1,00
3	*A. clypeata*	1	0	0	1	0,33
4	*A. crecca*	3	0	1	4	1,33
5	**Unidentified duck species**	15	9	10	34	11,33
6	**Unidentified goose species**	1	0	0	1	0,33

Sector C is a mirror of water with area 60 ares (max. 20x30 m) with a fairly rugged coastline. The depth is small, about 1m. In the middle of the water table there are about a dozen small, up to 2 m² area, mounds, overgrown with reeds. After the suitability of nesting the sector is also much better than the previous two. Food supply is, also, quite abundant (tab. 3).

Table 3. Total number of species individuals on sector C

No.	Species	Number of species individuals								
		27.03		03.04		10.04		11.04	Total	Mean
		У	В	У	В	У	В	В		
1	***Anasplatyrhynchos***	20	9	13	3	14	8	13	80	11,42
2	***A. acuta***	1	3	1	0	2	0	0	7	1
3	***A. penelope***	0	0	0	1	0	0	0	1	0,14
4	***A.clypeata***	2	0	0	0	3	0	4	9	1,29
5	***A. strepera***	0	0	0	2	4	0	3	5	0,71
6	***A. crecca***	0	0	0	3	0	0	0	3	0,43
7	***A. querquedula***	0	0	0	3	0	0	0	3	0,43
8	***Aythya ferina***	0	0	1	0	0	0	0	1	0,14
9	***Anas fuligula***	2	0	3	1	0	0	0	6	0,86
10	**Unidentified duck species**	18	28	7	7	17	9	2	88	12,57
11	***Anser albifrons***	0	0	4	0	0	0	0	4	0,57
12	**Unidentified goose species**	17	0	12	0	15	0	0	44	6,29

Conclusions

Despite the fact that the ecosystem is located near a large locality, due to high humidity and bugginess, the invasion of man into the ecosystem is very difficult. The proximity to the locality also pushes away, when possible, another negative factor - the spring burning of reeds.

Among negative factors can be mentioned: a) grazing; b) haymowing in the period of clutch incubation; c) poaching during the breeding season; d) populations of harmful animals: wild dogs, foxes, magpies and crows, ruining the nests, eating the eggs from the clutch, as well as non-flying juveniles. These lands are of interest in terms of population dynamics of the representatives of waterfowl and waders.

Indented coastline is an important factor in the diversity and abundance of aquatic species in the wetland hunting grounds. Namely the hunting grounds are the most important in the modern game management.

Bibliography

1. Chiriac E., Udrescu M. Fauna României. Vol. II., EdituraAcad. București, 1973.

2. Munteanu A., Vasilașcu N. Ornitofauna urbană și rolul ei în menținerea biodiversității. //Mediul Ambiant. Revistă științifică, nr. 4 (28) Chișinău 2006, p. 16-19.

3. Munteanu A., Vasilașcu N., Zubcov N. Tendințele procesului de sinantropizare a populațiilor de păsări în mediul urban. // Buletinul AȘM Științele vieții nr.2 (297) Chișinău, 2005, p. 81-87.

4. Блинников В.И. Зоология с основами экологии. Изд. Просвещение, 1990.

5. Василашку Н.Н. Сезонная динамика населения птиц различныхбиотопов крупного города. // Современные проблемы зоологии иэкологии. Одесса, 2005. – С. 37-39.

6. Волцит О.В., Черняховский М.Е. Природа России. Жизнь животных. Изд. Москва, 1999.

FAUNA OF CARNIVOROUS MAMMALS IN THE ECOSYSTEMS FROM LOWER COURSE OF NISTRU RIVER

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The carnivorous mammals are situated on the top of trophic pyramid of animal world, therefore, they are very susceptible to the drastic modifications of the ecosystems caused by anthropogenic factors. As result, the fauna populating the ecosystems subjected to radical modifications suffer serious modifications. Thus, when the Balti steppe from the north and Bugeac steppe from the south of the republic were reduced,

many animal species disappeared or became threatened, as is the status of steppe polecat.

Intense deforestation and swamp draining had a strong negative impact upon ecosystems fro lower Nistru meadow. After the deforestations accomplished in 60's of the past century (Kravciuk et al., 1976), the fauna in general and the mammal fauna in particular have suffered a lot. In such situation many carnivorous mammal species were included in the Red Book of Moldova.

Material and methods

The materials were collected by the researchers from Laboratory of Mammal Ecology of Institute of Zoology during several decades, starting with the 60's of the past century, when the region of Lower Nistru was projected for transformation in agricultural lands. The assessment, evaluation and observations of carnivorous mammal behaviour were performed according to standard methodology (Novicov, 1949). Determination of carnivorous mammal species composition and of population density was carried out by counts on the route, after the traces and trophic activity. The length of routes ranged from 1-10 km, depending on the total area of the studied biotope. In registered animals the following parameters were registered: species, sex, age, physiological and reproductive state.

Results and discussions

The Nistru valley in the sector Copanca – Palanca is rather wide and reach 10-15 km width. In this area many types of biotopes are present, including coastal, lacustrine, paludous, arboreous etc. Coastal biotopes are represented by Nistru riverbed with smooth banks and slow flow, which in Glinoaia village sector bifurcate in Turunciuc stream and unites again with Nistru in Beleaevca village sector from Odessa Region, forming the island with the same name – Turunciuc, which was deforested in the past century till Nezavertailovca village. The inferior part of the island has remained untouched with lakes, reeds and unfathomable willow thicket. The lakes from Nistru mouth, Cuciurgan lake and the lakes from Turunciuc island are lacustrine biotopes.

Arboreous biotopes at present are formed by remains of meadow wood from Copanca, Talmaz and Corcmaz and by coastal forest stands from Copanca, Leontievo and Olăneşti. In the forests fro Nistru valley the dominant tree species are oak, ash, elm, white poplar, black poplar, willow. Many of the trees are old, with thick stems and many hollows, where European Pine Marten, wild cat and many bat species find shelter. The places with many trophic resources are in sectors with dense shrub vegetation formed by Tatar maple, tamarix, hawthorn and willow thicket. Here also feed the fox, the black polecat, the otter, the ermine and the weasel.

The lakes from Turunciuc island and those from Nistru mouth have a rich hydrophilous vegetation of reed, rush and sedge, where the ermine, the European mink, the polecat and the least weasel find favorable trophic conditions. In Nistru riverbed is the feeding territory for the otter and the European mink. The otter feed on fish, crayfish, river clams and water insects, while the European mink feed on small fish, water voles and other small rodents living near the river. In lacustrine biotopes the wild cat prefers the thickets of reed and rush near the lakes and unfathomable willow thickets from the lower course of Nistru river.

In coastal woods the dominant tree species are represented by pubescent oak, petiolate oak, Norway maple, elm, ash and bush vegetation formed by hawthorn, Tatar maple, blackthorn etc., which ensure safe shelter for the wild cat, the European pine marten, the stone marten, the polecat, the weasel, while in steep slopes the badger and the fox burrow their lairs. Often, in the abandoned by badger or by fox lairs the wild cat find shelter.

At present, the most of mentioned above species, due to the measures taken by State bodies, supported by the Society of Hunters and Fishers of Moldova, started to increase their population number in this zone of Nistru river. The traces of activity of otter and European mink are registered in Nistru riverbed from Copanca to Glinoaia villages. In 80's of the past century the activity traces of these mammals were recorded at distances of 1 – 3 km, while at present they are recorded at 10 – 15 km. The wild cat in reed and rush thickets has the density of 3-4 individuals per 10 km, thus the species is two times more frequent than 20 years ago. In living habitats of water vole the activity traces of the stoat are 2-3 times more frequent than in 80's of the past century. Only the activity traces of the European pine marten are registered more seldom, because of the missing of enough suitable shelter places, where it could reproduce, and because of nocturnal hidden life mode. Therefore, the protection measures of carnivorous species in lower Nistru, launched by the competent bodies, contribute sufficiently to restore the number of threatened species from the lower course of Nistru river.

Conclusions

The lower Nistru valley, in spite of the ecological crisis provoked by anthropogenic factors, comprises a

wide variety of natural ecosystems of indisputable value for biodiversity conservation. In this area during the periods of negative ecological transformations the most of vertebrate animal species have preserved. Therefore, all 12 species of carnivorous mammals, inhabiting the ecosystems of R. Moldova are registered in lower Nistru valley.

Bibliography

1. Корчмарь Н. Д. Хищные звери Молдавии обитающие в плавневых биотопах Днестра, Прута и их притоков. Т-сы докладов научной конфере-нции по итогам исследовательской работы за 1964 год, Тир.ГПИ.Киши-нев, 1965, с. 118-119.
2. Кравчук Ю. П., Верина В. Н., Сухов И. М. Заповедники и памятники природы Молдавии. Кишинёв, 1976, 311с.
3. Новиков Г. А. Полевые исследования экологии наземных позвоночных. Советская Наука, 1949, 602 с.

SENSORY CHANNELS AND SEXUAL COMMUNICATION MESSENGERS OF CAUDAL AMPHIBIANS - SYNTHETIC ANALYSIS

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The concept of ritualization and its consequences regarding to a group of animals studied by us - amphibians, provides us with a description of extreme opportunism in the evolution of sexual communication systems in which signals from various species of newt's convenient biological processes are modeled. It is so obvious and legitimate to consider the advantages and disadvantages of sensory modalities used by *Triturus vulgaris* and other species of the genus *Triturus* newts as they would be in competition for the privilege of transmitting messages. In other words, scientifically we can make reasonable hypothesis ***that the newt species evolve its arsenal of sensory behavior by blending (mixing) them that maximizes either energy or information efficiency, or both (in the ideal case).***

Let's examine the main sensory channels with special reference to their competitive ability, relative advantages and disadvantages of their characteristics. The most relevant sensory arsenal and communication channels of genus *Triturus* are: ***chemical, tactile*** and ***visual communications***; in comparison, we have to emphasize that for the ecaudal amphibians audio communication is very important.

Chemical communication. Pheromones of caudal species with underwater reproduction were certainly the first intraspecific communication signals used in realizing it, especially for sexual communication. Pheromones are considered, including sexual ones, as direct ancestors of hormones, not accidentally pheromones leave essential signals for the most taxon of animals. Chemical communication in this regard is certainly a universal way of animal communication, for newts having an important role in achieving the reproductive process. The following remarkable advantages are due to chemical signals compared to following forms of communication: a) can be used by newts in darkness, regardless of the degree of water clarity and its dense vegetation, because pheromones bypass the obstacles; b) pheromones are biosynthesized without much energetic effort and are eliminated in operative way which does not require complicated system of diffusion and a high energetic efficiency; c) they are detected on olfactory way, both in direct contact as well as on distance; d) they have indirect effect and constant action of the addressee enabling and issuing the chemical message dealing with other important vital activities (feeding, resting, etc..). Namely, for this consideration male newts have multiplied sex pheromone-producing glands by increasing key sizes cloacal labia, in which the main odoriferous glands responsible for their secretion are located. To increase the distance range of pheromones that are addressed primarily to females (of course, and other conspecific individuals), males perform vigorous movements of the body and tail to produce water jets through which pheromones are getting the addressee rapidly.

In fact, sexual pheromones of the newt are performing two important functions of communication: they serve as chemical messages for reliable sexual partner that the "author" of pheromones is ready for reproduction on the one hand, and on the other these pheromones, are received by the other sexual partner which lead to a motivation for Final Act of the reproductive process – finalizing eggs depositing and tendency to fertilization.

Tactile communication represents an additional sensory channel for *Triturus vulgaris* species, meant

to complement, strengthen, and at the final stage to serve as a key incentive for the end of the last act of reproduction – spermatophore submission and fecundation. This method of communication is attested at all stages of the cycle of suite behavior and is manifested by both conjugal partners. Female being touched by the male in the abdominal, cloacal, head and neck area, during the initial phase of individual meeting on his territory, as well as during mid and final stages of courtship, has the function to demonstrate its presence and the additional stimulation of the female, to induce as much as possible the act of courtship moving toward the next compartmental stage. The female, being stimulated by the male olfactory and optically is getting in touch with the nose on the side, neck and tip of the tail of the male. These behavioral measures, involving the sense of touch, are the signals that female is sexually motivated and ready for the final phase - the fertilization of eggs.

Therefore, communication through touch (tactile stimulation) is fully developed in those intimate sexual sequences of courtship which lead conjugal partners to closest ***physical contact***. This ***physical contact*** (direct presence and culminant attachment between partners) is extremely important to caudate, due to the fact that for ecaudate, the coupling process is missing itself, whereby the partners in this amphibian group get into direct physical contact throughout the period of egg deposition and fertilization (which assures an exact tactile coordination of these physiological and behavioral processes of reproduction).

Visual communication is very important in achieving reproduction of species *Triturus vulgaris* since, along with olfactory stimulation, visual stimulation is acting distant and quite efficient due to its size, shapes, performant and expressive colors of particular morphological structures (dorsal ridge, fringe skin of the limbs, prominent cloaca etc.) with role of secondary sexual organs appeared as a result of intraspecific sexual selection. Not incidentally, for this type of natural selection of *Triturus vulgaris* and other species of newts appeared and strengthened a well expressed sexual dimorphism. Males, by their relevant secondary sexual characters and color Suite unrepeatable, produce an irresistible visual stimulation effect on females. Certainly, the same as other important ecological factors that had influenced (air and water temperature, sunstroke, light etc.) the passage of the newt breeding season to the diurnal mode of life (in other active periods of the year the newts are active on twilight or at night), the involvement of visual communication in the implementation process of reproduction was also one of the most important ecological factors. Therefore, to achieve a high efficiency of suite behavior - conjugal partners have to observe and examine each other under water in details their particular morpho-chromatic characteristics, nuptial behavior take place most frequently during day time namely in sunny areas, these environmental conditions allowing to conjugal partners full use of the optical communication channel.

Priority of this communication sensory system is because of its dominant feature - **directionality:** the visual images of the partners are immediately fixed in space. Newts' visual signals act in accordance with following strategies which are diametrically opposed to the length of the transmitted optical signal. At one extreme, models (changes in) of shading and different color may be exposed to conjugal partners more or less permanent and temporarily supplemented by: a) special pigment deposit; b) cromatofors' expansion and contraction; c) taking a certain position in the area for emphasizing or diminishing of certain chromatic particularities etc., and, thereby, prov**iding long-term visual signals with minimum lose of energy**. Therefore, when the use of visual communication channel is possible, optical signals are extremely important in identifying specific individuals belonging to both sexes, and their level of sexual motivation or their sexual status within groups. At the other extreme, optical signals can be constituted in such a way to ensure a rapid disappearance and change, and thus, they can transmit the fastest certain intentions of partners in their general courtship behavior. As already mentioned above, distinct features of the optical signals are advantageous only in limited circumstances: in the absence of light, optical communication is unsuccessful. Not incidentally, this sensory channel of newts is linked with the olfactory (chemical) one, designed to ensure smooth conduct of suite behavior when there is lack of light or darkness. In addition, to communicate visually with some precision, both conjugal partners must not only meet certain appropriate actions, but also orient correctly one another for each transmission of visual message.

THE MECHANISMS OF THE MATERNAL EFFECT ON THE BEHAVIOUR OF YOUNG RABBITS IN THE PREPUBERTAL PERIOD

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Introduction. The offspring of all mammals interact efficiently with their mother during early stages of ontogenesis. Later depending on species-specific characters, the young animals need progressively reach autonomy from the mother, in both social and alimentary terms. Mikhailov (1991) reported that the live weight of meat rabbits kept together with their mother up to 3 months of age was significantly higher that of the offspring weaned at the age of 1 month. The mechanisms of the mother's influence on the young rabbits' growth remain unclear. The aim of our study was to examine the mechanisms of the maternal effect on the behavior of young rabbits in the prepubertal period.

Material and methods. Experiments were conducted at the experimental station "Chernogolovka" of the Institute of Ecology and Evolution of the Russian Academy of Sciences (Russian Federation, Moscow region). The dwarf rabbits Oryctolagus cuniculus (Linnaeus 1758) were used as the object of our investigation. Baby-rabbits were kept in the similar cages with a transparent front wall in groups of three individuals (up to 1 month of the age together with the mother, then to 3 months of age either separately from the mother (two "apart" groups) or up to 3 months of age together with their mother (three "joint" groups). At the age of rabbits of 1 to 3 months, we conducted observations and recording of their behavior using a digital camera 2 days a week for 2 hours during the period of animals' activity (149 hours of observations). For each 2-hour observation period, we analyzed the movie (15 minutes) with a computer program 'The Observer Video Pro. 4.1". Statistical processing were performed using MS Excel and Statistica.

Results and discussions. The ethogram was compiled. 78 elements of behavior were grouped into the following 8 classes: *eating* (8 elements of behavior), *neutral socio-oriented* (43), *playing* (10), *aggressive* (10), *comfortable* (2), *marking* (1), *suckling* (3) behavior and the active suppression of *aggressive* behavior of the young rabbits by the mother (1). 23 of behavioral elements of different classes represent the interaction of the mother with it's rabbit-babes.

The dominating behavioral classes were *eating* and *neutral* in total duration and in total number of behavioral acts of baby-rabbits and of the mother. The high proportion of *playing* behavior was in number of behavioral acts, but only among rabbit-babes.

Table 1. Percentage of elements of the behavior of different classes.

Behavior	Young rabbits apart (n = 6)		Young rabbits together with mother (n =9)		Mother (n = 3)	
in total number of behavioral acts / in total duration of behavioral acts						
neutral, %	24,1 ± 4,3	27,0 ±10,3	29,2 ± 2,1	32,5 ± 7,2	29,5 ± 8,5	28,0 ± 5,7
eating, %	36,4 ± 3,9	65,4 ± 7,3	30,5 ± 6,1	55,8 ± 10,3	41,3 ± 5,5	56,9 ± 7,7
comfortable,%	11,9 ± 6,3	4,6 ± 1,0	15,1 ± 6,0	9,2 ± 4,3	25,3 ± 7,7	15,0 ± 2,0
playing, %	27,0 ± 6,7	2,0 ± 1,4	21,9 ± 6,8	1,1 ± 0,6	9,5	0,4
suckling, %	–		1,5 ± 1,2	1,2 ± 1,0	–	

Note. Playing behavior was registered in only one mother of three.

Comparison (using U-Mann-Whitney test) of groups of rabbit-babes together the mother with ones apart revealed a significant differences in the *eating* (in total number and duration of behavioral acts, P = 0,045), *neutral* (in number of behavioral acts, P = 0,010) and *comfortable* (in total duration of behavioral acts, P = 0,028) behavior. The proportion of *neutral* and *comfortable* behavior of babies in the groups together with the mother was more than the proportion of *eating* and *playing* behavior which shares were smaller. Thus we observed the following trend: the value of share of behavioral classes of young rabbits in groups

kept together with the mother shifted toward values typical to the mother's behavior in comparison with the offspring apart. This indicates that the differences in the ratios of elements of certain classes of behavior in groups together with the mother and apart are the result of mother's influence. The mother's behavior was characterized by following: either *playing* behavior was not recorded, or it's share was significantly smaller to the other the classes of mother's behavior and to the share of *playing* behavior of the babies. *Marking* behavior was recorded only in joint groups in individual cases. *Aggressive* behavior was observed only in few groups, and its share was small: from none to 2,7% in the apart groups and from none to 7,7% in the joint groups (differences are insignificant, $P > 0,05$). The *aggressive* behavior of the mother was observed only in cases when it actively suppressed the aggression of babies to each other. We singled such behavior in a separate class. It is remarkable that the mother sometimes can make active steps against the aggressor, making him cease to show aggression, but still most of the incidents of aggression, were not visually suppressed by the mother. Probably the decrease of the aggression was the result of mere contact of the aggressor with the mother, even without its active action. Observations revealed that rabbit-babes, which were exposed to aggression, tended to keep closer to their mother. This may also help to prevent the rise of aggression. Proportion of young rabbits' behavior, aimed at *suckling* was negligible, but still such behavior persisted up to 3 months of age (in all three joint groups we registered attempts to suckle and in two of them – long-lasting sucking). Decrease in the proportion of *eating* behavior in groups of young rabbits together with the mother as compared with groups apart from mother may be caused in inter alia by their possibility to get nutrients from the mother's milk. The variation of all classes of behavioral acts on the duration and the number was typical for the age dynamics of behavior in groups both together and without the mother throughout the observation period. However, variations occurred considerably synchronously in different animals of the same group. Table 2 presents the results of the analysis of synchronous behavior in groups.

Table 2. The average proportion of synchronous behavioral acts as a percent of total recorded behavioral acts for different classes of behavior.

Behavior	Young Rabbits apart (n = 6)	Young Rabbits together with mother (n =9)	Mother (n = 3)
neutral, %	60,9 ± 13,4	45,8 ± 8,7	52 ± 12,3
eating, %	94,4 ± 3,3	88,1 ± 8,4	92 ± 5,0
comfortable, %	33,1 ± 11,6	47,2 ± 10,2	53 ± 21,3
playing, %	52,9 ± 14,0	42,3 ± 20,1	52
suckling, %	–	50,6 ± 38,7	–

As seen from the table in all behavioral classes there was a high level of synchronization of young rabbits' behavior in groups (together with mother and apart), as well as the mother's behavior. Statistical evaluation of data using a criterion $\chi 2$ (chi-square test) showed that the presence of the mother leads to a significant increase in synchronization only of *comfortable* behavior ($P = 0,0014$) and significant decrease of synchronization of *neutral* ($P = 0,0209$), *eating* ($P = 0,0021$), *playing* ($P < 0,0001$) behavior and behavior in general ($P < 0,0001$). Synchronicity of the *aggressive* behavior was very variable and ranged from 0 to 66.7 % in the apart groups, and from 0 to 100 % in the joint groups, the significant differences were not revealed ($P > 0,05$). Observations and data analysis revealed that any of the young rabbits as well as the mother can appear the initiator of the synchronization of behavior both in groups of the offspring together with the mother and apart but at the same time the contribution of each animal varies considerably throughout the observation period. Comparison of young rabbits inside a group by the total number of initiated behavioral acts (during the whole observation period) revealed the following trend: the young rabbit most aggressive in the group used to be the initiator of most behavioral acts of all classes (in the joint groups and in the apart groups).

Conclusions. Mother's presence affects the behavior of young rabbits in the prepubertal period, in particular the correlation of elements of behavior of different classes and the level of synchronization of behavior. We determined the presence of some mechanisms of influence of the mother, connected with suckling and with regulation of the level of offsprings aggression.

BIRDS FAUNA IN THE PISCU MORII LAKE AREA (VASLUI COUNTY, ROMANIA)

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During the period November 2008 - 31 October 2009, we done a regularly monitoring focused on the birds populations present during the all yearly phenological aspects, inside and in the neighbourhood of the site Ivesti – Pogonesti – Coroiesti - Ciocani (Vaslui County), where will be develop a wind farm. Outside of the future wind farm Ivesti, but nearest the south-western limits of this territory, the Pereschev rivulet forms the Piscu Morii Lake, that represent an important stopover point, breeding area and feeding territory for numerous aquatic and semi-aquatic bird species. There no previously ornithological data on this area (Papadopol, 1975). For this reason, we paid our attention to the birds' diversity and their behaviour in order to establish the potential risk for this group after the appearance of the wind farm in the area. The habitats are represented by the open water surface, wet meadow with marshes areas, compact reed beds and a flooding meadow forest along the Pereschev rivulet valley, respectively, one young woodland plantation and some bushes areas in the south-eastern side of the lake.

The list of the recorded birds' fauna in this area includes 105 bird species, 53 of them being breeding species. Our field observation permitted us to identify a principal flyway of the birds in autumn, coming from north-western to south – south-eastern direction, respectively, from south – south-eastern direction to the north-western during the spring migration, following the Pereschev rivulet valley, outside of the future wind farm's perimeter. So, we can assume that, during the migration time, but also in the other phenological aspects from the year, these birds' movement would be not affected by the potential presence of the wind turbines.

Between the aquatic birds recorded in the wintering period, we notice the presence of *Anser albifrons* that could search for food on the arable lands inside the future wind farm. We recorded a movement of the birds to the western limit of the wind farms, but we found the birds just on the aquatic surface and in a feeding area on the western slope of the lake, so, outside of the wind farm's area. When the temperature is falling down 0 ^{0}C, the lake is completely frozen and the aquatic birds are leaving the area, going to other southern wintering areas. In this winter, we found the lake covered by complete ice bed in January (probably, the lake could frozen in later December) till the February month. We assume the probability that the water' surface could be thawed temporarily, permitting the stopover of some aquatic, semi-aquatic and wader species beginning from February, but the access to the lake was impossible before the last decade of March. We assume this possibility starting from the situation recorded on the Simila Lake (Bacani), which is situated in north, at about 25 km distance, where we could identify and count the aquatic birds using the telescope from a high point in the northern bank of the lake, on the road. For example, on the 6th February 2009, on the open waters we counted small groups of *Cygnus olor*, *Anser anser*, *Anas platyrhynchos*, *Anas penelope*, *Anas querquedula* and *Aythya ferina*, but also some exemplars of *Ardea alba* and *Tringa ochropus*. We must notice that, when the temperatures decreased in the March beginning (till -15 ^{0}C), associated with a high level of the rainfalls, all the lakes frozen completely in the area, so, the aquatic and semi-aquatic bird species (ducks, herons and egrets, waders) were forced to go back in the southern areas. The birds came back just in the final of the second decade of the March.

The aquatic and wader species are dominant through the counted effectives, especially, during the first part of the spring migration period. In the March 2009's weather conditions, the birds halt just for few days in the area, so, we cannot eliminate the probability that the really passage effectives of some species through the lake's area can be significantly greatest than those recorded (we visited the site just twice time monthly). In May, the waterfowls and waders effectives decreased obviously, in the lake's perimeter remaining just the breeding species and some young, immature birds that are not leaving to the northern breeding territories.

As we mentioned before, due the very freaky weather conditions recorded in the first part of the 2009' spring, the aquatic and semi-aquatic bird species that stopped on the Piscu Morii Lake and on the surrounding wet meadows or in the flooding meadows along the Pereschev rivulet valley, left this territory very quickly, going to the northern breeding areas.

The suitable breeding habitats cover, relatively small surfaces and the local community from Fichitesti

village has a really pressure on the meadow forest along the Pereschev valley taking woods for fire and exploiting the red beds and the osiers (for wickerwork). Differently from the migration period, in the breeding season, the birds' fauna is dominated by the passerines through their diversity and breeding effectives, too. The passerines group is present with species that weave the nests inside the compact reed beds (*Acrocephalus arundinaceus*, *Acrocephalus scirpaceus*, *Acrocephalus schoenobaenus* or *Emberiza schoeniclus*), in the trees and bushes' crown inside the meadow forest from the Pereschev rivulet valley and in the young woodland plantation from eastern slope of the lake, using the hollows and the old woodpecker' nests, too, but also in the cultivated lands and grasslands, with small isolated bushes and shrubs. Practically, the aquatic and semi-aquatic bird species are just few and with just some breeding pairs, building the nests inside the compact reed beds from the lake's tail area and prolonged along the Pereschev rivulet valley or on the flooding grasslands from the north-western sector of the lake. We notice the presence of some pairs of herons and spoonbills that are forming a mixed breeding colony in the reed bed (*Ardea alba*, *Ardea cinerea*, *Nycticorax nycticorax* and *Platalea leucorodia*), but also of one pair of *Cygnus olor*. The waders are represented through three species – *Vanellus vanellus*, *Charadrius dubius* and *Himantopus himantopus* (the last is a rarely breeding species in Romania and is present here with two pairs).

We must notice, too, that we not recorded the presence of the corncrake – *Crex crex*, despite the existence of some surfaces with suitable habitats in the humid grasslands along the Pereschev rivulet valley.

The falcons (*Falco tinnunculus* and *Falco vespertinus*) were observed on the nest and staying in the trees, used like sites for resting and prey survey points, but hovering on the hunting territories from the eastern border of the lake, too.

In the cultivated lands outside of Fichitesti village, we met adult and juvenile individuals of *Perdix perdix*. In the perimeter of the clay extraction closed quarry, situated along the local road to Fichitesti village, we identified a mixed breeding colony formed by ten pairs of *Merops apiaster*, six pairs of *Passer montanus* and two pairs of *Sturnus vulgaris*. We saw the birds searching food along the Pereschev valley and on the northern side of the county road, so, completely outside of the future wind farm's perimeter.

Very different from the spring migration time, when the birds left quickly this area in order to arrive in the northern breeding territories, during the autumn passage period, the birds are staying for longer time, sometimes even for ten – twelve days, feeding in the rich wetlands existing around the Piscu Morii Lake. We notice the earlier presence of one flock of *Anas clypeata* for the second decade of August (10 individuals, 13.08.2009). The waders appear in small flocks (15 – 20 individuals) during September (*Calidris temminckii*, *Arenaria interpres*, *Charadrius dubius*, *Limicola falcinellus*, *Actitis hypoleucos*, *Tringa ochropus* or *Tringa nebularia*), the exception being *Vanellus vanellus* that can be present with flocks about hundreds individuals, adult and juvenile birds – 380 individuals, 28.09.2009.

During the October, the ducks are going to the south, passing in flocks about hundreds individuals: *Anas platyrhynchos* is the dominant species, being recorded in groups about 380 – 420 individuals, but there are present other species, too, with effectives about tens individuals – *Anas penelope*, *Anas clypeata*, *Aythya ferina* and *Aythya nyroca*. In the same time, the wader species appear in the second migratory wave, with more significant effectives than in August and September – *Vanellus vanellus*, *Gallinago gallinago*, *Gallinago media*, *Lymnocryptes minimus* and *Tringa totanus*. In the ending October, we identified some wintering visitor aquatic birds in our country: *Gavia arctica* (3 males, 19.10.2009), *Anas crecca* (158 individuals, 19.10.2009, or 280 individuals, 27.10.2009) and *Anser albifrons* (174 individuals, 27.10.2009).

We recorded 21 bird species included in the Birds' Directive present in the lake's perimeter, 12 from its being included in the Romanian Red Book of the Vertebrates, too. We notice presence of *Aythya nyroca*, globally threatened species and the presence of *Phalacrocorax pygmeus*, vulnerable species in Europe, where is concentrated almost 75% from the global breeding population of the species, the both being passage species in the investigated area, but also the breeding presence of *Platalea leucorodia* and *Himantopus himantopus*, species that are breeding in small pairs number and just in very few sites on the Romanian territory. In the same time, we notice the presence of two breeding pairs of *Falco vespertinus*, species with negative trend in our country.

References

Papadopol, A. 1975 - *Contribution à la connaissance de l'avifaune du district Vaslui*, Travaux du Museum d'Histoire Naturelle "Grigore Antipa", Bucureşti, 16: 249 - 264.

***, 2009 - Directive 2009/147/EC on the conservation of wild birds

THE INFORMATION SYSTEM "STATE CADASTRE OF THE ANIMAL WORLD OF THE REPUBLIC OF BELARUS (GAME ANIMALS)" AS A TOOL OF PROTECTION AND RATIONAL USE OF BIOLOGICAL RESOURCES

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The cadastr is the systematized, officially made on the basis of periodic or continuous observations set of basic information about the economic resources of the country. The game animals, as well as animals in general and as well as other kinds of biological resources, are an important component of national wealth, the systematic monitoring of their condition with the purpose of efficient use is an important element of economic activity.

For the formation of the information array inventory of the hunting animals of the Republic of Belarus the following sources were used:

a) the data of materials of hunting projects and bio-economic studies presented by hunting in 2001-2009;
b) data of the Ministry of natural resources and environmental protection (reports of regional committees of natural resources and environmental protection in the section of protection and use of fauna and the environment conservation);
c) data of the reporting of State forestry organizations of the Ministry of forestry;
d) data of the republican and regional associations of Belorussian society of hunters and fishers;
e) archival data of the Ministry of natural resources and environmental protection and the Ministry of forestry for 1986-2000 years;
g) environmental monitoring data.

As a result of the works collected and systematized factual material on the characteristic of hunting enterprises, subject to the number of stock assessments, data on production of hunting animals in enterprises of different forms of ownership in 22 districts of the Minsk region (54 enterprises), 21 district of Vitebsk region (61 enterprises), 21 district of Gomel region (36 enterprises) and 21 district of the Mogilev region (34 enterprises). The time period of observations covers 1996-2010.

Such information system allows for the assessment of changes in population status, plan for growth and bag of the hunting animals.

The system allows to conduct the comparative analysis of the spatial and temporal principle, and also construction of the population-based models.

As a model sites can be selected Gorodok and Minsk areas, as examples of the least and the most anthropogenically applied areas - area 2980,4 km^2 and 2021,5 km^2 , the population density 8,98 and 78.9 people per km^2.

On the basis of the five-year observations of wild hoofed animals (*Alces alces*, *Capreólus capreólus*, *Sus scrofa*) (tables 1 and 2) from 200 to 2009 year built polinominal model of number changes.

Table 1. The dynamics of the number of wild hoofed animals in the Gorodok district of the Vitebsk region.

Wild animal	2005	2006	2007	2008	2009	2010		Diversion, %
						Real number	Prognosis number	
Sus scrofa	858	1047	1062	1088	1184	1360	1162	14
Capreólus capreólus	368	478	429	513	579	703	638	9
Alces alces	617	692	605	640	684	692	700	2

Table 2. The dynamics of the number of wild hoofed animals in the Minsk district of the Minsk region.

Wild animal	2005	2006	2007	2008	2009	2010		Deviation, %
						Real number	Prognosis number	
Sus scrofa	326	326	172	220	197	294	218	25
Capreólus capreólus	314	240	199	198	186	263	220	16
Alces alces	69	60	25	27	31	39	42	8

Thus, for anthropogenically slightly transformed territory the average deviation is 8.3 %, and for much transformed is 12, 3 %, and in both cases, the maximum deviation reaches for *Sus scrofa*, and the minimum for Alces alces. High deviation from the prognosis number for *Sus scrofa* can be easily explained by the active use of agricultural land that is widely confirmed by the practice.

The existing electronic system of cadastr provides a fairly exact tools for forecasting of hunting hoofed animals for anthropogenically poorly mapped areas. On territory with prevalence of the agricultural lands in the hunting areas the current model requires a correction to account for the use of wild hoofed animals of agricultural land.

THE IMPORTANCE OF SOME DAM LAKES FOR BIRDS' BREEDING IN BASINS OF PRUT AND SIRET RIVERS (ROMANIA)

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We present our ornithological results obtaining through regular visits beginning from 2004 on seven dam lakes from the basins of Prut and Siret rivers (Iasi and Vaslui Counties). All the lakes are situated inside or near two important Nature 2000 sites in the eastern Romania: Carja-Mata-Radeanu-Roscani (ROSPA061), respectively, Jijia and Miletin Ponds (ROSPA014). Our birds' lists in these two areas include 191 bird species in the perimeter of Carja-Mata-Radeanu Ponds, respectively, 205 bird species on the territory of Jijia and Miletin Ponds; from these, 117 are breeding species, the aquatic and semi-aquatic birds being very well represented.

We used the transect method and fixed point surveys through binoculars and telescope; in some sites, we visited the breeding colonies, in order to make nests and eggs' measurements.

Usual, the birds prefer the fishponds like breeding areas, using the rich feeding resources and the suitable habitats for nests' building - the vegetation covers larger surfaces than on the dam lakes, where, normally, the reed beds and swampy surfaces are present just on the lake's tail areas. In the two visited Nature 2000 sites, the birds that use the large and compact reed beds for nests' building (Ardeidae, Anatidae) and those that use the floating vegetation like nesting habitat (Podicipedidae, Laridae, Sternidae) starting their breeding season in later March or in April, depending on the weather conditions. But in the intensive fishery farms, the administration is keeping the birds' breeding habitat surfaces to one low level and try to avoid the presence of great breeding effectives disturbing the birds through different techniques. In this situation the birds take profits from the presence of other dam lakes in the area. During the first period of spring migrating time, we recorded a big diversity, but also important effectives of birds on these lakes. The birds are forming the breeding colonies later than in the fisheries areas due the water level fluctuations, usual during May or, sometimes in the beginning June. For example, on 20.05.2011, we found a small mixed colony with 9 nests of *Recurvirostra avosetta* and 4 nests of *Vanellus vanellus* in the Miletin swampy area, while, on 5.06.2011, we recorded a big mixed colony on the swampy tail area of Rapa Albastra Lake, including 110 nest of *Chlidonias hybridus*, 7 nests of *Podiceps cristatus*, one nest of *Podiceps grisegena*, 5 nests of *Podiceps nigricollis*, 3 nests of *Tachybaptus ruficollis* and 20 nests of *Fulica atra*, all of them in different building stages or with incomplete clutch. Meanwhile, all these species were presenting on Carja – Mata – Radeanu Ponds' area with grown up chickens, some of them with flying juveniles. At first side, the breeding pairs in the fisheries' perimeter have bigger opportunities, numerous of them having two or three clutches per season. But the breeding birds on the dam lakes' perimeter use the longer time between their arrival and breeding season beginning to feed and restore their reserves depleted during the migration time, so their clutch has greater number of bigger eggs, as we found through our eggs' measurements. In this way, their chickens are bigger and have greater viability rate. Usual, the breeding pairs from fisheries have one or two flying juveniles/clutch while the pairs from the dam lakes take off three or four flying juveniles/clutch.

Halceni Lake, situated on the Miletin River (Prut basin) and part of ROSPA014, is used for fishery and like water source; there is no vegetation around the lake, but the river forms a large swampy area on the western side of the lake, sheltering impressive breeding bird fauna diversity. We mention breeding species like: *Vanellus vanellus*, *Recurvirostra avosetta*, *Himantopus himantopus*, *Limosa limosa*, *Charadrius dubius* or *Chlidonias hybridus*; in 2010 and 2011, we found the nests of two pairs of *Sterna hirundo*. The effectives are not big; juts some tens of pairs are breeding there, mostly forming mixed colonies due the small available habitat' surface.

Also in the Prut River basin, we visited Posta Elan Lake from the Elan River valley, with a surface about 200 hectares, being used to regulate the flooding risks, like water source and fishery. In the northern sector, there exist a large area covered by rush and reed. The breeding fauna is represented by a small number of pairs, but we must mention species like *Ixobrychus minutus*, *Circus aeruginosus*, *Falco tinnunculus* (in the poplars from the shores), *Fulica atra*, *Vanellus vanellus* and *Himantopus himantopus*.

Solesti Lake (Siret basin) has a surface about 348 hectares; the southern shore is concrete, on the eastern and western shores are present meadows and agricultural lands, while the northern shore, representing the lake's tail, is swampy, with small rush beds. The breeding bird fauna include just few pairs of *Chlidonias hybridus*, one pair of *Cygnus olor* and we found some nests of *Motacilla alba* between the partially bare ground roots of willow trees from the north-eastern side of the lake. During the last years, we recorded individuals of *Ardea cinerea*, *Ardea alba* and *Egretta garzetta*, which are coming to feed in this area and we are thinking that these species can become breeding species using the willows and poplars from the north-eastern sector of this lake.

On the Puscasi Lake, from the Racova River (Siret basin), we recorded the constant breeding presence of species like *Podiceps cristatus*, *Vanellus vanellus*, *Charadrius dubius*, *Himantopus himantopus* and *Larus ridibundus*.

Manjesti Lake (Siret basin) present a large area covered by swampy vegetation, including reed and rush beds in the lake tail's perimeter. We found a rich breeding bird fauna, including species like *Podiceps cristatus*, *Tachybaptus ruficollis*, *Ardea cinerea*, *Cygnus olor*, *Anas platyrhynchos*, *Aythya ferina*, *Aythya nyroca*, *Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus, Actitis hypoleucos* and *Chlidonias hybridus*. In the nearest poplars, there some nests of *Falco tinnunculus*, but the area is feeding territory for *Buteo buteo*, too. A colony about 15 pairs of *Merops apiaster* is present in the clay quarry from lake vicinity.

We visited also Rapa Albastra Lake (Siret basin), with a surfaces about 207 ha on Bogdana rivulet, sheltering some breeding birds species *Podiceps cristatus*, *Podiceps grisegena*, *Podiceps nigricollis*, *Tachybaptus ruficollis*, *Ardea cinerea*, *Cygnus olor*, *Anas platyrhynchos*, *Aythya ferina*, *Aythya nyroca, Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus*, *Larus ridibundus*, *Chlidonias hybridus* and *Chlydonias niger*. We mention the probably breeding presence of *Nycticorax nycticorax* in the forest from the south-western shore and the colony formed by 20 pairs of *Riparia riparia* in the high clay banks.

Cuibul Vulturilor Lake is situated on the Tutova River (Siret basin), presenting a large and compact surface covered by reed and rush in the tail area. We mention like breeding bird species *Podiceps cristatus*, *Tachybaptus ruficollis*, *Ardea cinerea*, *Egretta garzetta*, *Botaurus stellaris*, *Anas platyrhynchos*, *Aythya ferina*, *Aythya nyroca, Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus*, *Chlidonias hybridus* and *Chlydonias niger*. In the clay banks, we recorded more than 100 nests of *Riparia riparia*.

The investigated dam lakes present a remarkably importance nor only like stop-over territories during the migrating time, wintering sites and feeding points for the breeding bird species in the protected areas but also it seems to offer suitable breeding conditions, especially for the birds that use to built their nest on the open waters or in not very large reed beds.

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References

Cazacu, Mariana, 2007. *Ecological and ethological study on the Chlidonias genus (Aves – Charadriiformes, Sternidae) from the Romanian inferior basin Prut,* Ph.D.Thesis, Facultatea de Biologie, Univ. "Al. I. Cuza" Iaşi.

Gache, Carmen, 2002. The dynamics of avifauna in the basin of Prut river, Publ. S.O.R., 15, Ed. Risoprint, Cluj Napoca.

Müller, Johanna, Walie, 2005. Breeding waders species in the Prut River Basin, *Oltenia*, *Stud. & Com. Şt. Nat. Muzeul Olteniei Craiov*a, XXI: 178 – 180.

Papp, T. & Fântână, C. (editors), 2008. The Areas of Avifaunistic Importance from Romania, Publication of SOR/BirdLife Romania and "Grupul Milvus" Association.

ASPECTS CONCERNING ORNITHOFAUNA IN VRANCEA REGION

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Introduction

Vrancea County partially overlaps over the southern part of eastern Carpahians in the South-West of Moldavia. The southern part of eastern Carpathians region is a territorial entity formed of the southern part of eastern Carpathians and Subcarpathians, but also of their surrounding plains. Morphologically, the region looks like an opposite amphitheatre, with its convexity outward as three distinct relief levels. The first level consists of mountain massifs of the southern part of eastern Carpathians, Buzau and Vrancea Mountains. The second stage of relief, closely associated with the first, is represented by the southern part of eastern Subcarpathians. Its relief is extremely complex, being made of two rows of depressions and two parallel peaks. The internal depressions (sub-mountainous) are in contact with the mountain frame, starting with Soveja and Vrancea County and continuing with Neculele, Lopatari, Patarlage. A curved alignment of central peaks follows, with altitudes of over 900m (Rachitis, Raiutu, Gurbaneasa, Salcia, etc.), interposed to interhill external depressions (Vidra, Mera, Dumitresti, Policiori). (Posea Gr. et al., 1974) The interhill depressions are separated by a plain, through Magura Odobesti (996m) and by hills: Deleanu, Blajeni, Dealu Mare-Istrita. The southern part of eastern Carpathians region also includes Ramnicu piedmont plain, but also Buzau subsidence plain. The studied area is in the north of the curve area, following the axis of Putna and Ramnic rivers, the region being overlapped with some varied relief units, arranged in steps which descend from west to east.

Vrancea Region holds 8 Important Community Areas and 2 Special Protected Areas for Birds (Magura Odobesti and Vrancea Mountains). In the great diversity of habitats in Vrancea County, with mountains and hills that are lost in Siret Plain, there is a vast corridor of migration, but also a very important nesting bird place.

Materials and methods

The subject of the current work deals with an overview over the avifauna and it is based on Ion I.'s personal observations in the field during over 50 years, on Ion C., C. Stoleriu and A. Ursu's observations, between 2000 and 2011, but also on specialized research papers in literature: Pascovschi S., 1938, Munteanu D., 1969, Boanca Elena & Renea Afrodita, 1969, Mihalciuc M., 1973, Talpeanu M. et al., 1976, Ion I., 1982, Ion I., 1992-1993. The avifauna was analyzed, taking into account the main zones and sub-stages of vegetation to delineate the ornitho-geographical areas: 1. the subalpine avifauna with shrub, meadows, rocks habitats; 2. the coniferous forests avifauna ; 3. the mixed forests avifauna; 4. the deciduous forests avifauna; 5. the streams avifauna; 6. the anthropogenic area avifauna. Birds do not have a strict dependency on certain plant associations, given their mobility and therefore, their distribution is done according to their main preference for these zones of vegetation.

Results and discussion:

1. In the subalpine level, in juniper habitats there are: *Turdus torquatus, Anthus trivialis, Phylloscopus collybita, Prunella modularis, Troglodytes troglodytes, Carduelis flammea.* In the meadows of this layer dominates *Anthus spinoletta*, then *Oenanthe oenanthe* (in the meadows with rock fragments), *Motacilla alba* and *Prunella collaris.* On the rocks, steep slopes there are: *Phoenicurus ochruros* and more rarely, *Falco tinnunculus.* The subalpine avifauna is poor, a few species hatch here because of the more severe conditions (*Anthus spinoletta, Prunella collaris*). In this zone there are also *Tetrao urogallus* and *Tetrastes bonasia*.

2. In the coniferous forests, characteristic birds are more widespread:

Tetrao urogallus, *Dryocopus martius*, *Bubo bubo*, *Aegolius funereus, Periparus ater*, *Lophophanes cristatus, Nucifraga caryocatactes, Fringilla coelebs, Erithacus rubecula,* and more rarely, *Loxia curvirostra*.

3. In the mixed forests, the avifauna is richer. The most common species are: *Garrulus glandarius, Corvus corax, Turdus merula, Turdus philomelos, Sylvia atricapilla, Ficedulla albicollis, Ficedula parva, Dendrocopus medius, Picus canus*, *Caprimulgus europaeus, Columba palumbus*. *Lullula arborea* or *Sylvia nisoria* can be observed in the edge areas. Among protected species of birds of prey which prefer nesting, there are: *Circaetus gallicus*, *Aquila pennata*, *Strix uralensis*. In the last 6-8 years an expansion of nesting in the case of *Pernis apivorus* was noticed, especially along large rivers, where it finds favorable feeding places.

4. The decidous forests avifauna is represented by species as: *Dendrocopus major, Columba oenas, Turdus merula, Turdus philomelos, Sylvia atricapilla, Ficedulla albicollis, Ficedula parva*, *Oriolus oriolus.*

5. The streams avifauna includes characteristic species such as: *Actitis hypoleucos, Alcedo atthis, Cinclus cinclus,* and *Motacilla cinerea. Charadrius dubius* is present on sandy areas of the rivers: Putna, Milcov and Ramnicu Sarat, where it also nests. Another notable presence in the area is the species *Charadrius alexandrinus,* in the nesting period, on Ramnicu Sarat valley. The birds which depend on water through food and nesting are *Tachibaptus ruficollis*, which nestle at Toporasu Lake in Ramnic Basin and the Black Lake – Cheile Narujei, then *Anas platyrhynchos* nests at Vintileasca Lake. *Galinulla chloropus* nests in all the small pools of water with a rich vegetation of the river valley.

6. The antropogenic area avifauna refers to the valleys of the rivers: Putna, Ramnicu Sarat, Milcov. The more common species in the garden are *Jynx torquilla, Dendrocopus medius, Turdus merula, Turdus philomellos, Streptopelia turtur, Carduelis carduelis, Sturnus vulgaris, Parus major, Fringilla coelebs, Lanius collurio, Lanius minor, Passer domesticus* and more rarely, *Poecile lugubris*. Both *Apus apus* and *Delichon urbica* nest in human settlements from the upper to the lower basin of the river. *Coracias garrulus* is a rare presence in the area. In the areas of low altitude, we identified *Streptopelia decaocto, Dendrocopus syriacus, Sylvia nisoria, Poecile lugubris, Serinus serinus, Emberiza hortulana.* In the case of some larger churches in the hill and mountain area (Dolhăuți, Soveja, Năruja, Poiana Mărului) you can find *Tichodroma muraria*. During the fall migration the white stork (*Ciconia ciconia*) crosses the hills area in flocks of hundreds of birds. During summer it nests sporadically in the area, most nests gathering in Ramnicu Sarat Basin (Buda, Alexandru Odobescu, Dumitreşti, Jitia). During the last 8-10 years an active presence and a relatively large number of the species *Turdus phylomelos, Turdus merula* is found in the village area. They nest here and stay during winter, looking for food in people's yard with poultry, *Sturnus vulgaris, Coccothraustes coccothraustes.* In some years, together with these birds, appeared species of *Bombycilla garrulus, Fringilla montifringilla, Lanius excubitor*. Near the anthropogenic habitats there are meadows and pastures where protected species can be observed *Crex crex, Anthus campestris*. With these species there are also many *Alauda arvensis,* (also met in crops) *Carduelis cannabina*, *Emberiza citrinella, Miliaria calandra, Perdix perdix, Coturnix coturnix*.

Our research identified over 156 bird species of which, as we expected, most have Palearctic, Holarctic and European origin. We also conclude that over 60% of these species find breeding conditions, although their presence in the warm period fluctuates every year. The greatest diversity and density of birds are registered on the valleys of the rivers, in the anthropogenic areas because here there is a great diversity of habitats which provides food and nesting conditions.

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References:

Boancă, Elena, Renea, Afrodita, 1969. Păsările ocrotite existente în colecția Muzeului de Științe Naturale din Focșani. Ses. Com. Șt. Muz., Șt. Nat., p. 165-169

Horeanu Cl., 1980. Flora și vegetația Rezervației Forestiere Cenaru (Județul Vrancea). Ocrot. Nat. și Med. Înconjurător, Bucureşti, tom 24, nr.1, p. 21-28

Ion I., 1982. Cercetări asupra avifaunei din bazinul superior și mijlociu al râului Râmnicu Sărat, Stud. și Com., Soc. De Șt. Biol. Reghin, p. 433-442

Ion I., 1992-1993. Glimses on vertebrate fauna of the upper and middle basin of Râmnicu Sărat River. Anal. Șt. ale Univ. „Al. I. Cuza" Iali, s. Biol. Anim., Tom XXXVIII-XXXIX, p. 157-162

Mihalciuc M., 1973. Considerations sur l'avifaune du bassin superieur et moyen de la riviere Putna. Trav. Mus. His. Nat. "Grigore Antipa", vol. XIII: 409-417

Mihalciuc M., Tălpeanu M., Cătuneanu I., 1976. Contributions a la conaissance de la faune du Department Vrancea, Trav. Mus. His. Nat. "Grigore Antipa", vol. XVII, p. 323-334

Munteanu D., 1969. Privire de ansamblu asupra avifaunei din Munții și Depresiunea Vrancei. Lucr. Staț. Cercet. Biol.-Geol.-Geogr. "Steajarul", 2: 201-209

Pașcovschi S., 1938. Observații ornitologice în Carpații Munteniei, Rev. Carpați, an VI, nr. 6, p. 168-174, nr.7, p. 196-202

Posea Gr., Popescu N., Ielenicz M., 1974. Relieful României, Ed. Ştiinţifică, Bucureşti

Tălpeanu M., Mihalciuc M., 1974- Contibutions à la connaissance de l'avifaune de la yone de Vrancea. Trav. Mus. Hist. Nat. "Grigore Antipa", vol. XIV, p. 419-421

CONDITION OF WETLAND BIRD FAUNA OF MOLDOVA ON CONVENTIONAL STADES OF THE LAST DECADES OF ITS DEVELOPMENT

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Introduction

Habitat of waterbirds within Moldova and throughout the surrounding geographical area was transformed with constantly varying pace and qualitative changes under the influence of human and natural factors. These changes affected the fauna of birds that had developed under their dictation.

Materials and methods

Material was compiled from the published data and is based on the experience of long-term observations in nature.

Results

N	Species	Character stay (To 1971 – Iuri Averin)				Fa-una
		To 1971	1970 -1989	1990 - 2010	Position	
1	Gavia arctica L.	tc, hr	tc, hr	tc, hr	-	S
2	G. stellata Pont.	tr	tr, hr	tr, hr	+h (r)	A
3	Podiceps cristatus L.	nc	nc, hr	nc, hr	+h (r)	T
4	P. grisegena Bodd.	nc, tc	n rr, trr <	n X ?, trr <	c – rr -X (n), c - r r (t) <	E
5	P. auritus L.	-	trr	trr	+t (rr)	S
6	P. nigricollis	nr	nrr	nrr X ? <	r – rr - X (n) <	E
7	Tachybaptus ruficollis Pall.	nr	nr, hc	nrr X ?, hc <	r – rr - X (n), +h (c) <	E
8	Phalacrocorax carbo L.	ec	nc, hr >	nc, hr <	e - n (c), +h (r) > - <	T
9	Ph. pygmeus Pall.	er	nr, hrr	nr < hr >	e - n (r), < +h (rr – r) >	Md
10	Pelecanus onocrotalus L.	n X, er	ec >	ec <	r – c (e) > - <	M
11	P. crispus Bruch.	-	err >	err <	+ e (rr) > - <	M
12	Botaurus stellaris L.	nc	nr, hr	nr, hr	c - r (n), +h (r)	M
13	Ixobrychus minutus L.	nc	nc	nc	-	E
14	Nycticorax nycticorax L.	nc	nc, hr	nc, hr	+h (r)	Md
15	Ardeola ralloides Scop.	nc	nr <	nr >	c - r (n) < - >	Md
16	Egretta garzetta L.	nc	nc	nc	-	Md
17	E. alba L.	nr	nr, hc, >	nc, hc, >	r – c (n), +h (c) >	K
18	Ardea cinerea L.	nc	nc, hc	nc, hc	+h (c)	T
19	A. purpurea L.	nc	nc	nc, <	- <	Md
20	Ciconia nigra L.	n X, tr	nr, tr >	nr, tc >	+ n (r), r-c (t) >	E
21	C. ciconia L.	nc	nc	nc	-	E
22	Plegadis falcinellus L.	nr X	nr	nr	-	Md
23	Platalea leucorodia L.	nr X	nr	nr >	>	E
24	Phoenicopterus rubber L.	err	X (?)	X	e – X	Md
25	Cygnus olor Gmel.	nr, hr,	nr, >, hc >	nr, <, hc	n > - <, r - c (h) >	E
26	C. cygnus L.	trr	tr, hr <	tr, hr <	+h (rr) <	S
27	Anser fabalis Lath.	-	tr	tr	+t (r)	A
28	A. albifrons Scop.	tc	tc, hr	tc, hr >	+h (c) >	A
29	A. erythropus L.	tr	tr	tr, hr >	+h (r) >	A
30	A. anser L.	nr	nrr, hr, t <	nrr X ?, hr, t<	r - X (n), +h (r), t <	M
31	Branta ruficollis Pall.	err	er, tc, hr	er, tc, hr >	rr – r (e), +h (r) >	A
32	Tadorna ferruginea Pall.	err, n?	err	nrr >	+ n (rr) >	M
33	T. tadorna L.	er	er, hr >	ec, hr >	r-c (e), + h (r) >	M
34	Anas penelope L.	tc	tc, hr	tc, hr <	+h (r) <	S
35	A. strepera L.	nc, hr	nr, hr	nrr, hrr <	c - rr (n), r-rr(h) <	T
36	A. crecca L.	nr	nrr, hrr, <	nrr X ?, hrr <	r-X (n), +h (rr) <	T
37	A. platyrhynchos L.	nc, hc	nc, hc	nc, <, hc >	nc <, hc >	T
38	A. acuta L.	tc	tr, hrr <	tr, hrr <	c - r (t), +h (rr) <	S
39	A. querquedula L.	nc	nc	nr < - >	c – r (n) < - >	T
40	A. clypeata L.	nr	nrr <	nrr <	r – rr (n) <	T
41	Netta rufina Pall.	nr, h	er, hr	err, h X ? <	n - e (r-rr), h – X <	Md
42	Aythya ferina L.	nr	nc, >, hc >	nc, <, hc >	r - c (n), > - <, +h (c) >	E
43	A. nyroca Guld.	nc	nr, hc <	nr, >, hr	c - r (n), < - >, +h (r)	E
44	A. fuligula L.	tc, hr	nr, hc >	nrr X ?, hc <	+n (r – rr X ?), r –c (h)>-<	S
45	A. marila L.	tc, hr	tc, hr	tc, hr	-	A
46	Clangula hyemalis L.	err	X	X	err – X	A
47	Melanitta fusca L.	tr	tr	tr <	<	S
48	Bucephala clangula L.	tc	tc, hc	tc, hc >	+h (c) >	S
49	Mergus albellus L.	tc	tc, hc	tc, hc	+h (c)	S
50	M. serrator L.	tr	tr, hrr	tr, hrr <	r - rr (t), +h (rr) <	S
51	M. merganser L.	tr	tc, hc	tc, hc >	r - c (t), +h (c) >	T
52	Oxyura leucocephala Scop.	er	X	X	e – X	Md
53	Haliaeetus albicilla L.	srr X	n ?, tc, hr	n ?, tc, hr	n (rr) ?	T
54	Circus aeruginosus L.	nc	nc, hr	nc, hr >	n >, +h (r)	M
55	Pandion haliaetus L.	tc	n (?), tc	n (?), tc	-	T
56	Rallus aquaticus L.	nc, hr	nc, hr	nr, hr <	c – r (n) <	E
57	Porzana porzana L.	nc	nc, hrr	nr, hrr <	c – r (n), +h (rr) <	E
58	P. parva Scop.	nc	nc, hrr	nr, hrr <	c – r (n), +h (rr) <	E
59	P. pusilla Pall.	nr	nr	nrr <	r – rr (n) <	E
60	Crex crex L.	nc	nr <	nc >	c – r, r –c (n) < - >	E
61	Gallinula chloropus L.	nc, hr	nc, hr	nc, hr	-	E
62	Fulica atra L.	nc, hr	nc, hc	nc, hc	r - c (h)	T
63	Haemantopus ostralegus L.	er	er	err	r – rr (e)	T
64	Himantopus himantopus L.	n? rr	nr >	nr >	? rr - r (n) >	M
65	Recurvirostra avosetta L.	e	nrr	nrr	+ n (rr)	M
66	Glareola pratincola L.	n? rr	n – X, trr	trr	? rr - X (n)	Md
67	G. nordmanni Fisch.	n? rr	X (?)	X (?)	? rr – X (n)	M
68	Charadrius dubius Scop.	Nc	nr	nrr	c - rr (n)	M
69	Ch. hiaticula L.	tr	tr	t – X ?	r – X (t)	A
70	Ch. alexandrinus L.	tr	trr	t – X ?	r – X (t)	M
71	Ch. morinellus L.	tr	X (?)	X (?)	t - X (r)	A
72	Pluvialis apricaria L.	tr	trr (?)	trr (?)	r - rr (t)	A
73	P. squatarola L.	tr	trr (?)	trr (?)	r - rr (t)	A
74	Vanellus vanellus L.	nc	nc, hr	nc, hr	+h (r)	M
75	Calidris minuta Leisl.	tc	tc	tc	-	A
76	C. alpina L.	tc	tc	tc	-	A
77	C. ferruginea Pont.	tc	tc	tc	-	A
78	Philomachus pugnax L.	tc	tc	tc	-	S
79	Lymnocryptes minimus Brunn.	tc	tc, hrr	tc, hrr	+h (rr)	S
80	Gallinago gallinago L.	tm	tc, hrr	tc, hrr	+h (rr)	E
81	G. media Lath.	tr	tr	tr	-	E
82	Scolopax rusticola L.	tc	tc, hrr	tc, hrr	+h (rr)	E
83	Limosa limosa L.	nr	n – X	n – X	n – X (r)	M
84	Numenius phaeopus L.	er	e – X ?	e – X ?	e - X ? (r)	S
85	N. arquata L.	tc	tc	tc	-	E
86	Tringa erythropus Pall.	tr	tr	tr	-	S
87	T. totanus L.	nr	tc	tc >	- n (r)	M
88	T. stagnatilis Bechst.	nrr ?	tc	tc	- n (rr)	M
89	T. nebularia Gunn.	tc	tc	tc	-	S
90	T. ochropus L.	tc	tc, hrr	tc, hrr	+h (rr)	S
91	T. glareola L.	tc	tc	tc	-	S
92	Actitis hypoleucos L.	nc	nc	nc	-	T
93	Phalaropus lobatus L.	-	trr	?	+t (rr) ?	A
94	Larus melanocephalus Temm.	-	err	err	+e (rr)	Md
95	L. minutus Pall.	tr	tr	tr	-	S
96	L. ridibundus L.	nc, hr	nr, hc	nr, hc	c - r (n), r - c (h)	T
97	L. canus L.	tc	tc, hr	tc, hr	+h (r)	S

98	L. argentatus Pont.	nrr, hr	nrr, hc	nrr, hc	r - c (h)	T
99	L. fuscus L.	-	tc, hr	tc, hr	+t (c), +h (r)	A
100	L. marinus L.	err	X e(?)	X e(?)	e - X (rr)	A
101	L. hyperboreus Gunn.	er	X e(?)	X e(?)	e - X (r)	A
102	L. glaucoides Meyer	er	X e(?)	X e(?)	e - X (r)	A
103	Rissa tridactyla L.	-	err, hrr	?	+e (rr), +h (rr) ?	A
104	Sterna caspia Pall.	er	tc	tc	e - t	T
105	S. hirundo L.	nc	nr	nr >	c - r (n)	E
106	S. albifrons Pall.	e ?	e ?	e – X	e - X	E
107	Chlidonias hybridus Pall.	tr	nc, hr	nc, hr	+n (c), +h (r)	Md
108	Ch. niger L.	nc	nc	nc	-	E
109	Ch. leucopterus Temm.	nc	n – X (?)	n – X (?)	c – X (n)	E
110	Alcedo atthis L.	nc, hr	nc, hc	nc, hc	r - c (h)	E
111	Riparia riparia L.	nc	nc	nc < >	-	T
112	Locustella naevia Bodd.	nc	nc	nc <	-	E
113	L. fluviatilis Wolf	nc	nc	nc <	-	E
114	L. luscinioides Savi	nc	nc	nc <	-	E
115	Acrocephalus paludicola Vieill.	tr	X (?)	X (?)	t - X (r)	E
116	A. schoenobaenus L.	nc	nc	nc <	-	E
117	A. palustris Bechst.	nc	nc	nc <	-	E
118	A. scirpaceus Herm.	nc	nc	nc <	-	E
119	A. arundinaceus L.	nm	nc	nc	-	E
120	A. agricola Gerd.	er ?	X (?)	X (?)	e - X (r)	E
121	Panurus biarmicus L.	sc	sc	sc <	-	M
122	Remiz pendulinus L.	nc, hrr	nc, hrr	nc, hrr	-	M
123	E. schoeniclus L.	sc	sc	sc <	-	T

Abbreviation: Status of residence: s- sedentary species; t-migrant; n- breeding; h-wintering; e-stray(regardless of season); c- normal; r-rare; rr-very rare; X- disappeared; + - appeared. Trend of population development: >- population is growing; < - population is reducing. Type of fauna: E-European; M – Mongolian; Md- Mediterranean; A-Actic; S – Siberian; T – Transpalearctic; K – Chinese. In parentheses - on what grounds have changed status.

Conclusions

In parentheses - the most pronounced consequences and causes.

- There is observed a trend decline of bird species on the absolute majority of breeding and migration. (Decline in the area of wetlands and favorable locations for habitat).
- Diversity and abundance of wintering birds is growing. (mild winters and the appearance of ice-water areas on the basis of Cuciurgan reservoirs, rivers Dniester (especially the Middle Dniester region), ice-water areas of the Prut River and some other regions)/
- The negative consequences are more touched waterfowl inhabitants of the vast areas of shallow river valleys. (Reduction of the areas inhabited space and nesting resources).
- There is a constant dependent (increase / decrease) of the diversity and abundance of birds (especially fish-eating and diving ducks) of the presence / absence of fish farms. (Fluctuation resrves of trophic and breeding resources).
- Increases the size and distribution of birds of open shallow water zones. (Frequent floods lead to the formation of shallow waters and areas with marked fluctuations in their water level, which contributes to the development of forage for many species of birds and provides easy access to their).
- Most noticeably reduced the number of ordo: Podicipediformes, Gruiformes. (Decreases Biotopical potential for these birds).
- Actively introduce and strengthen its position in the fauna southern species fauna types, especially (K)- *Egretta alba*. (Factor distribution of species ranges and global warming).
- Disappeared or are more likely to have disappeared species, whose status of residence in the fauna was initially in doubt, as well as several species of large floodplain and wetland spaces. (Low status and a further reduction initially low content of vital resources).

Literature

Аверин Ю.В., Ганя И.М., Птицы Молдавии. Кишинев, 1971. Т. II: 238 с.

UNGULATES *(ARTIODACTYLA)* ASSOCIATIONS IN BELARUS, POPULATIONS STRUCTURE AND PROBLEM OF RATIONAL USE THEIR RECOURSES

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Ungulates are the valuable natural recourse that has important economical importance as an object of game and trophy hunting. Mainly negative biocoenotic role of ungulates in natural ecosystems and agrocenosises is great. Therefore the importance to conduct investigations and retrospective analysis the data about condition and quantity dynamics of species populations and their reaction on anthropogenic factors influence obtained before has raised the last time. The main problems that were stated for theriologists and hunt management experts on the modern stage of development are: population quantity rising and their maintenance in balanced condition with habitat, rational use their resources, improving trophies quality, enrich of aborigine fauna with new perspective gaming species.

The association of ungulates in Belarus is represented by 6 species, among them: 3 aborigine (wild boar – *Sus scrofa,* elk – *Alces alces,* roe deer – *Capreolus capreolus)* and 3 reintroduced (red deer – *Cervus elaphus,* european bison – *Bison bonasus,* fallow deer – *Cervus (Dama) dama)*. In private and state forestries in open air cages there is sika deer *(Cervus nippon* Temm.). Introduction of european moufflon *(Ovis musimon* Pall.) is planning. Wild boar, elk and roe deer era spread on all over Belarus territory, red deer is spread on about a half, bison is represented by 9 geographically isolated populations, fallow deer (263 individuals) was brought in 2007/08 and is temporarily in open air cages in 5 places.

The spatial structure of each species is specific. Zonal distribution is typical for wild boar and elk: their population density is naturally decreasing in 3-4 times from North to South. Roe deer, on the contrary, has well marked azonal nature, that simpliciter depends on air temperature, blanket of snow depth and lying time in winter seasons. Red deer, bison and fallow deer distribution is defined by selection the places of their reintroduction or/and introduction, spreading the fragments of populations aerials, that concerned with quantity and population density growth and their supply by natural forages.

In last 60 years the trend of changing and quantity dynamics of ungulates is observed. In 50-60-s steady increase of wild boar and elk quantity and slow decrease of roe deer and red deer quantity took place. Up to middle of 70-s elk riched maximum quantity (about 30-35 thousands individuals) during period observed. In 1973-1990 the quantity of wild boar and elk in stage of relative stabilization (table 1).

Table 1. The indexes of quantity and ungulates species resources use

Year	Wild boar		Roe deer		Elk		Red deer	
	quantity, ind.	pray, %	quantity, ind.	pray, %	quantity, ind.	pray, %	quantity, ind.	pray, %
1981	24290	10,3	17330		20830	10,0		
1982	26440	7,9	19490		20960	10,9		
1983	26180	11,5	19760		22720	12,2		
1984	27000	13,9	20500		23760	11,6		
1985	30400	17,5	21700	0,4	23900	12,5		
1986	31520	12,3	21400	0,6	24070	11,2		
1987	32800	17,7	24000	1,5	24200	12,9		
1988	32200	18,0	26000	1,0	26400	13,9		
1989	36370	17,0	27600	1,8	27760	10,7		
1990	35600	18,1	28400	2,6	26500	12,5	5900	5,0
1991	39210	15,5	31500	3,0	28100	13,4	6200	5,4
1992	35500	14,6	33300	2,9	25770	8,6	6000	5,1
1993	33800	9,0	36800	3,0	22800	8,7	6300	6,2
1994	29300	7,6	38300	2,5	19500	5,8	7000	3,9

1995	25960	6,5	35600	2,7	14900	2,5	4210	6,3
1996	24000	4,5	39480	1,9	13500	0,2	4000	5,4
1997	23670	6,3	42150	2,7	12820	0,6	3670	3,4
1998	30560	6,2	45000	2,1	14970	0,5	4218	6,0
1999	34350	7,5	49200	3,0	15900	1,0	4270	5,8
2000	35700	9,9	51300	3,5	15480	1,6	4540	9,0
2001	33550	10,6	49700	4,6	15530	2,4	4630	4,3
2002	35010	12,0	49600	5,7	15400	2,9	4590	4,4
2003	37000	12,69	51260	6,3	15970	3,2	4680	4,3
2004	38730	16,3	55210	5,3	16280	3,6	5160	2,9
2005	39210	14,9	55400	5,7	17400	3,9	4930	3,9
2006	43180	18,2	56900	5,1	16200	4,3	5750	7,0
2007	47870	27,9	58000	6,6	17600	5,7	6770	4,9
2008	55000	32,3	59000	7,9	19000	7,0	8070	8,4
2009	63900	37,7	64300	7,9	21100	6,3	8720	7,0
2010	69700	37,2	69100	8,4	22800	6,9	9400	7,5

Notice: up to 1985 there were no roe deer hunt and up to 1990 there were dozens individuals of red deer hunted per year.

Excluding roe deer, in middle 1990-s sudden decreasing of elk (45.9%), wild boar (39.7) and red deer (38.9%) quantity took place, that were determined by social-economical conditions and negative biocoenotical situation. Applying a number of actions of The Program of hunting economy development (2005), creating The Inspection of wildlife protection (2003), reforming The State hunters and fishers society (2006) and others gave good results: the ungulates quantity and prey greatly raised.

There were counted 69 700 wild boars, 22 800 elks, 69 000 roe deers, 9 400 red deers, more than 400 fallow deers and 974 bisons after commercially season in 2010. wild boar density was 8.90, elk – 2.85, roe deer – 8.80 individuals per 1000 ha of forest area. But in general hinting management in Belarus in these numbers severally remains behind from western European "standards". So, as in literature stated (Brylski, 2003), annual prey in Poland is: wild boar from 60 000 to 90 000 individuals, red deer a little more than 40 000 ind., roe deer – 140 000-150 000 ind. In Germany – greatly more.

The main factor of ungulates quantity dynamics are: strong predators press (about 3 000 wolves, about 63 000 foxes, 700 lynx, 120 bears), hunting (the equation of age-sex structure is kept badly), insufficient volume of biotechnical measures held, storage of main group of natural autumnal-wintry forages depletion, in inclement winters – abiotic factors. As for our calculations, during the year wolves take from ungulates guild the "contribution" equal 18-20 thousand individuals. Shooting large part of wild boar females in maximum reproductive age, lowers breeding indexes and annual populations growth up to 20-30%.

The results of local populations perennial researches have shown that their age-sex structure is defined by species biology specificity, but changes a lot depending on reproduction intensity, power of predators press and diseases, anthropogenic and other factors. E.g. weighted mean index of wild boar population structure in quantity growth stage was (in per cent): adult females – 16.2±0.81, males – 8.1±0.95, 2 years old – 23.2±4.90, yearlings – 52.3±3.81, and in depression stage 24.0±4.20; 20.8±5.8; 14.8±1.85; 40.3±11.85 respectively. While researching 340 shot wild boars yearlings were (in per cent) 44.8, 2 years old – 17.6, 4-5 years old – 10.2, 6-7 years old 8.7, 8-10 years old – 2.8, 11-12 years old and older – 3.

Maximal potential growth in wild boar populations can reach 52-68%, elk – 40-45%, red deer – 25-35%, roe deer – 35-40%. Breeding intensity depends on physiological condition, part of reproductive active females and their age proportion in population. 55-60% offspring are related to two-three age groups (3-4 – 5-6 years old) of females.

In spite of definite progress in game management development, the use of ungulates resources runs not quite rationally: shooting males with high trophy qualities press on reproductive active part of population, almost all-the-year-round hunting.

PECULIARITIES OF MOUND BUILDING MOUSE *MUS SPICILEGUS* PETENYI 1882 IN REPUBLIC OF MOLDOVA

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One of the main peculiarities of mound building mouse (*Mus spicilegus* Petenyi 1882), is the building of specific shelter, called mounds with trophic reserves to survive the cold period of the year. At the end of august – beginning of September, after the ripening of seeds of herbaceous plants and at the end of reproductive period, the mound building mouse form groups of 4-10 and more individuals and begin to build the mounds. This period is rather long and the size and the form of mounds are very different (Munteanu, 1990; Larion, 2003).

Inside the mounds the microclimate is stable and the beginning of building is provoked by temperature decreasing and humidity increasing. The period of mound construction beginning also largely depends on seed ripening terms and varies depending on climatic conditions, as well as on the field where the mound is located. The first mounds can be observed on stubble of wheat, barley, etc. immediately after harvest. Their construction start at the end of July and is conditioned by agrotechnical measures applied in these fields (mowing, harrowing, ploughing). On the field with perennial plants the first mounds appear at the end of august. The latest mounds are started on the fields with hoes cultures. The mass construction of mounds on grass field starts in the first half of August, on filed with perennial plants – in the second half of September and on the fields with hoes cultures – in October-November.

Mounds are built at least during 20 days. The duration of mound construction depend on number of individuals that participate at its construction. Also, the slowing of food reserves gathering can be caused both by adverse weather conditions (rain, snow) and lack of food.

In autumn the number of individuals and, respectively, of the mounds is higher by about 1.3 times at the outskirts than in center of fields. The spreading of individuals is limited by the possibility of mound construction with food reserves, therefore the abundance of plant seeds used in food and ripening terms of seeds determine the distribution of mounds.

During the mound construction the individuals live in summer galleries and the place where the storing of food reserves starts is located directly next summer burrow or at the distance of 2-3 m from it. Mound construction begins on a hillock with 10-20 cm diameter and with height of 5 – 10 cm. The animals bring ears, seeds of various plants, which are covered by a layer of ground extracted during the excavation of galleries and from the holes around the mound. Along with the above-land part the underground part of the mound became more and more complicated.

In the first week of mound construction the small diameter is 12±1.5 cm, big diameter – 4±2.3 cm, height is 6±l.4 cm, weight of food reserves is 0.3±0.02 kg, the depth of galleries is 45±6.2 cm, the total length of galleries constitute 2.6±0.4 m, in some cases the construction of nest room begins.

In the second week the small diameter of the mound is about 85±3.2 cm, big diameter – about 120±9.4 cm, height is 16±1.2 cm, weight of food reserves is 2.l±0.5 kg, the depth of galleries increases and up to 66±9.5 cm, underground galleries become more complicated with the length of 4.6±0.7 m, the nest chamber, in the most of cases, is already finished.

After the third week the mound construction is finished. The small diameter is 102±10.6 cm, big diameter is 145±20.6 cm, height – 36±6.4 cm, weight of food reserves constitute 4.6±l.2 kg, the depth of galleries is 99±4.5cm and the total length of galleries constitute 10.2±l.6m. The nest is built and lined with dried leaves and stems of different plants, depending on which biotope is located the mound.

The finished mound represents food reserves covered with soil in form of hill, under which is a rather complicated system of galleries and the nest. The thickness of soil layer covering the food reserves is about 10-15 cm. After its form the mound basis is often like an irregular ellipse, rarely is irregularly round. The form of terrestrial part is like a cone. Sometimes, double mounds with two cones were observed: the big mound has form of irregular ellipse with small diameter of about 80 cm, big diameter of 130 cm, height of 35 cm, and the small mound that is irregularly round with small diameter of about 50 cm and height of 20 cm. The mounds were located at distance of 30 cm from each other and communicated trough galleries. The main principles of mound constructions are similar, nevertheless, their dimension depend on the size of food reserves (tab. 1) and on the number of individuals, which inhabit the mound.

Table 1. Relation between the size of food reserves and mound dimension in various biotopes

Biotope	Density of mounds per ha	Mound dimension, cm (big diameter/small/height)	Weight of food reserves, kg
Hoes cultures	26±4.6	150±13.6 / l06±4.7 / 30±2.6	5.2±1.3
Perennial plants	20±3.7	120±3.4 / 95±3.6 / 25±3.3	4.1±1.4
Fallow grounds	15±2.8	100±4.5 / 60±4.0 / l5±2.6	3.6±2.1

The depth of galleries is also different. The galleries to food reserves are placed at the depth of 5-15 cm under soil surface. The deepest are the galleries to the botoom of the mound and reach 20-100 cm (46.67±14.92 cm), in some cases – 110 cm. Usually, under every mound there is a chamber with nest. The spheric form of the nest chamber protect at maximum the animals living in it from the negative influence of external factors (low temperature, humidity). The nest chamber is located at the depth of 42.67±12.24 cm, maximum depth – 90 cm. Mounds with two nests were also registered. The size of the nest depends on number of individuals and its volume varies from 2144 cm^3 to 7232 cm^3, with the mean of 3988±1195 cm^3. In the double mounds the nest is placed in the center of the big mound at the depth of about 70 cm and had the size bigger than usual; in the small mound there was no nest.

In addition to galleries, which start to food supply, another 2-3 galleries start ending blind, with the length of 10 - 20 cm, and 2 – 3 galleries with exit at ground surface at 50-100 cm distance from the mound. The galleries that lead to the food reserves branch in circular, havin some galleries ending blind. The diameter of galleries is 2,5-3 cm. Around the mounds at the distance of 20-200 cm are several small unfinished galleries, the number of which can reach 25.

At the mound construction participate many individuals (4 – 14), this being an adaptation to the living conditions. The mound with food supply built in common is used by the animals in late autumn, in winter and in early spring. The longest time period the mounds stay on fields with perennial plants, because on these fields the agrotechnical measures are rather rare (tab. 2.). On fields with hoes cultures the mounds stay from 2 – 3 to 6 – 7 months, depending on agrotechincal measures applied on them. The shortest time period the mounds stay on cereal (Gramineae) fields, only 1 – 2 months, because in the most of cases these fields are ploughed in autumn.

Table 2. Time period of mound maintaining in various fields

Field	Period of construction	Period of mound maintaining
Perennial plants	IInd half of september	6 – 7 months (till spring)
Spice crops	Ist half of august	2 – 3 months (till field ploughing)
Hoes cultures	IInd half of october – Ist half of november	6 – 7 monts (till spring ploughing)
Fallow grounds	Ist half of august	6 – 7 monts (till spring)

Therefore, an adaptation of species *M. spicilegus* to winter conditions is the construction of mounds with trophic reserves. At mound construction only juvenile individuals participate, and when their number is low, the mound construction doesn't start. The most intense mound construction occurs in September – October. Mound dimensions, weight of food reserves and volume of nest chamber depend on number of individuals (r=0.99) participating at construction.

References

1. Muntyanu A.I. Ecological features of an overwintering population of the hillock mouse (*Mus hortulanus Nordm*.) in the South-West of the U.S.S.R. // Biological Journal of the Linnean Siciety. 1990. V. 41. P. 73-82.

2. Larion A. Particularităţile biologice şi comportamentul specieie *Mus spicilegus Petenyi* (Rodentia, Muridae) în sezonul rece. Teză de doctorat. 2003, 154 pp.

THE GREAT CORMORANT (Phalacrocorax carbo) ON NESTING IN LANDSCAPE RESERVE HOLOSNITA (Middle Dniester)

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This species appeared in the middle part of the Dniester River in 1986, after the regulation of the river flow in connection with the start of exploitation of the Novodnestrovsk hydro-power stations. Long-term observations carried out on the middle Dniester River section between Nasllavcea and Soroca settlements showed an increase in the number of cormorant, initially for migration, and later in the breeding period. However, nesting on the right side of the river to find it was not possible until 14 may 2011, when the first colony of about 130 nests was found.

For the first time the great cormorant (*Phalacrocorax carbo*) is noted by us on a sector of middle Dniester Unguri-Holosnita, as a flying species during autumn flight in 1998. Till 2001 the great bulk of birds of this species, at the given site, was observed in August, and the next years there was also an appreciable increase of number of the great cormorant during summertime, in nesting period. However, till 2011, we didn't find nested colonies on the right side of Dniester though good conditions for nesting, on the given site, are available (S.Zhurminsky 2004; N.Zubkov, S.Zhurminsky, O.Mantorov 2004; O.Mantorov, I.Vizir 2005; I.A.Vizir 2006; O.Mantorov 2008).

Occurrence of the great cormorant on the given site of middle Dniester is bound with ecological variations in connection with regulation of Dniester water flow by HYDROELECTRIC POWER STATION Novodnestrovsk, and then also HYDROELECTRIC POWER STATION Naslavcea, since 1986, year of start-up HYDROELECTRIC POWER STATION Novodnestrovsk. The specified ecological variations are in detail described in the above-named works and works of other authors, including hydrochemists and hydrobiologists, in particular Professor Zubkova E.I.

The number increase of the great cormorant during nesting period on the given site assumed a possibility of its nesting on well kept woded slopes of the right side of Dniester on site Unguri-Holosnita. During several years we have noted seats of mass night spending of this species on the poplars growing along an edge of water of the river in landscape reserve Holoshnitsa. Here, about on the middle of wood natural boundary of landscape reserve Holoshnitsa, we had been detected a new colony of the great cormorant on 14th May of 2011.

The colony consists, by the preliminary estimation, complicated by fusion of crones completely of a green forest, from 130 nests arranged on those poplars (a black poplar) where we marked their congestion on the night spending. The greatest quantity of nests on one tree there are 37, the least – 3. Under a poplar with the greatest quantity of nests we find three chicks who have dropped out, or thrown out of nests. One of them dead, another alive, but with the broken wing, the third – the whole, alive and active (see a photo).

The colony is located on a site of Dniester where from both coast there are no settlements. Here, on both coasts the strict frontier regime is established, that essentially reduces the factor of concern the person. Existence of the given colony raises scientific value of landscape reserve Holoshnitsa and as a whole of middle sector of Dniester Унгурь-Холошница registered in aquatic-marsh sectors of Ramsar site.

References

Sergey Zhurminsky. The birds population of middle sector of Dniester /Proceedings of the International conference «The Integrated management of natural resources of transboundary basin of Dniester », Chisinau, 16-17 September, 2004, p.120; (Rus)

Nikolay Zubkov, Sergey Zhurminsky, Oleg Mantorov. Ornitofauna of valleys of Dniester on site Отачь-Холошница, /Proceedings of the International conference «The Integrated management of natural resources of transboundary basin of Dniester», Chisinau, 16-17 September, 2004, p. 125; (Rus)

Oleg Mantorov, Irina Vizir. The account results of aquatic birds during spring of 2004 years on a Dniester site Unguri-Iarova /The Scientific bulletin of the National Museum of the Nature and Ethnography of Moldova №2 (15), Chisinau 2005, p. 86; (Rus)

I.A.Vizir. The great cormorant (Phalacrocorax carbo) on middle Dniester /The Scientific bulletin of the National Museum of the Nature and Ethnography of Moldova №4 (17) Chisinau 2006, p. 114; (Rus)

Oleg Mantorov. The Role of the anthropogenic factor in variation of an ecological situation on middle

Dniester /The Scientific bulletin of the National Museum of the Nature and Ethnography №8 (21), Chisinau 2008; (Rus)

O.G.Mantorov, I.A.Vizir. The features of winter spending and spring flight of aquatic birds on middle Dniester during winter-spring period of 2006-2007 years /International Symposium "Diversity, rational exploitation of animal world" Academy of Science, Science, 2009, p. 66; (Rus)

Elena Zubkova, Daniel Shlenk. The actually quality of water of the river Dniester /Proceedings of the International conference «The Integrated management of natural resources of transboundary basins of Dniester», Chisinau, 16-17 September, 2004, p. 128 (Rus)

Photo 1. The died chick of a cormorant

Photo 2. The active chick of a cormorant

POPULATION NUMBER DYNAMIC OF THE JACKAL (*CANIS AUREUS* L, 1758) IN BULGARIA: PAST, PRESENT AND FUTURE

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According to the historical records, the jackal (*Canis aureus* L, 1758) is an autochthone species in Bulgarian mammals' fauna. His exterior somatometric measurements are: total length – up to 80-85 cm; tail length – up to 25-30 cm; withers – up to 45-50 cm. Weight is usually about 12-14 kg and more. Footstep length is about 6 cm and width is about 5 cm. Males are slightly larger than females. Jackal begins to reproduce in February-March. After 60-62 days of pregnancy the female gives birth to 4-6 cubs, which open their eyes after 10-11 days. Under environmental conditions of Bulgaria, the jackals begin to reproduce in February-March.

Until the early 1960s the jackal has occurred only in the region of Strandja Mountain, in the Southeast part of the country. After that his numbers rapidly increased. The main reasons for its expansion throughout the country were: (1) large amount of available food provided by intensive development of hunting in the country during this period; the offspring of mouflon, fallow-deer and roe-deer as well as the pheasants and rock partridges, introduced into Southeaster Bulgaria and Thracian Valley, have become main food base for the jackal at this time; (2) in 1962 the jackal has been declared a protected species. As a result of cumulative impact of these two factors, the jackal has rapidly occupied lowland habitats in the country and has extended its distribution to the west. Its numbers has increased and after 1985 it was assumed that the jackal had occupied almost the entire country with less manifested presence in highlands.

According to the data obtained from the game count carried out in 2011, the increase in total number of jackals becomes more and more sensible in the recent years. The total number of jackals recently reached 39 343 animals, and there are 3268 more jackals in the country than in 2010; that means increase of 8% of total population numbers. It seems that the largest jackal population in Europe occurs in Bulgaria.

While occupying new territories, the jackal avoids large and canopy forests; it adheres mainly to dense

parts of small in size forest habitats – young coniferous plants and clearing areas near to settlements and roadside restaurants. The presence of people doesn't disturb this animal. At night it comes close to settlements and even goes in there searching for food wastes. Wolf and large shepherd dogs are the natural enemies of the jackal in Bulgaria.

According to the current regulations the jackal could be shot yearly in order to control its numbers, but the payment of bonuses for killed animal has stopped after 2009. This is probably one of the subjective reasons that the number of jackals remained relatively high over the country after 2009; in 2010 it was 36075, higher than in 2009 by 229 animals.

Improved assessment of jackal distribution obtained after the 2011 count showed that the jackal have extended its distribution range in the country and have found suitable habitats in the mountainous и semi-mountainous part of hunting regions.

The jackal chases in groups and easily catches cubs of artiodactyls. The high numbers of jackal in these newly occupied habitats probably could represent one of the factors limiting the numbers of game animals and harming domestic animals. At the same time, there isn't any quantitative information on diet composition in lowland agricultural environment in Bulgaria in relation to food availability in different seasons. To obtain this information, which could help assessing the jackal impact on wild and domestic animals in different landscapes, a specialized investigation on jackal diet composition and food availability, especially the abundance of small mammals, is in progress in agricultural regions, where a different set of factors are likely to operate.

As the numbers of jackal in Bulgaria retain its trend to increase, adequate measures for its regulation are needed in regions with proven harm of jackal on game and domestic animals. Preservation and stable presence of jackal in Bulgaria could be achieved through declaring it normal game species and treating it as native species of Bulgarian mammals' fauna.

SMALL-MAMMALS IN EAST AND WEST OF AUSTRIA (COMPARISON OF 2 STUDIES)

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In 2001 (May to September, 3780 trap-nights, 3 seasons, 18 study plots) at the Nationalpark Lake Neusiedl in E-Austria and from June 2007 to April 2009 (5922 trap-nights, 8 seasons, representing two full year-cycles, 9 study plots) in the Lower Rhine Valley in W-Austria (NATURA 2000 and other protected areas) two studies about small-mammals were carried out. At Lake Neusiedl effects of different management methods (reed- and grass-cutting, cattle-grazing) on small-mammal communities was evaluated. The second study location was 500 km far from the first and basal data of the small-mammal fauna (and bats) of this region (species-richness, population parameters) should be obtained. Both localities are representing a wide variety of habitats: pastures, meadows, areas with short grass and almost bare soils, reed areas, high-grass areas with much herbs, riparian woods. Moreover methodology (traps, CMR or killing of animals, determination of animals, evaluation of vegetation or not), climate, hydrology and soils of both localities are different. Aim of this presentation is to compare these different studies by means of classifying 1) 27 ecologically homogeneous, but different plots into 3 habitat-groups (differed by vegetation, management methods, hydrology and soils), 2) small-mammals into 3 life-form types (*Soricidae, Muridae* and *Arvicolidae*) and 3) to evaluate species-richness and abundance by Shannon-index and Evenness. Habitat-group A (8 plots) was characterized by high vegetation with trees and bush, high vegetation cover, much plant litter and wet soils. Habitat-group B (10 plots) had medium vegetation (height from 20 cm to one metre), much grass and wet soils only most of the year. Habitat-group C (9 plots) showed short vegetation (<20 cm), little plant litter, often hard soils with salt surface and is flooded merely a few months in the year.

Total 687 individuals of 15 species were captured, whereas at Lake Neusiedl only 233 individuals of 11 species and in W-Austria 454 individuals of 10 species were recorded. Despite Shannon-index and Evenness didn´t differ very much. At each locality two species (*Apodemus sylvaticus* and *Sorex araneus* in E-Austria

respectively *Myodes glareolus* in W-Austria) were most abundant and made up more than 50 % of all individuals. Very different was community structure with regard to life-form types at each study locality. Only in E-Austria *Soricidae* were most abundant. All along the seasons portions of life-form types fluctuated much. Totally most animals (70,16 %) were caught at habitat-group A, followed by habitat-group B (20,96 %) and group C (8,88 %): A similar trend showed each life-form type regarding to habitat-groups for both study localities together and for each one: Except habitat-group C at Lake Neusiedl had a lot of *Soricidae* and even seven species, habitat-groups A and B didn´t differ much due to species richness (nine and eight species respectively), habitat-group C (W-Austria) was settled by five species. Despite of small catching numbers of some most of the 15 caught species were present in all habitat-groups, but showed highest abundance in only one. In contrast to that *Crocidura leucodon* and *Microtus arvalis* had somewhat of an even distribution among all habitat-groups, *Apodemus flavicollis* and *Neomys anomalus* were merely present at habitat-group A. Six of 15 recorded species were present both E- and W-Austria (*Apodemus sylvaticus, A. flavicollis, Micromys minutus, Microtus arvalis, Sorex araneus* and *Crocidura leucodon*). *C. russula, S. coronatus* and *Microtus oeconomus* had hitherto solely been recorded in W-respectively E-Austria.

Key-words: Lake Neusiedl (E-Austria), Lower Rhine Valley (W-Austria), small-mammals, habitat-groups, life-form types, comparison of two studies.

SHREW SPECIES (SORICOMORPHA, SORICIDAE) IN URBAN ECOSYSTEMS OF CHISINAU CITY AND ITS SUBURBS

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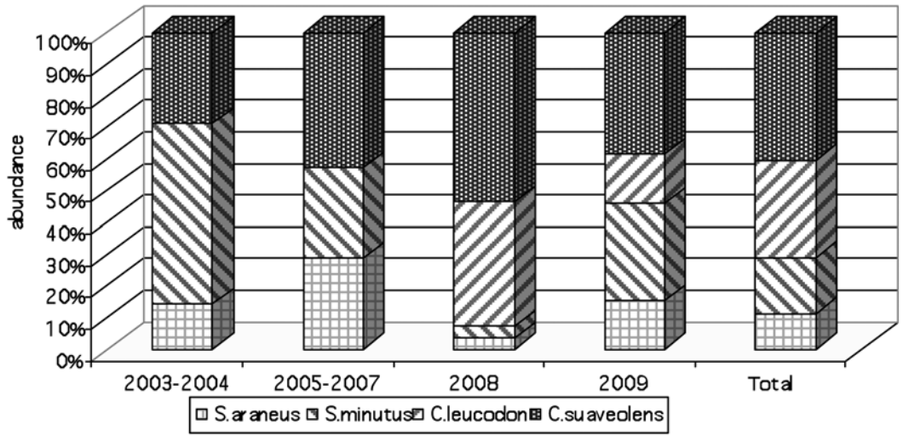
In the last decades an intense development of urban localities is registered in the republic. From evolutionary point of view the urban habitats are young ones with a complex of ecological conditions that permanently changing. The surfaces of cities and adjacent territories subjected to disturbances are continually expanding. In such conditions a fundamental problem of the modern ecology is the evaluation of adaptation strategies of the animals toward the anthropogenic disturbances of the environment.

Urban fauna is an important element in maintaining the ecological balance of city ecosystems. The shrews are indispensable components of mammal fauna in urban ecosystems. At the same time they can serve as ecological indicators of ecosystem stability and of the urban cenoses status. There are only few mentions in some studies concerning insectivore urban fauna in the past century (Anisimov, Cojuhari 1978, Anisimov 1966), where several shrew species are cited as component of urban fauna. After 2000 the study of Chisinau small mammal fauna in general and of shrews in particular was more intense.

The aim of the paper is to establish the ecological peculiarities of shrews inhabiting various biotopes of Chisinau city and its suburbs.

The studies were accomplished between 2003-2009 in various biotopes of Chisinau city and its suburbs. The small mammals including the shrews were caught with snap traps. Each individual was determined, weighed, age, sex, and reproductive status were established, the skulls were preserved for further morphological studies. In the study period 36 habitat types from 15 biotopes were investigated. For the ecological evaluation of each cenosis the methodology used in study of small mammal fauna from different cities of Russia (Tikhonova et al. 1997, 2001, Tikhonov et al. 2009) was considered. Thus in Chisinau the following biotopes were emphasized: 1. Remains of natural woods and forest plantations, which were localized at city limits and its suburbs. 2. Landscape parks created by man for recreational purpose. 3. City parks with smaller surface and often visited by people. 4. Orchards and vineyards. 5. Gardens, located mostly near Byc River, surrounded by weeds. 6. Cemeteries with tree and brush vegetation: birch, cherry, maple, Thuja, boxwood, the open sectors were covered with forbs. 7. Fields are relatively large agrocenoses, located near city edge (corn and wheat). 8. Grasslands are wide spread type of biotope, formed by communities of various herbaceous plants. 9. Forbs are ruderal herbaceous communities, developing on anthropogenically modified sectors. 10. River banks are wet biotopes situated along flowing water, in our case Byc River. Usually they are covered with wetland vegetation. 11. Lake shore located near stagnant water basins. 12. Waysides are usually located along railway embankments and are grown with segetal and ruderal vegetations, sometimes with bushes. 13. Food storage yard are peculiar biotopes with specific and abundant trophic source. 14. Lawns are territories with planted or left for esthetical purpose herbaceous vegetation. 15. Wastelands are sectors covered with scarce herbaceous vegetation and sparse shrub seedings.

On the territory of Chisinau and its suburbs 56 individuals from 4 shrew species were registered: *Sorex araneus, S. minutus, Crocidura leucodon* and *C. suaveolens*. The dominant species in shrew community of the city in study period was *C. suaveolens* with more than 44%, followed by *C. leucodon* (34%), *S. minutus* (about 20%) and *S. araneus* with 15.38% (fig. 1). The lesser shrew is the most synanthropic species among shrews and was recorded in the majority of studied biotopes, including those very affected by human activity: city parks, cemeteries, food storage yards. *C. leucodon* is rare threatened species, included in the Red Book of Moldova, 2nd edition. Before 2008 it wasn't registered at all in urban area, but since 2008 it is present with rather high abundance. Therefore, this species has adapted to new urban environment and inhabited a wide variety of biotopes.



The *Sorex* shrew species are rather spread and abundant in urban environment, but they are connected mostly to wet biotopes, while white toothed shrews inhabit more arid habitats. Thus in 2008, which was a very dry year with low quantity of precipitations, the number of *Sorex* species decreased and constituted less than 8% among urban shrew population. Before 2008 these species were dominant in the city and represented more than half of urban shrew population. Within Sorex genus the pigmy shrew dominated in all the years, being the most abundant in 2003-2004 and the second in 2005-2007. The common shrew, which is the most widespread and frequent in natural and non-urban environment of the republic, was the least abundant in studied city biotopes.

Among studied biotopes the most suitable for shrew fauna were those similar to natural ones: insular forests, shelter belts and landscape parks situated at city limits, where all 4 shrew species were registered. Such habitats as lawns and wasteland are avoided by shrews, while in people's gardens shrew were found only near Byc River. In city parks, in cemeteries and in fields, placed mostly in suburbs, only *C. suaveolens* was recorded, while along waysides (railway) only *C. leucodon*. In yards of food storage both *Crocidura* species were found.

In wet biotopes and in those situated near water basins representatives of all 4 shrew species were registered. In orchards pigmy and lesser shrew were recorded, where *S.minutus* dominated. In grasslands both *Crocidura* species and the common shrew were found, the last one being less frequent with the abundance lower than 10%. In forbs both *Sorex* species with the same abundance were registered.

The shrew fauna in Chisinau city and its surroundings is rather well represented. Shrew species are adapting well to the urban environment. Nevertheless, they are better represented in biotopes situated at city limits and suburbs, which are similar to the natural ones, or are remains of existing in the past forests.

ASPECTS COMCERNING THE DIVERSITY OF RODENTS (MAMMALIA: RODENTIA) IN AN ALFALFA CROP (BÂRSĂNEȘTI COMMUNE, BACĂU COUNTY, ROMANIA) (I)

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Introduction

The Bârsănești commune is situated in the South East of Bacău County, on the ridge between Tazlău and Trotuș rivers at the junction of the 46º20' lat. N parallel with the 26º40' long. E meridian. From a physical and geographical point of view, i tis situated in the Moldavian Subcarpathians, at the junction of Berzunți Mountains, Trotuș Subcarpathians and the Tazlău-Onești-Cașin depression. The maximum altitude is found in its north-eastern part i.e. Berzunți ridge (Măgura summit – 982 m). The climate is continental – temperate. The average annual temperature is 9,3 ºC and the annual precipitations have a 591,8 mm annual average.

The vegetal layer is represented by various vegetal associations such as: *Festucetum sulcatae* Burduja et.collab. 56, *Andropogonetum ischaemi* Krist 33, *Chrysopogonetum grylli* Soó 39, *Sisiymbrio- Artemisietum absinthii* I. Pop 69, *Lycietum halimifolii* Felföldy 42 (Barabaș N., 1978).

Material and Methods

The diversity of rodents in the alfalfa crop in the Bârsănești commune, Bacău county, was studied during April – October 2008, 2009 and 2010. The material was captured by using 50 live traps laid on the field in the form of a net, at a distance of 10 m from each other, three days consecutively on each month (Simionescu V., 1984).

The material was determined by using the specialty literature (Ionescu V., 1968 and Popescu A., Murariu D., 2001).

Besides the total number of individuals and the total number of species we evaluated the diversity according the Simpson, Shannon-Wiener index and the Lloyd-Ghelardi equitability (Varvara M. et. al., 2001).

Results and discussions

During 2008 – 2010 in the researched alfalfa crop we captured 133 individuals belonging to Rodentia Order: 56 individuals in 2008, 41 in 2009 and 36 in 2010. From a systematical point of view, the individuals belong to 2 families, 6 genera and 9 species. In table 1 we present the species identified in the investigated agroecosystem, for each year of study and for the whole period of study. The graph of the capture variation in the 3 years of study indicates differences from a year to another. The specific diversity was higher in 2008, in comparison with 2009 and 2010. In 2008 the species with the largest number of individuals was *Microtus arvalis*, followed by *Apodemus flavicollis*, while in the following year the situation was reversed and in 2010 *Mus spicilegus* was the species with the largest number of individuals, followed by *Apodemus sylvaticus.* These differences were due to conditions along the year which favour one species or another. During the whole period of study the best numerically represented was *Apodemus flavicollis*, followed by *Mus spicilegus* (figure 1).

Table 1 Rodent species identified in the alfalfa crop during 2008 - 2010

No.	Family	Species	Number of individuals			Total
			2008	2009	2010	
1	Arvicolidae	*Pitymys subterraneus*	2	1	1	4
2		*Microtus arvalis*	16	7	4	27
3	Muridae	*Rattus norvegicus*	1	0	0	1
4		*Mus musculus*	5	4	4	13
5		*Mus spicilegus*	10	6	15	31
6		*Apodemus agrarius*	0	2	1	3
7		*Apodemus flavicollis*	12	19	2	33
8		*Apodemus sylvaticus*	9	1	9	19
9		*Micromys minutus*	1	1	0	2
Total			56	41	36	133

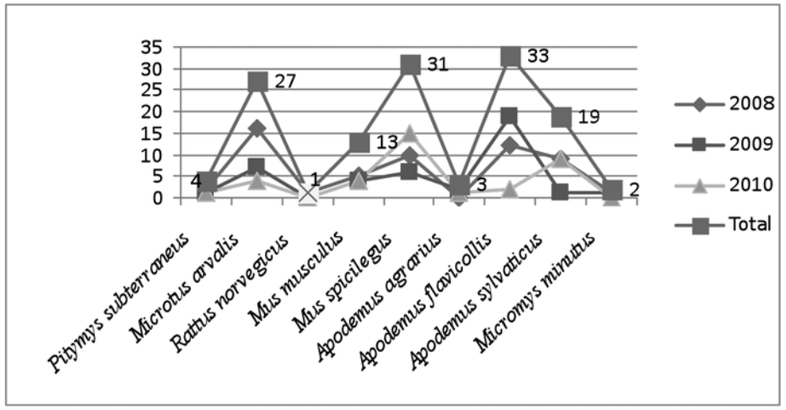

Figure 2 – Rodent capture variation in the alfalfa crop during 2008 - 2010

In table 2 we present data required for the calculation of diversity indices. For the species identified in the investigated alfalfa crop, the diversity index value is the following: D = 5,47; H(9) = 2,60; $H(9)_{max}$ = 3,1697; according to Shannon-Wiener index value, the theoretical number of species is 9. The equitability is 88,8% - among the 9 identified species, 3 species (*Apodemus flavicollis*, *Mus spicilegus* și *Microtus arvalis*) are represented by a larger and close number of inviduals.

Table 2 Data required for the calculation of diversity indices for species collected in the alfalfa crop during 2008 - 2010

No.	Species	n	n-1	n (n-1)	Log_{10} n	n log_{10} n
1	*Apodemus flavicollis*	33	32	1056	1,5185	50,1105
2	*Mus spicilegus*	31	30	930	1,4913	46,2303
3	*Microtus arvalis*	27	26	702	1,4313	38,6451
4	*Apodemus sylvaticus*	19	18	342	1,2787	24,2953
5	*Mus musculus*	13	12	156	1,1139	14,4807
6	*Pitymys subterraneus*	4	3	12	0,6020	2,408
7	*Apodemus agrarius*	3	2	6	0,4771	1,4313
8	*Micromys minutus*	2	1	2	0,3010	0,602
9	*Rattus norvegicus*	1	0	0	0	0
Total		133 N	124 Σ(n-1)	3206 Σn(n-1)	8,214 Σlog_{10} n	178,2032 $\Sigma n log_{10}$ n

Simpson diversity index

$D = N(N-1)/ \Sigma n(n-1)$ $D = 133 \cdot 132/3206 = 5,47$

Shannon-Wiener index

$H(S) = (K/N) (N \cdot \log_{10} N - \Sigma n \log_{10} n)$

$H(9) = 3,321928/133 (133 \cdot \log_{10} 133 – 178,2032) = 3,321928/133 (133 \cdot 2,1238 – 178,2032)$

$H(9) = 3,321928/133 (282,4654 – 178,2032) = 3,321928/133 \cdot 104,2622 = 2,60$

Theoretical diversity

$H(S)_{max} = K \cdot \log_{10} S$ $H(9)_{max} = 3, 321928 \cdot \log_{10} 9 = 3,321928 \cdot 0,9542 = 3,1697$

Equitability

$E = S'/S$ $E = 8/9 = 0,888 \cdot 100 = 88,8\%$

Conclusions

1. During 2008 – 2010 in the alfalfa crop in Bârsănești village, Bacău county we captured 113 individuals belonging to Rodentia Order; 56 individuals in 2008, 41 in 2009 and 36 in 2010. From a systematical point of view, the individuals belong to 2 families, 6 genera and 9 species.
2. In 2008 the species with the largest number of individuals was *Microtus arvalis*, followed by *Apodemus flavicollis*, while in the following year the situation was reversed and in 2010 *Mus spicilegus* was the species with the largest number of individuals followed by *Apodemus sylvaticus.* These differences are due to the conditions along the year which favour one species or another.
3. The diversity index value Shannon-Wiener - H(S) = 2,60 – for the species identified in the alfalfa

crop during 2008 – 2010 indicates the theoretical number of species as 8. In this situation the equitability is 88,8% - among the 9 identified species, 3 species (*Apodemus flavicollis*, *Mus spicilegus* și *Microtus arvalis*) are represented by a larger and close number of individuals.

References

1. Barabaș N., 1978. Noi contribuții la studiul florei și vegetației din Bazinul Tazlăului, Stud. și Comunic., Muz. Șt. Nat. Bacău, 1976-1977, 9-10: 163-192;
2. Ionescu v. 1968. Vertebratele din România. Edit. Academiei R.S.R. București: 424-443.
3. popescu alexandrina & murariu d. 2001. Rodentia. Mammalia. In: Fauna României. Edit. Academiei Române, București, 16 (2): 1-214.
4. simionescu v. 1984. Lucrări practice de ecologie. Edit. Universității. „Al. I. Cuza" Iași: 75-87.
5. varvara m., zamfirescu ș., neacșu p. 2001. Lucrări practice de ecologie-manual. Edit. Universității „Al. I. Cuza". Iași: 100-113.

BACKGROUND LEVELS OF CHROMOSOME DAMAGE IN WILD RODENTS FROM THE URAL

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The problem of choosing reference territories and populations untouched by the anthropogenic factor influence is very urgent for the Ural region. That is why it is important to have information about background chromosome damage rates among the rodents of these regions while conducting eco-genetic monitoring of some Ural districts and regions with the help of wild and synanthropic rodents and also for studying the mechanisms of spontaneous mutagenesis in natural populations. With this purpose we have studied the chromosome damage rate in bone marrow of four rodent types from the Middle and South Ural natural populations, living under conditions of minimal anthropogenic pollution: a red-backed mouse (Clethrionomys glareolus), a common vole (*Microtus arvalis*), a mole vole (*Ellobius talpinus*) and a common field mouse (*Apodemus uralensis*), (table 1).

Table 1. Geographic coordinates of rodent trap places

Type/place of capture	Geographic coordinates
Clethrionomys glareolus (the neighbourhood of the settlement of Shalya, Sverdlovsk region)	57°14′ N lat., 58°44′ E long.
Microtus arvalis (the neighbourhood of the Orenburg reserve, Kuvandyksky district, Orenburg region)	51°07′ N lat., 57°40′ E long.
Ellobius talpinus (the neighbourhood of the village of Nizhneye, Kunashaksky district, Chelyabinsk region)	55°45′ N lat., 61°39′ E long.
Apodemus uralensis (the neighbourhood of the village of Uyetskoye, Talitsky district, Sverdlovsk region)	57°02′ N lat., 63°47′ E long.

The analysis of the heavy metals content in livers of common field mice and mole vole (table 2) shows that their concentrations rest in physical norm limits known for rodents (Gileva, 1997). The content of radionuclides in the musculoskeletal tissue of the same rodent specimens and also the Sr-90 content in the organisms of red-backed mice (table 3) do not exceed the global levels (Sokolov, 1989).

Table 2. Heavy metals contents in the livers of rodents from natural populations of the Middle and South Ural

Type	Metals content in liver, mcg/g of dry mass			
	zinc	cupper	lead	cadmium
Ellobius talpinus	95,54±4,64	17,19±0,69	1,92±0,15	0,17±0,01
Apodemus uralensis	78,38±5,69	14,41±1,36	1,87±0,30	0,52±0,07

Table 3. Radionuclides contents in the livers of rodents from natural populations of the Middle and South Ural

Type	Contents of radionuclides in musculoskeletal tissue, Bk/kg of dry tissue				
	K-40	Ra-226	Th-232	Sr-90	Cs-137
Clethrionomys glareolus	–	–	–	<41,72	–
Ellobius talpinus	<251,94	<19,13	<19,13	<13,96	11,48
Apodemus uralensis	<677,42	<39,75	<35,75	<28,76	28,06

The metaphase chromosome preparations were made from bone marrow of rodents in a standard way and tinctured with azure-eosine, according to Romanovskiy (McGregor, Varly, 1986). The methods cytogenetic analysis of chromosome preparations are discussed in detail in the research of E.A. Gileva (1997). The rate of cells with chromosome aberrations, the total rate of aneuploidic and polyploidic cells and cells with gaps have served as the main cytogenetic characteristics. The results of the cytogenetic analysis are presented in table 4. The average rates of cells with chromosome aberrations of the four types of the examined rodents varied from 0.33% with the common field mouse up to 2,18% with the mole vole. A reliable excess of the rate of cells with chromosome structural disorders with mole lemmings in comparison with other species has been found (F=7,01; p=0,0005). The reason for it can be the specific genome organization and functioning with the specimens of the genus of *Ellobius*, which manifests itself, for example, in a wide interpopulation variability *of Ellobius talpinus* karyotypes (Lyapunov, Vorontsov,1978). An exclusively underground mode of life is typical for the mole vole, which provides a close contact with the soil, especially with its upper level (Yevdokimov 2001). It is well known that it is the bedding and the upper soil level that retains a substantial amount of potentially toxic metals, coming with precipitations (Van Straalen et al., 1999)

Table 4. Frequencies of cells with chromosome damage in bone marrow of four rodent types from the Middle and South Ural natural populations

Species	Quantity of animals	Quantity of cells	Average cells percentage		
			with chromosome aberrations	aneuploid- and polyploid	with gaps
Clethrionomys glareolus	21	1050	0,48	0,48	2,48
Microtus arvalis	9	450	0,44	0,67	1,56
Ellobius talpinus	11	550	2,18	0,36	3,27
Apodemus uralensis	18	900	0,33	1,11	0,44
F (df=3/51)			7,0118	1,4534	3,7067
p			0,0005	0,2382	0,0173

The analysis of the occurrence of different chromosome aberrations types showed that among structural disorders the reconstructions of the chromatid type prevailed, which were generally single fragments. It is such spectrum of aberrations that is typical for spontaneous mutagenesis (Lylp, Korogodina, 1981; Bochkov, Chebotarev, 1989; Smith, 1992).

The background levels of cell rates with genomic mutations in the examined wild rodent populations varied from 0,36% to 1,11% (table 4). The interspecies distinctions of this cytogenetic characteristic were not true (F=1,45; p=0,2382).

The significance of the blanks as indicators of mutagenic effect remains disputable (Gileva 2002). According to A. Brogger (1982), a part of gaps must be referred to genuine chromosome breaks. One of the arguments in favour of this fact is the parallelism repeatedly established between the rate of blanks and the rate of chromosome aberrations (Gileva, 1997; Nochrin, 1999). In the three examined populations the average rate of cells with blanks was 1,5-5 times higher than the rate of cells with chromosome aberrations. However, such effect is not always observed under a weak mutagenic influence. In case of the field mouse both cytogenetic characteristics were at about at the same level. The similar tendency was shown in the research of E.A. Gileva (Gileva, 2002), conducted on house mice and common voles. The achromatic blanks must be used only as additional indicators of chromosome instability, especially in the background areas. In general, the presented levels of chromosome disorders with the examined rodents species may be considered the background ones for the Ural region, taking into account their specific species manifestation.

CONTROVERSIES ON THE PRESENCE OF *LACERTA VIVIPARA* SPECIES JACQUIN, 1787 ON THE TERRITORY OF REPUBLIC OF MOLDOVA

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In the past the territory of Moldova was a part of Bessarabia, also a part of Romania and a part of the Soviet Union. This fact has created large differences for fauna of this territory, particularly in the presence of *Lacerta vivipara* species. But special attention to the author, there are sparked an article "Amphibians and reptiles of Moldavia: Additions and corrections, with a list of species" published by Leo J. Borkin, Spartak N. Litvinchuk, and Yuri M. Rosanov in the "Russian Journal of Herpetology", vol.4, № 1, 1997, p. 50 -62. In this article authors affirmed that to found *Lacerta vivipara* species nearly the Vulcanesti village (Nisporeni district). According to these authors, determinations were made on the basis of the capture of two young exemplars of this species in spring 1996.

Earlier mentions of this species we find in the work "Bastards of Bessarabia" wrote by Brauner A. published in 1907. The author mentions its finding in Bukovina, near the Kolencovtsy village, former Hotin district. Nowadays this city is situated on the territory of Ukraine.

Vulcanesti village is located in Nisporeni district at 12 km from Nisporeni and about 55 km away Chisinau City, on the route Chisinau - Straseni - Bucovat - Vorniceni - Lozova - Dolna - Vulcanesti - Nisporeni (on the territory of Moldova, in its southern side, there is a city with same name). Geographical coordinates are following: 47° 09' 17.43" N, 28° 11' 17.83" E, altitude of 380 m above sea level, in the vicinity with Seliste village at NW, Cioresti village – at NE, Sendreni village - south of Vulcanesti village. Direction of village location is at NW of the capital of Moldova – Chisinau, in Codri forest area. Here the average rainfall for warm season (April-November) is framed between 400-425 mm. Agricultural lands and deciduous forests surround the village. There are highlighted two types of forests: Oak Forest(*Quercus robur*) with cherry(*Cerasus avium*), *Carpinus betulus*, ash(*Fraxinus excelsior*) and maple(*Acer campestre, A.pseudoplatanus, A.tataricum*), *Tilia cordata*, *Fraxinus excelsior* and beech(*Fagus sylvatica*) forest sector. At the edge of the forest *Prunus spinosa*, hawthorn(*Crataegus leiomonogyna*) and *Rosa canina* are meeting. At the lower floor of the forest there are *Allium ursinum*, *Polygonatum latifolium*, Stellaria sp. and others, which formed many associations of plants. At a distance of 3-4 km from the village, on the valley at an altitude of 190-200 m there are two lakes surrounded by forest. Also several small lakes can be encountered even near the road.

From 2002 till 2011 years in this area were done eleven field expeditions. The eighteen pedestrian routes with 3-5 km length each have traversed. The total length of routes made up about 62 km. In the research field nine species of amphibians and six species of reptiles was found (Table 1).

Table 1. Species of amphibians and reptiles from the Vulcanesti village (Nisporeni district)

	Amphibians		Reptiles
1	*Bombina bombina* L.	1	*Lacerta agilis* L.
2	*Bufo viridis* Laur.	2	*Lacerta viridis* Laur.
3	*Bufo bufo* L.	3	*Anguis fragilis* L.
4	*Rana ridibunda Xesculenta*	4	*Natrix natrix* L.
5	*Rana dalmatina* Bonap.	5	*Coronella austiaca* Laur.
6	*Pelobates fuscus* Laur.	6	*Vipera berus* L.
7	*Hyla arborea* L.		
8	*Triturus vulgaris* L.		
9	*Triturus cristatus* Laur.		

During field expeditions *Lacerta vivipara* species have not been detected, despite the fact that research included summer periods of the year from the end of March until the end of September. In general, geography of this area is not the most favorable for this species.

Their presence in the northern districts of the country, border with Ukraine may be questionable, but until now there are not detected anyone.

The author believes that in this region (Vulcanesti village, Nisporeni) *L. viviparous* species is absent and yet this species can not be included in the fauna of the Republic of Moldova. Possible the description made by Leo J. Borkin and et al is a mistake in the determination.

ODONTOLOGIC VARIABILITY OF *TALPA EUROPAEA* IN SOUTH-EASTERN BELARUS

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Special researches of population characteristics of everywhere living moles practically were not carried out on the territory Republic of Belarus almost 50 years (Григорьев П. П., 1966). The only later special work on ecology of the European mole living in the central part of Belarus is known (Душин Н. Г., Ставровский Д. Д., 1991). There are no data on metric and phenotypic characteristics, pathologies and anomalies of a skull of the European mole.

We survey 39 dead individuals of *Talpa europaea* ordinary, found within 1994-2010 in Gomel region. Finding out exact causes of death of individuals was not possible.

In the skulls of mole living on territory of the South-East of Belarus, following odontologic anomalies are registered: decrease or increase in quantity of premolars (frequency of occurrence of 7,7 %), presence of an additional raphe in the *palatinum durum* (2,6 %), gypoplasia (fig. 1) of the second and third incisors of lower jaw (10,3 %). Olygodontia (reduction of quantity of teeth, there are no corresponding alveoluses) is registered at two individuals (5,2 %).

Skulls with variations of quantity of teeth do not differ from other skulls with metric characteristics.

The received frequency of variations' occurrence of quantity of teeth will not be co-ordinated with the stated (Юдин Б. С., 1989) point of view on geographical variability of teeth of the European mole. Results of researches confirm opinion that all insectivorous mammals' premolars are subject to quantitative anomalies.

Gypoplasia of teeth also can have genetic nature. Because of it high occurrence's frequency of hypoplasia of lower jaw's incisors makes actual carrying out of cytogenetic researches of the given kind for the purpose of an interrelation establishment between genetic features of geographical populations and display of odontologic anomalies. It is necessary to notice that these morphological and functional changes of teeth are not connected with the age of individuals. Adult individuals' incisors appear to be divided with small diastemas but the thickness of teeth changes slightly.

It is impossible to consider these anomalies of quantity of a teeth as teratological variability. Life expectancy of a mole is estimated in only 2-3 years in natural conditions that is caused not by odontological anomalies but by influence of the whole complex of abiotical and biotical factors.

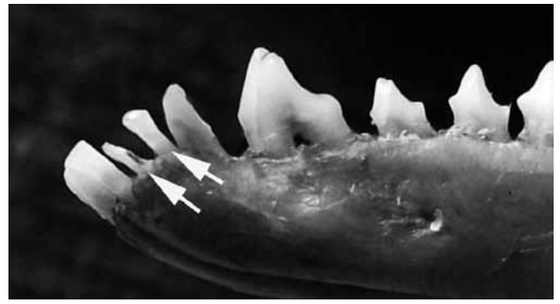

Fig.1. Reduction of the second and third incisors

Some anomalies and a pathology were revealed simultaneously in one skull of the male (fig. 2). There was an additional premolar on a left-hand side of the maxilla (+Pm3), and an additional raphe and destruction of bone tissue on the right side (the similar pathology is not unique as it is characteristic only for individuals of the given species).

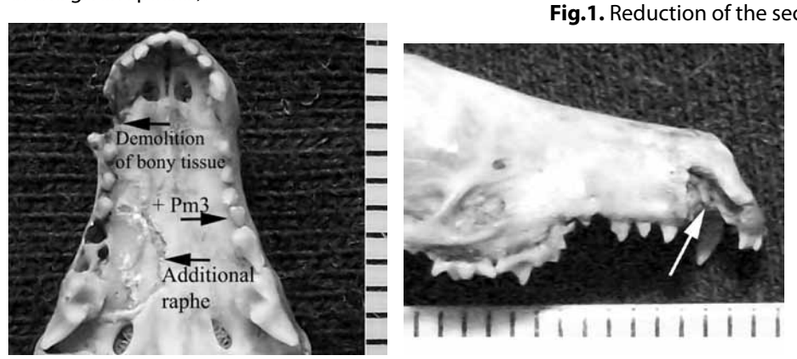

Fig.2. Skull with anomalies and a pathology

ABOUT MORPHOLOGY OF THE INTERNAL SURFACE OF THE SKULL'S ARCH OF THE EASTERN HEDGEHOG, *ERINACEUS CONCOLOR*, INHABITING THE TERRITORY OF BELARUS

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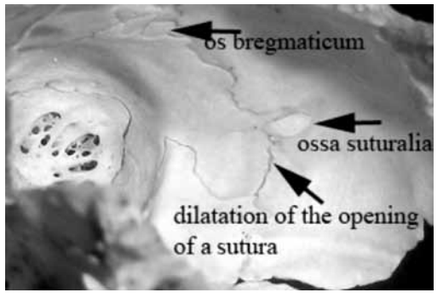
As a result of long-term researches (1994-2010) of territorial groupings of the Eastern hedgehog (*Erinaceus concolor roumanicus* Barrett-Hamilton, 1900) on territory of Belarus numerous pathologies and anomalies of a skull were revealed: fragments without osseous tissue, big sizes of *os fonticuli anterioris*, extension of teeth for this bone, high occurrence's frequency of its plural form; parting of sutures; destruction of lower and upper jaws with exposed teeth roots; protruding of frontal bones with thinned attaching fragments, etc. The facts which testify to a pathological origin of *os bregmaticum* in the skull of region hedgehogs are received. Many registered morphological changes of a skull's arch are authentic signs of pathophysiologic processes in the central nervous system which cause intracranial hypertensia.

Revealing of the pathogenic factors causing similar morphological changes represents great theoretical and practical value. Craniological researches of hedgehogs (and other mammals), as a rule, include revealing of metric and phenotypic features only of a lateral surface of a skull. At the same time, change of an internal surface's morphology of the skull's arch (*facies fornicis interna*) is an important sign in diagnostics of diseases of a brain and skull bones. Thus the condition of vascular picture and skull suturas is a highly informative characteristic. At an estimation of morphology of vascular network's grooves changes in position, quantity, forms and width of vessels are analyzed. At the analysis of the condition of skull's sutura their conformity to the age of individuals, presence of additional bones and other signs are considered.

It is known that skull suturas are growth zones and sutura bones (*ossa suturalia*) are formed of independent points of ossification. At strengthening of seams' function expansion of a gleam and lengthening of teeth is observed, plural sutura bones can be formed. This morfo-anatomic changes are especially expressed at an intracranial hypertensia.

The purpose of our researches was revealing of such neurokranium's changes which confirm pathophysiologic processes.

Parietal and frontal bones are connected by a suturaof a scaly form. The coronal one is often dilatated in the scull and can include single or plural additional bones (fig. 1A). On occasion rises over other part of an internal surface of the arch (fig. 1B). Numerous long teeth are formed in the other sculls (fig. 2).



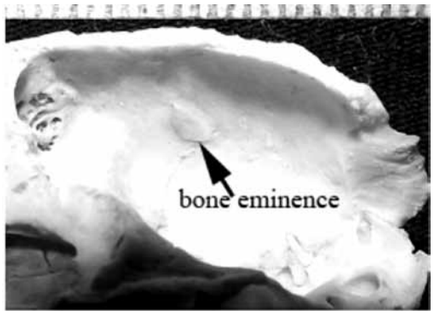


Fig.1. Peculiarities of an internal surface's structure of a skull's arch

Furrows of arteries (the widest) originate from an interparietal bone and are directed to frontal bones, being gradually narrowed on periphery. In some cases furrows are straightened (fig. 2).

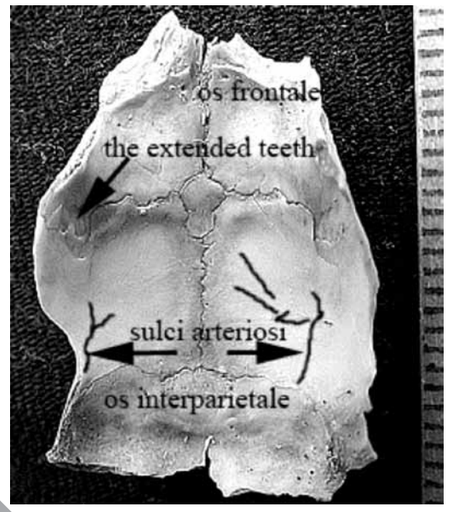


Fig.2. Vascular picture on the parietal bones (furrows of arteries sulci arteriosi are traced)

The revealed features (formation of numerous sutura bones and the extended teeth, dilatation of the sutura's opening, straightening of arteries' furrows) are authentic signs of intracranial hypertensia.

DENSITY OF *APODEMUS SYLVATICUS* AND *APODEMUS URALENSIS* SPECIES POPULATIONS AND AGGREGATION PROCESS IN NATURAL STATIONS

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The sibling speces of genus Apodemus *A. sylvaticus* and *A.uralensis*, that are dominant in rodent populations inhabiting agricultural ecosystems, have a solitary life mode. The individuals depending on sex and annual cycle phase occupy individual sectors which surface varies between 200 and 1800 m^2. The populations of these species are structured in intrapopulational reproductive or shelter groups and occupy 500 – 4000 m^2 depending on numeric or seasonal phase an don station type. At the same time we have to mention than sibling species *A. sylvaticus* and *A.uralensis* show different strategies in their spatial mobility at different number phases. Only in initial phases of station colonization at the beginning of vegetation period the migrant individuals have random distribution. The role of intrapopulational groups is extremely important in phases of number depression, ensuring the reproductive process in conditions od small and medium density of animals in stations.

The data (figs 1, 2) show that the density within groups at any number phase and in any season is higher than the mean density of the population in certain biotope and donesn't correlate with aggregation index (K_{Lloyd}) of the species. For example, when the aggregation coefficient (Lloyd,1967) is zero in July of a pessimum year, which prove an absolute uniform distribution of the species, the density in *A. uralensis* groups is 37.0±5.7 individuals/ha, which is 41 timeshigher than the mean value in station (0.9±0.15 ind./ha). In autumn of the same years the aggregation increases evidently (K_{Lloyd}= 8.7±0.9), while the density increase in groups is very low (40±7.0 ind./ha). In the phase of maximum density number in autumn the aggregation is even lower (K_{Lloyd} = 7.4±0.9), while the density in groups in much higher (76±9.7 ind./ha).

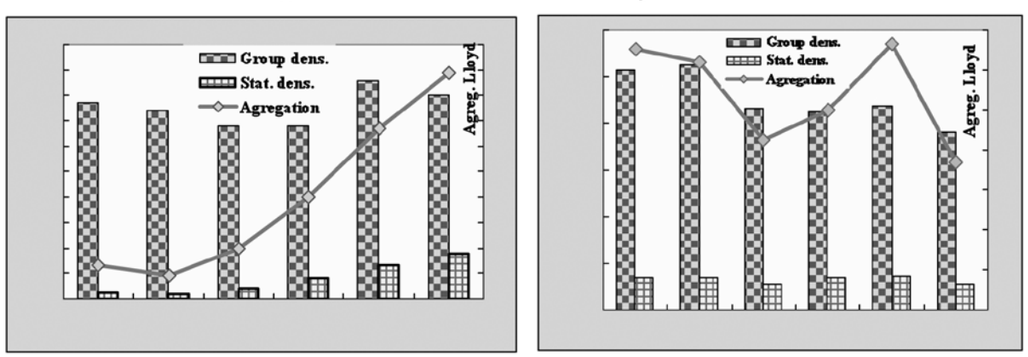

Figure 1. Density (ind./ha) andi aggregation (K_{Lloyd}) in populations of *A. uralensis* species at different phases (***A*** – depression; ***B*** – maximum) of number density in natural stations

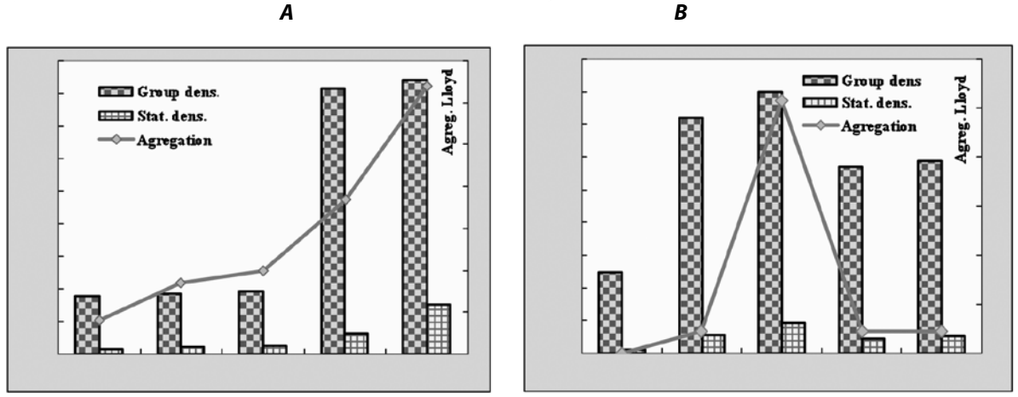

Figura 2. Density (ind./ha) andi aggregation (K_{Lloyd}) in populations of *A. sylvaticus* species at different phases (***A*** – depression; ***B*** – maximum) of number density in natural stations

The density of local groups in natural stations at *A. uralensis* is higher in both number phases, especially in summer period and very much less during the year. It was established that at maximum phase the group density increases twice, while in *A.sylvaticus* more evident increase was recorded only in summer period. In the phase of number depression in both species the aggregation and the mean density in station show an ascendent increasing from spring to autumn. Completely different dynamics of these populational parameters of both species was recorded in phase of maximum number dynamics, when the maximum values are reached at the end of summer and decrease in autumn.

Aggregation in *A. uralensis* stronger correlates (r = 0.91) with mean density of population at phase of minimum number (fig. 3) and the regression is expresses by the equation y = 1.7011+ 0.91425x. *A. uralensis* distribution is aggregated at the density higher than 4 ind./ha.

For *A. sylvaticus* at a relatively uniform distribution (K_{lloyd}= 0.92-0.94) the density in groups is rather increased (71.9±13; 59±8.9 ind./ha) and the species is distributed aggregately (K_{lloyd} > 2) at the density in the station higher than 6 ind./ha. Aggregation coefficient (K_{Lloyd}) also correlates stronger (fig. 4) with mean density in station, especially at minimum number phase (r = 0.99, y=-1.862+1.4533x).

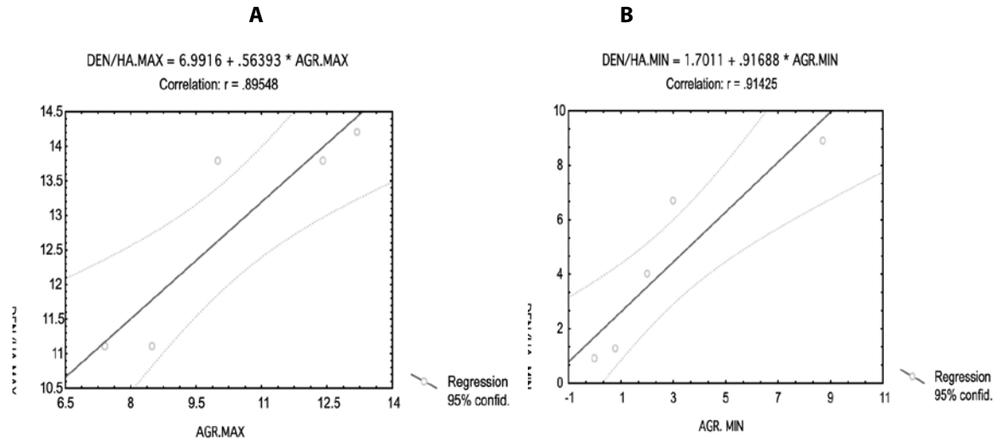

Figure 3. Regression analysis of correlation between aggregation (K_{Lloyd}) and mean density in *A. uralensis* at different phases of number density (A- maximum, B- minimum)

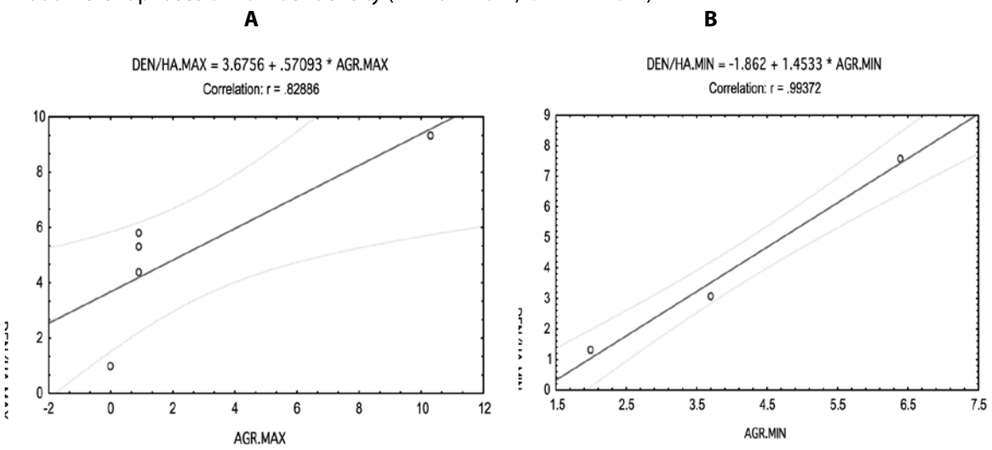

Figure 4. Regression analysis of correlation between aggregation (K_{Lloyd}) and mean density in *A. sylvaticus* at different phases of number density (A- maximum, B- minimum)

At the phase of minimum number density *A. sylvaticus* is distributed aggregately at lower mean density of population in station (1.3 ind./ha., fig.1).

In conclusion it can be pointed out that in both species at phase of minimum number density the aggregation increases toward autumn and is maximal in October (K_{lloyd}= 6.4±0.7 in *A. sylvaticus* and 8.7±0.9 in *A. uralensis*). In the years with maximum population density *A. sylvaticus* is distributed more aggregately in August, when the mean population density is also maximal (K_{Lloyd} = 10.3±1.2; population density 9.3±1.4 ind./ha). *A.uralensis* at phase of maximum number density show two peaks in dynamics of aggregation process (in June and in September), and correlates positively (r = 0.89) with mean population density in station. It was established than individual density in groups at *A. uralensis* is 2.3 times higher in years with maximum mead density and varies less during the year. Density in groups is also stable in years with minimum density in station, in opposite to mean density of the population, which during the year varies at this phase of number cycle from 0,89±0.15 ind./ha. in June to 8.9±0.93 ind./ha. in October. It was established than in both number phases in autumn period the populations of stdueid species in natural stations have increased mean densities an essentially differ depending on the specific of adjacent habitats. In natural stations limited by perrenial cultures, in autumn the species of *Apodemus* genus reach mean densities of 18-22 ind./ha.

MODELING OF POPULATION PROCESSES DYNAMICS IN PREDATOR-PREY SYSTEMS

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The dynamics of extracting efficiency of small rodents – main pest species in agrocenoses by the myophagous predators was analyzed and it was established that in the phase of number depression the maximum removal of individuals occurs in autumn, while *Mus* genus species are also extracted rather intense in spring in period of mound leaving (fig.1), being at this phase rather low (< 50 %).

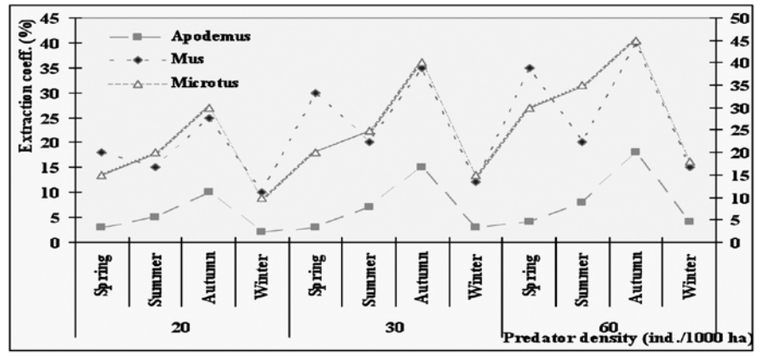

Figure 1. Seasonal dynamics of extracting efficiency of dominant rodent genera at different density gradients of predators in the phase of number depression

At maximal densities (fig.2) the removal is efficient for species from genera *Microtus* and *Mus* from the first summer months, especially when the predator density is higher than 30 ind./1000 ha. The species *Apodemus sylvaticus* even at this phase is much less removed by comparing to other main rodent species in agrocenoses.

The efficiency of field voles regulation in peak phases, when reaching the pest thresholds, is satisfactory (C_{ex} > 50 %) starting with the density of 20 predator individuals per 1000 ha –in autumn and at the density of 30 predators – in summer (fig. 2).

The strophic spectrum of long-eared owl (*Asio otus*) in northern zone of the republic was analyzed in the phase of number depressions of small rodents. In autumn the preferred prey of the owl were *Microtus* individuals that constituted 75%, followed by species of *Mus* genus (10%) and *Apodemus* genus (9%).

Approximately the same proportion was established in fox diet (68%, 14 % and 6 % respectively). The data show a high selectivity of prey extraction which is less dependent on its abundance in ecosystems.

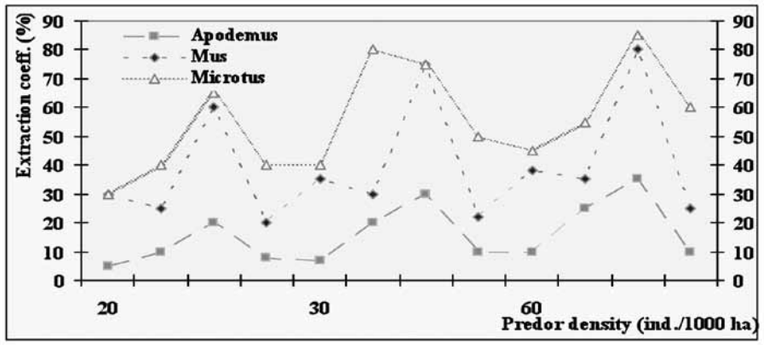

Figure 2. Dynamics of extracting efficiency of dominant rodent genera at various density gradients of the predators in the phase of peak number

Elaboration of regression models of correlation between the extracting efficiency of rodents and the density gradient of the predators emphasized that the efficiency of influence of the main predatory species upon the density of main prey species in the predatory-prey system correlates at maximum (r = 0,88) at the predator density of 30 ind./ 1000 ha (fig.3) and the regression equation of this correlation is Y= - 1001,19674 + 129, 009095 X (fig. 4).

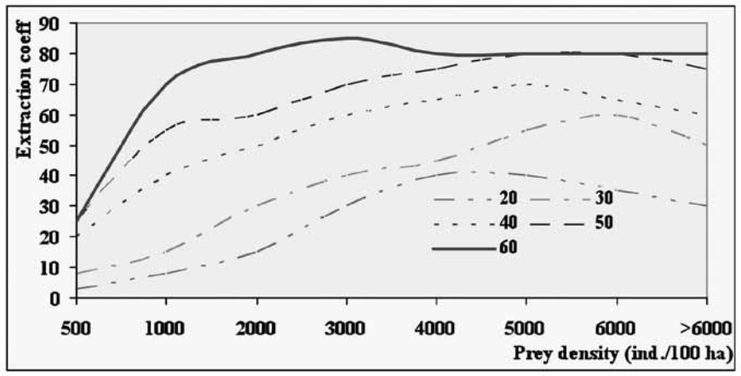

Figure 3. Dynamics of process of prey extracting at various gradients of predator density

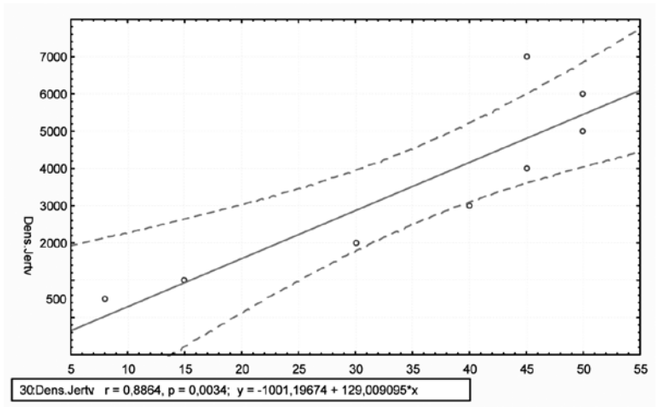

Figure 4. Corelation ans regression ecuation between prey density and extractig coefficient at predator density of 30 ind./1000 ha

It is well known the fact that the predatory rate increases along with the increasing of prey population density. This phenomenon is the result of two effects: 1 – the natural tendency of each predator to increase the food consumption rate when a high abundance of food exists and 2 – the predator density increases with increasing of prey density these effects are two types of predatory population response to the modification of prey density: increasing of food consumption rate is a response with functional significance, while the increasing of predatory density has numeric significance.

The modeling of population dynamics of some species of predators and prey realized according to model proposed by Holling (1959). A predatory-prey model that will include the functional response as well as the numerical one is based on prey population. Therefore, knowing the rodent and fox density from the last years, the dynamics modeling of these groups was accomplished using Holling equations. The equation describing the dynamics of prey population is: $\frac{dH}{dt} = r_H H\left(1-\frac{H}{K}\right) - \frac{aHP}{1+aHT_h}$

The dynamics of predator population is described by a below equation: $\frac{dP}{dt} = r_P P\left(1-\frac{P}{kH}\right)$

The below figure describe the numeric response of the fox population to the annual modifications of rodent population in the last years in anthropized ecosystems (fig. 5).

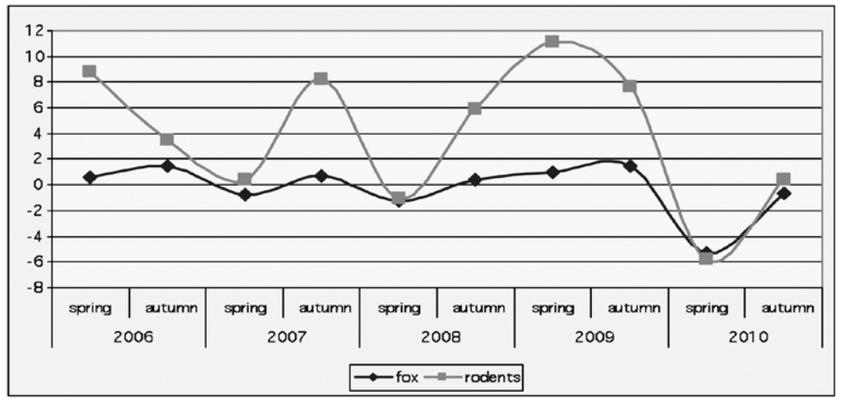

Figure 5. Dynamics modeling of fox populations depending on rodent dynamics

As it can be seen, the increasing of rodent density provokes the increasing of fox density, but which is delayed in time. At the beginning of 2010, when rodent density was very low the indexes of fox density were even higher than that of the rodents and they became equal only in autumn period. In such condition the fox switched to alternative trophic resources, causing damages in hunting farms and localities.

THE INFLAMMATORY REACTION IN THE MEDIUM INTESTINE IN THE METAMORPHIC CLIMAX OF RANA TEMPORARIA TEMPORARIA (L.1757)

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Abstract: the oxidative stress determines phenomena of cellular death in the medium intestine in Rana temporaria temporaria. The local biochemical modifications caused by the cellular death, produce the increase of macrophage, eosinophiles, neutrophiles, lymphocytes cell numbers, that agglomerate in the blood vessels of the digestive tube tunic and migrate, predominantly in the larval epithelium, causing an inflammatory response.

Key words: metamorphosis, anuran amphibians, medium intestine, inflammatory reaction

Introduction

The metamorphosis of anuran amphibians is a phenomenon used as a model for the study of cellular growth and differentiation, programmed cellular death, histolysis and hystogenesis, endocrinology and phylogeny etc. (2, 3, 7, 10, 12).

Of the stages of metamorphosis, the climax is represented through the most spectacular morphostructural transformations, in which the larval tissues are replaced by tissues characteristic to the adult. The digestive tube is the segment suffering the most important transformations during this process. Due to the increase of the sanguine concentration of the thyroxin, an oxidative stress is produced, determining the coming into function of the apoptotic cellular death mechanism, in different cells (1, 4, 5, 6, 8, 9).

Materials and methods

The material comes from the Rana temporaria temporaria ponte, collected from marshes of the Birnova forest, Iasi, Roumania. The hatching tooks place in laboratory. The larvae were grown in the laboratory, and the developmental stages were established according to Taylor and Kollross' tables (13).

For the microscopy, the medium intestine was fixed in formalin 4%, included in the paraffin and coloured with hemalaun eosine.

The photos were taken at an Olimpus microscope.

Results and discussions

From the structural point of view, the medium intestine of the larvae of Rana temporaria temporaria, is formed of four tunics: epithelium, mucous, musculature and adventitia.

The most profound transformations, in this structure, occur in the climax of the metamorphosis and refer to the larval epithelium. This is equipped with a certain enzymatic load and will be replaced through lyses, in connection with the change of the food regime, with an epithelium equipped with another enzymatic load, functional in the juvenile and adult.

In the metamorphosis climax, in the cells of the digestive tube tunics, an oxidative stress occurs, characterized through the growth of the free radicals and decrease of the antiradical enzymes value (11).

As a result of the oxidative stress, the cells of the larval epithelium are destroyed, phenomenon called apoptosis. The ultrastructural characteristics of the apoptotic epithelial cells are: desmosomal connections between the cells weaken, nucleus with condensed chromatin in bunches near the nuclear membrane, strong vacuolation of the cytoplasm, appearance of the apoptotic bodies, phagocyting of apoptotic cells by the neighbor cells from the healthy epithelium, vacuolization of some regions from certain cellular organites (endoplasmatic reticule), accumulation of lipofuscin and presence of micronuclei in apoptotic bodys. The apoptosis from the digestive tube of anuran amphibians is a particular case of programmed cellular death, whose elements confer it uniqueness.

The remains of the epithelium cells, resulted from apoptosis follow several ways: some are lysed in own apoptotic bodies, others are phagocyted by neighbor cells, others in macrophages and some pass directly in the intestine lumen.

On transversal sections these elements resulted from the death of cells are noticed as a compact mass, voluminous, of pale coloration, towards the intestine lumen. In the subjacent side, we notice areas more strongly colored, which represent the cellular nests, from whose cellular divisions the larval epithelium will be differentiated.

In all the tunics of medium intestine (with the exception the epithelium) in the stages of the climax, we notice an increase of the number of sanguine capillaries, eosinophils and neutrophiles, both in the vessels and in their neighborhood. This as a result of the loss of membrane integrity of apoptotic cells and the modification of the local biochemical conditions (fig. 1).

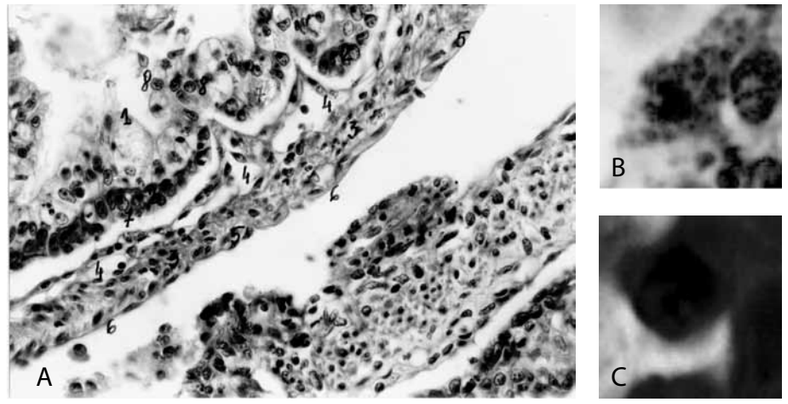

Fig. 1. The inflammatory reaction in the medium intestine in the climax, Rana temporaria temporaria, A. middle intestine section, 1. larval epithelium, 2. juvenile epithelium, 3. connective tissue, 4.blood vesels, 5. muscularis mucosae, 6. serosa, 7.macrophages, 8. leucocite, B. macrophage, C. leucocite, hemalaun eosine, MO20X

The presence of macrophages, eosinophiles and neutrophiles in a large number in the epithelium of medium intestine in the metamorphic climax, represent an inflammatory reaction of the body to the profound transformations that occur.

Synthesizing the transformations that occur in the stages of metamorphosis at Rana temporaria temporaria, we drew up a scheme that places the noticed structural elements (fig. 2).

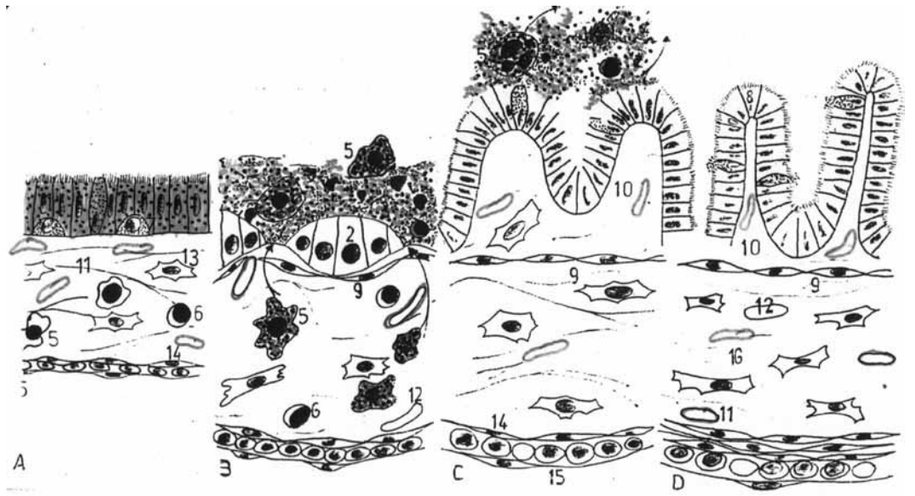

Fig. 2 The metamorphosis of anuran amphibians, medium intestine, A. premetamorphosis, B. and C. climax, D. juvenile, 1. larval epithelium, 2. juvenile epithelium, 5.macrophages, 6. limphocite, scheme.

Conclusions

The inflammatory response from the medium intestine in the metamorphosis climax determines in the case of Rana temporaria temporaria the growth of the number of macrophage, eosinophiles, neutrophiles, lymphocytes, that migrate from the blood vessels of the digestive tube, predominantly in the larval epithelium. This represents a response reaction to the local biochemical modifications, determined by the oxidative stress.

References

1. Heusser S., El Amrani S., Colin S., Keller J.M., Dauca M.- Bull.Acad.Soc.Lorraines Sci., 35, 99-108(1995).
2. Hourdry J., Beaumont A.– Metamorphoses des amphibiens, Masson (1985).
3. Ishizuya Oka A., Ueda S.- Cell Tissue Res., 286, 467-476 (1996).
4. Le Cam A., Legraverend C.-Synthese, 9, 1352-1361(1993).
5. Lockshin R.A., Zaheri Z.-Biochem.Cell Biol.,72,589-596(1994).
6. Yun-Bo Shi, Stolow Melissa, Puzianowsko M.-Kumicko, J. Wong- Le recherce, 285, 58-65(1996).
7. Yoshizato K.- Int.Rev.Citology, 119,97-145(1989).
8. Vaux D.L., Haecker G., Strasser A.-Cell, 76, 777-779(1994).
9. Savill J., Fradok V., Henson P., Haslett C.- Imunnol. Today, 14,131-136(1993).
10. Rovira J., Villara A.C., Bodegas M.E., Valverde E., Semsa P.-Tissue Cell, 27, 13-22(1993).
11. Sîrbu V., Luminița Jerca, Anica Iacobovici- Analele Științifice ale Universității „Al. I. Cuza", Secțiunea Genetică și Biologie Moleculară, TOM VIII, 119-123 (2007).
12. Tata R.J.- Biochem.Cell Biol., 72,581-588(1994).
13. Taylor A.C., Kollross J.J., Anatomical Records, 94, 7-23(1946).

CURRENT STATE OF RED DEER (*CERVUS ELAPHUS* L.) IN BELARUS

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Among ungulates of Europe the red deer (*Cervus elaphus* Linnaeus, 1758) is one of significant objects of recreational resources, capable to the full to satisfy requirements of the human for rest and tourism. This species, along with elk and roe deer, is a typical representative of mammals of family *Cervidae* (*Artiodactyla*), meeting in fauna of Belarus.

Finding-out of spatial placing of populations of red deer on territories of Belarus, the analysis of quantity dynamics, a gain and use of its resources was the main objective of this article. It is necessary for an estimation of a current state of populations of this species. The data obtained should be a scientific basis at the decision of practical problems, including concerning its further moving and reacclimatization in various regions of the country.

Present-day quantity of a red deer in Belarus composes about 10 thousand individuals (ind.) that more low at comparison with neighboring European countries. For example, the area of woody found of Poland is approximately equal to 9.1 million hectares (ha) that is a bit less, than in Belarus (about 9.4 million ha). However, quantity of deer in this country almost in 10 times more (Bresinski, 2003). In Lithuania there is 16 thousand red deer in spite of it is less wood area. The similar situation is observed in Latvia where bagged deer in 6 times more, than in Belarus (Tatarchuk, 2010). The size of deer harvesting in Germany is 53 thousand ind. (Safonov, Chashchuhin, 2004), in Austria – 41-46 thousand ind. (Milner *et al.*, 2006). Also it is known that the red deer has reached the big density and in other European countries. So, for example, in France its density makes 3–4 ind./100 ha, but quite often reaches 40 ind./100 ha (Leduc, Klein, 2004). In Hungary population density of red deer is in limits 5–10 ind./100 ha (Csanyi, 1999), in Norway harvesting is made from calculation 1–2 ind./100 ha at density 5–10 ind./100 ha (Mysterud *et al.*, 2001), and in Scotland the density 7–14 ind./100 ha (Trenkel *et al.*, 1998).

The overview about a change of quantity, harvesting and gain of red deer in Belarus for the 35-year-old period gives Figure. At the analysis of quantity dynamics it is allocated three periods. The first – growth of number passing with 1974 for 1992. For 18 years the quantity of deer has increased from 670 to 6300 ind. The second – decrease in the number observed with 1993 for 1996. For 3 years the quantity of deer has decreased to 3500 ind or on 56%. The third – steady growth of number since 1997.

Within 1974–2009 the annual gain of population of red deer was small and mainly didn't exceed 8–9%. Only in 1998 and 2006–2009 the normal gain for the given species which made from 16 to 19 % a year was observed. Annual bag of deer seldom exceeded 5% and has on the average made 3.3%.

Spatial placing of red deer on territory of Belarus has motley character. Distribution of deer on gradation of number testifies that their primary quantity lives very small population groupings. From 67 hunting economies where deer lives, in 38.8% from them its number doesn't exceed 30 ind. As the share of territories (22.4%) where population groupings with number from 31 to 60 deer are observed, 19.4% – from 61 to 100 ind., 23.9% – 101–200 ind., and only 15% of them have populations which stably use its resources with number more than 201 ind.

As a result before data received on fodder capacity of wood ecosystems of Belarus (Shakun 2009, 2010) the general resources of winter ramal forages for a deer make about 520 thousand ton. They can supply population density of a deer at 10-12 ind./1000 hectare of wood. Such quantity of forages taking into account available number of an elk (near 20 thousand ind.) and roe deer (65 thousand ind.) will be sufficient for maintenance of number of deer at level of 35-40 thousand ind. At intensive carrying out of system of biotechnical actions and minimization of negative influence of predators and poaching, this level is probably to increase in 1.5-2 times. Thus, in the long term, quantity of red deer in Belarus can make 70-80 thousand individuals and annual bag can run up to 9-12 thousand ind.

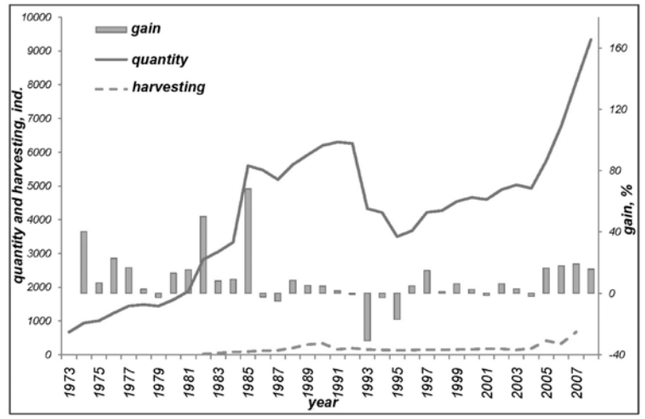

Figure – Change of quantity, gain and harvesting of red deer in Belarus

The current quantitative state of red deer population on territory of Belarus is on a low level, but development of its populations has the perspective future. Wood grounds are capable to support 3-4 times more quantity of this species than nowadays. But existence of such quantity of deer is impossible without scientific and practical support. It should be spent both at formation of separately living population, and throughout all period its existence, and to be expressed in effective animal protection, and also carrying out of volume biotechnical actions. Important value should be given to selection work which should be spent constantly for improvement not only trophy qualities of males, but also for population improvement in general. Also it is necessary to notice that the results of researches obtained are a necessary scientific basis for optimization further red deer reacclimatization on territory of Belarus which has been successfully realized in some areas in 2006-2009.

THE NUMBER FLUCTUATION OF *MICROTUS ARVALIS PALL* AND *MICROTUS ROSSIAEMERIDIONALIS OGN*. POPULATIONS (RODENTIA, CRICETIDAE) IN AGROCENOSIS FROM THE REPUBLIC OF MOLDOVA

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The number of the population is its main structural parameter, being tightly interconnected to the other structural condition parameters that it influences and is itself deeply influenced. As a rule, the number of population largely fluctuates at different rates, being very sensitive at changing environmental pressure. The main condition parameter of each population represented by its size continuously modifies as a result of pressure environment modulation over time that affects the reproduction capacity and, respectively, the surviving capacity of the individuals that belong to this population. These effects are exclusively responsible for the populations' size variation where dispersion is absent or neglected while in populations characterized by various degrees of intensity this phenomenon largely occurs [1,2,3].

The dynamic and periodic character of animals' populations remains a mystery so far. Many hypotheses referring to the population's number were expressed and postulated at the end of multiple researches conducted in different rodents living conditions but none of them entirely reflects this problem. This fact stands for the complex nature of the ecologic factors that have an influence over the rodents in time and space [4,5]. Some ecologists consider that the microtines populations cyclically fluctuate during 3-4 years, other say that non-periodic numerical eruptions occur. The peculiarities of the microtine's numerical density dynamics in agrocenosis differ very much from those registered in the natural biotopes and for whom a particular periodicity that was not registered in the conditions of the agrocenosis is typical. The reduced number of males recorded in agrocenosis during the period of intensive reproduction represents, particularly, a high numerical level of juveniles [7,8]. The researches conducted in agrocenosis during two decades allowed us to ascertain that *Microtus arvalis* doesn't show a strict periodicity of its population dynamics but the peak phases, with the highest density, is recorded after 5-6 years and coincide with those from other areas of habitat [6,9]. Intermediate phases with a lower density occur at 3-7 years during two peak phase periods. The abundance and the multiannual fluctuation of the two microtine species density clearly show the cyclical densities with their maximum levels from 1988, 1989, 1996, 2002, 2009. In the most cases, *M. rossiaemeridionalis* had the density and the abundance at about a half compared to *M. arvalis*.

It is not enough just to indicate, at the end of a research period, the field where the population size is modified and to assess that the fluctuations are determined by the environment pressure oscillation but we also have to determine the main environmental factors that influence the number of population. The mathematic pattern that describes the numerical fluctuation represents the functional relation expression in a proper mathematical formula.

The reproduction intensity decreases at the peak level that is, when the number of population increases, the reproductive female share decreases. The correlation between density and reproduction occurs during the entire reproduction period, r=-0.875 for *M. arvalis* and r=-0.729 for *M. rossiaemeridionalis*, thus fluctuations occur in opposite directions. M. arvalis individuals' density is higher than the density of *M. rossiaemeridionalis* during the entire research period.

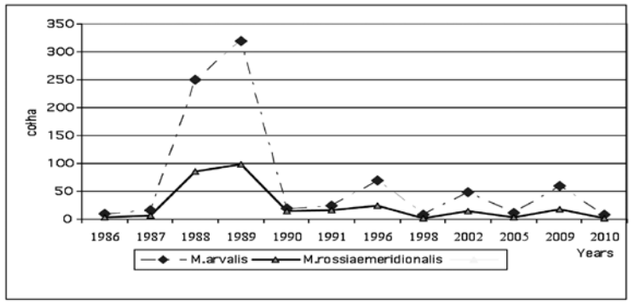
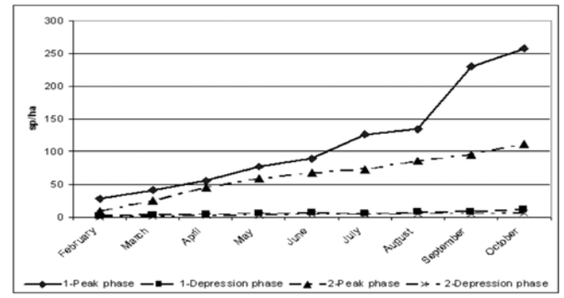


Figure 1. The multiannual individuals' density fluctuation of M. arvalis and *M. rossiaemeridionalis* species in agrocenosis

A verisimilar difference regarding the seasonal relative density was also registered at different fluctuation phases, the rates of *M. arvalis* being higher (Fig.2).

Figure 2. The seasonal relative density of: 1- *M. arvalis*; 2- *M. rossiaemeridionalis* species.



Perennial grasses and cereal crops are the most favourable for *M. arvalis*. An intensive migration of this species was registered alongside the crops harvesting and the agrotechnical activities. The size of the population's number in spring may not always be a certain criterion for the autumn number forecast.

The microtines suddenly increase in density during a relatively short period of time (3-4 months) due to their satisfactory physiological state as it happened in 1988, for example. There are two peak levels of the number of population: the first, that is less pronounced, occurs in July-August, and the second one – in September-October. Nutritional resources normalize the number of rodent populations and help reproduction. Variation of reproductive activity conditions the density fluctuation, being more important for the maintenance of the number of population.

Bibliography

1. Chitty D. Population processes in the vole and their relevance to general theory. Can. J. Zool.- 1960,- v. 36 № 1,- P. 99-113.

2. Chitty D. The natural selection of self-regulatory behaviour in animal populations. Proc . Ecol. Soc. Austral. - 1967.- v. 2,- pp. 51-78.

3. Goszczynska W. & Goszczynski J., Effect of the burrowing activities of the common vole and the mole on the soil and vegetation of the biocenoses of cultivated fields.-Acta theriol.- 1977- 22 (10): 181-190.

4. Lidicker W.Z., Jr. Solving the enigma of microtine „cycles"J. Mammal, 1988, v. 69, №2,- P. 225-235.

5. Lidicker W.Z. Regulation of numbers in an island population of the California vole, a problem in community dynamics.- Ecol. Monographs, 1973.- V-43—N-3.-P.271-302.

6. Muntyanu A., Sîtnic V. Spatial structure of population M. rossiaemeridionalis in ist phases of dinamicus numbers.- Polishe Ecologie. Poland, V.30. N 3-4, 1994. P.257-263.

7. Гайченко В.А. Некоторые систематические и экологические взаимоотношения двух близких серых полевок подрода Microtus Schrank.- Автореф. дис...канд.биол. наук. –Киев, 1977.

8. Зоренко Т.А. Групповое поведение как фактор регуляции внутривидовых отношений у обыкновенной полёвки Microtus arvalis Pall. (Rodentia, Cricetidae).-Автореф. Дис...канд.биол. наук, 1979, С.1-21.

9. Мунтяну А.И., Савин А.И., Сытник В.Л. Демографическая структура популяции обыкновенных полёвок на фазах роста и пика численности в агроландшафте.-Мат. Респ. Конф. -Кишинёв: Штиинца: -1989. С. 26-27.

THE ROLE OF EMIGRATION AND IMMIGRATION IN THE NUMERICAL DENSITY REGULATION OF TWO SPECIES OF *MICROTINES* IN AGROCENOSIS

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Dispersion was not regarded until the last decades as a demographic phenomenon that influences the population density. This can be explained by the difficulties of separation, attributing to specimens the status of sedentary and migrant individuals, as well as by those removed by the emigrants. A series of experimental researches of micromammal populations established that dispersion is one of the basic mechanisms in regulating the population density. A series of hypotheses that make clearer some stages of this process were drawn up for the purpose of elucidating the factors that cause dispersion. Social behaviour is one of the rodents' dispersion mechanisms. It is considered that the intensity of dispersion is determined, first of all, by the population density, the grouping nature and the biotopes degree of correspondence. For microtines, dispersion is more evident in growth and peak phases than in depression phase.

Emigration ratios of specimens do not depend on population density. Juvenile individuals disperse

more intense. These migrants become adults more quickly; they reproduce and survive better than juvenile residents. An increased dispersion is associated not only with the increasing number of population, but also with the social structure impairment, especially in spring and autumn. In order to determine animals' dispersion pattern that inhabit a heterogeneous environment, the structure of the biotope, that is the external factors, is more important than the endogenous ones. It is considered that emigration is a means of increase in rodents' adaptation. Dispersion develops in response to parents' behaviour. The possibility of migration of different intrapopulational groups varies and it is determined by the social structure in each case. According to their qualitative structure intrapopulational groups are different and this determines their hierarchical structure.

Microtine dispersion in agrocenosis is explained by the mechanism of specimens' interdependence and also by the condition of the agricultural landscape and the season. Individuals emigrate from their refuge places to closer areas with favourable conditions of nutrition and protection usually in spring, when their reproductive activity increases. The process of catching-mark-recapture of individuals in the experimental areas, allowed us to divide them in two categories: residents (sedentary), captured more than twice during 2-3 censuses and migrants captured only once. Analyzing the ratio between residents and migrants and taking into account the density and number dynamics, we set the intensity of dispersion and mobility of certain categories of individuals by age and sex.

M. arvalis share of migrants in gramineous fields is verisimilar greater in comparison to *M. rossiaemeridionalis* share in forest curtains at the peak phase from March to August. M. arvalis share of migrants in the fields of perennial grasses is greater than *M. rossiaemeridionalis* share in forest patches from March to June (Fig. 1, 2). Then the opposite phenomenon occurs.

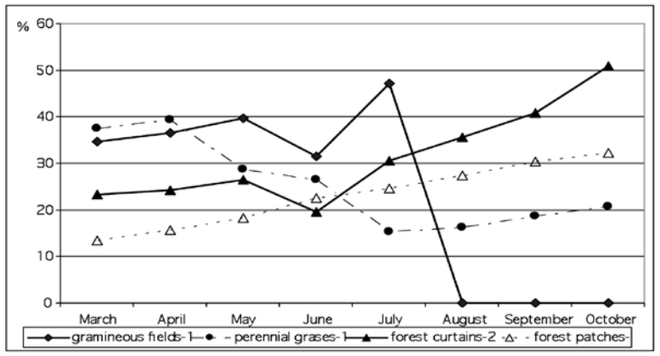
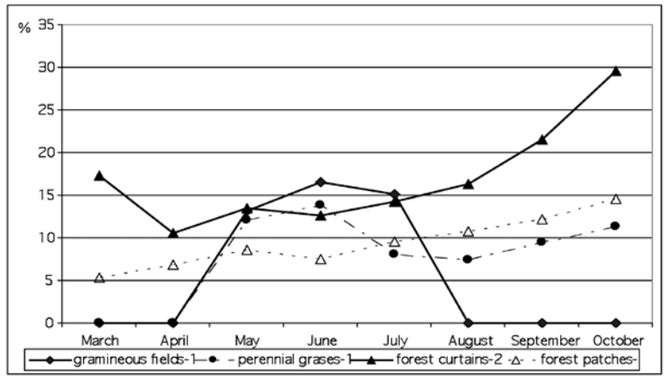


Figure 1. The share of Microtine species of migrants at the peak phase of density:
1-*M.arvalis*;
2- *M.rossiaemeridionalis*

Figure 2. Microtine species share of migrants at the depressed phase of density:
1-*M.arvalis*;
2- *M.rossiaemeridionalis*

It is worth mentioning that the share of *M.arvalis* male residents is likely lower in gramineous fields at the peak phase than the share of *M.rossiaemeridionalis* males in forest curtains in March-July, but it is likely higher at the phase of depression in the same months (Fig. 3). The share of M. arvalis resident males is verisimilar higher at the peak phase in fields with perennial grasses compared with *M.rossiaemeridionalis* specimens in forest patches only in March-May, while in June-October this share is lower. The highest share of *M.arvalis* migrant males is noticed in March in gramineous fields at the peak phase and it gradually decreases before harvest time, being lower at the phase of depression in the same cultivations.



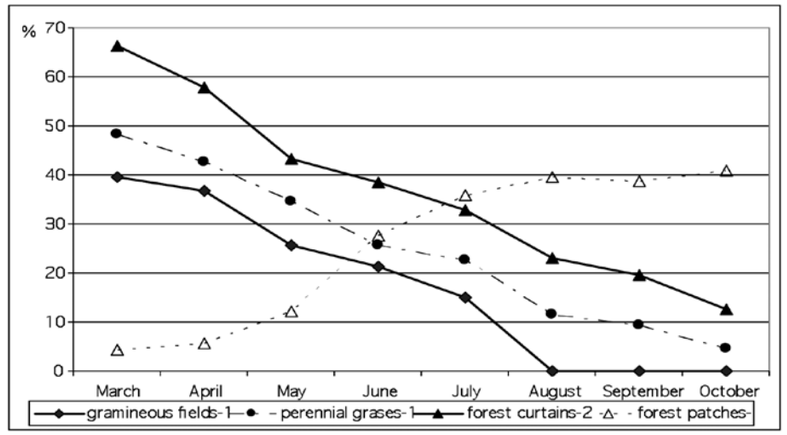


Figure 3. The share of resident males in agrocenosis at the peak phase density:
1-*M.arvalis*; 2- *M.rossiaemeridionalis*

The share of *M.arvalis* migrant males increases from spring to summer at the peak phase, the same process being recorded for *M.rossiaemeridionalis* in the forest strips, while during depression this share decreases. An opposite phenomenon is noticed in the forest patch – the share decreases at the peak phase and increases at the phase of depression. The share of *M. arvalis* migrant males is verisimilar higher in gramineous fields at the peak phase than the share of *M.rossiaemeridionalis* migrant males that are in forest strips. This phenomenon is opposite at the phase of depression. The share of *M.arvalis* migrant males is verisimilar lower in perennial fields at the peak phase if compared to *M.rossiaemeridionalis* from forest patches in March-June, but it is higher in July-October.

PECULIARITIES OF DISPERSION AT *MICROTINES* IN AGROCENOSIS FROM THE REPUBLIC OF MOLDOVA

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Dispersion occurs at a maximum density or at the growth phase until resource depletion. Individuals that are sensitive to increasing density usually migrate. Dispersion at a numerical effective phase is characterized by the emigration of a surplus of individuals or of the "socially expelled" including the aged and underaged individuals. The density on alfalfa fields increases up to 80-100 colonies per hectare in late summer and early autumn. The rate of survival grows from 33.7% in September up to 58.6% in October, while the number of reproducing females (67.4%) of the old summer generation exceeds the spring index (35.1%). As a result, the groups dissipate on neighbouring gramineous fields where a density of 10-15-hectare colonies was recorded. Two nursing females were caught in the same colony on alfalfa field but the individuals belonged to different generations. The number of group colonies grows on alfalfa fields up to 4-5, while they retain their simple structure on the gramineous fields. The process of dispersion of *Microtus arvalis* individuals from the alfalfa field to the adjacent gramineous field starts in November-December at the peak phase. The colonies were homogeneously distributed throughout the field, with no signs of aggregation. They were divided almost in straight lines in the direction of agricultural crops at a distance of 3-5 meters from each other, linked by paths. The straight oriented colonies were found at a distance of 7-10 meters from each other. The largest groups of colonies were located at 10-20 meters from the wheat field edge, where the first migrants dispersed from the alfalfa field, where their density in October was about 350 colonies per hectare. The migrant females prevailed (64.7%) in the gramineous field, while the males were more in the alfalfa field (58.3%) in February the next year. These groups differed in age structure. The population consisted of 3-4 cohorts in the fields of cereal crops. More than 28% of individuals belonged to the spring-summer cohort, having a body mass higher than 30 grams. The individuals of the autumnal cohort constituted 48.5% and had a body mass higher than 20 grams.

The population of residents on the alfalfa field as well as the population of the migrants from the straw-wisps was made up of 2-3 cohorts. The greatest part of the individuals from the straw-wisps (70.7%) were found in the summer-autumn cohort, 27.6% were found in the autumn cohort and only 1.7% – in the spring-summer cohort. The mass dispersion from the alfalfa field to the gramineous field coincided in time with the peak phase in late autumn. The intense alfalfa consumption and practically the whole field drilling undermined the nutrition basis and, on the contrary, the nutritional basis was abundant on the adjacent gramineous field. This type of dispersion is characterized by the fact that there are individuals, among migrants, that reproduce earlier than those who remained on the initial field. The dispersion phase starts after the living conditions outside the refuge place improve. This is a premise to increase the population viability in the places where the individuals emigrated due to the increase of groupings density that stimulates dispersion. Favourable conditions ensure survival and reproduction of individuals that dispersed outside refuge places. The population passes through the peak phase. Given the favourable weather conditions, reproduction occurs in winter as well, with an intensity of 8-10%. The colonies practically occupy the entire field, *M.arvalis* being the background species on the fields of perennial and gramineous grasses. At the beginning of winter the number of females exceeds twofold or threefold the number of males, while the juveniles make up 61.1%. The intensity of dispersion is caused, to a greater extent, by the period of population. For example, in the case of populating the gramineous cultures in autumn-winter period, the dispersion of individuals in spring and summer will be different from the same process in spring. Microtines' competition influences emigration and immigration only in the case of maximum density. The record of the migrant and resident individuals' body mass shown that during the peak phase on the gramineous fields and forest strips migrant males had a verisimilar higher body mass than migrant females, their mass, however, substantially differs from the mass of the resident males. (Fig.1).

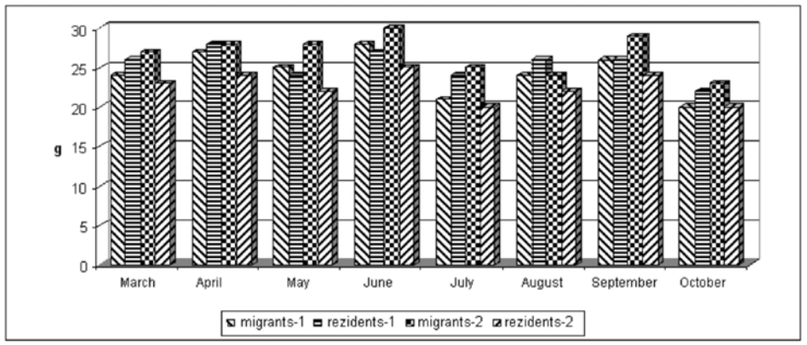


Figure 1. The body mass (g) of migrant and resident males: 1-*M.arvalis*; 2-*M.rossiaemeridionalis*

The mass of resident males is verisimilar greater than the mass of resident females. (Fig. 2). The probability was established between both species, the body mass of Microtus arvalis migrants being lower than the body mass of Microtus rossiaemeridionalis migrants. On the contrary, Microtus arvalis residents had a higher body mass. The migrants prevailed at a maximum density. In the depression phase when density and competition, the factors that favour it, were excluded, individuals outside marking sectors were not captured, and the reduction in number is rather explained by mortality than by dispersion.

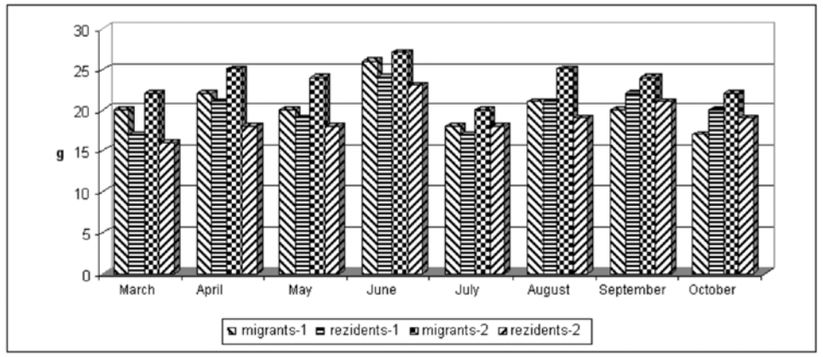
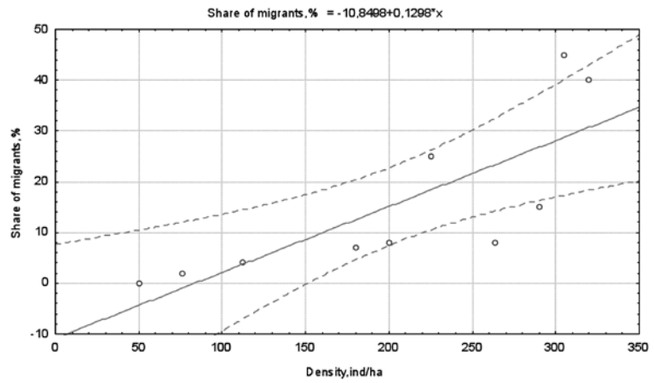


Figure 2. The body mass (g) of migrant and resident females: 1-*M.arvalis*;2-*M.rossiaemeridionalis*



There is no proportional dependence between the density and the number of migrants. (Fig.3)

Figure 3. The dependence of migrants' share (%) on density (individuals/ha) at Microtus arvalis

The increased mortality is also confirmed by a frequent replacement of some individuals on the marking scetor, where only 50% of the captured remain 20 days earlier, while after 1.5 months –only 15% of them remain. Thus, the individuals that colonize the gramineous fields in winter independent of density reproduce and survive better when the wheat is ripe they disperse on the field with crops (maize, beet, etc.) that are not characteristic of microtines. In this case the majority of the migrants stop reproducing and thus they die.

THE DISTRIBUTION OF BIRDS IN THE ALCUDIA VALLEY, SPAIN

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The importance of knowing the avifauna of the dehesa - a rare forest with multiple use, as agrosilvopastoral, which dominates this valley, is given by the fact that shows perhaps the most successful example of compromise between sustainable development of human society and environment to maintain biodiversity (Campos, 1993). It was studied the influence of the vegetation structure of the dehesa on the bird communities in an adjacent area - Extremadura (Pulido, Diaz 1992, Diaz et al, 2003). It was demonstrated the positive impact of grazing on the diversity of the specific avifauna, the negative impact of the shrub layer and the lack of the arboreal impact. The dehesas from the Alcudia Valley are different both by vegetation structure and landscape. Therefore the objective of this study consisted in highlighting the factors that determine the distribution of birds in this unique habitat. The working hypothesis resides in the decisive role of the arboreal in the distribution of birds in the dehesa as in forest environments.

This study was performed in the Alcudia Valley – a vast mountain depression about 20 x 100km, at the north of the mountain chain Siera Morena, province Ciudad Real, Spain. Here are some of the most characteristic dehesas – a half arboreal formation similar to the African savannah, consisting of the holm oak (Quercus ilex), more rarely the cork oak (Q. suber). It is characteristic grazing (including pigs with the acorn), agriculture (cereals), hunting, apiary etc. The biological diversity of this half natural formation is amazing. For example, the herbaceous coverage has the highest specific diversity from the temperate zone.

The estimation of the birds density were made during the naked period in the years 2007-2008 on 241 listening points with a radius of 50m distributed uniformly over the territory at the minimum distance of 0,5km. Parallel, after established methods was made the description of the main environmental factors as the structure of the arboreal, shrub and herbaceous layer, also the landform and the landscape. The results were subjected through a poly-factorial analysis by using the statistical program: **R** (Maindonald & Braun, 2010). The specific diversity was expressed through the Shannon – Weaver index, 1949 (H).

The study revealed the impact of the main environmental variables on the distribution of birds in this space. In table 1 we present the linear models of the distribution of birds calculated by the following equation: $\mathbf{lm\ (formula = log\ (Sp + 1) \sim K + Ax_1 + Bx_2 + Cx_{3...} + Nx_n.)}$ where**: K –** the constant which indicates the birds density in the absence of influence variables from model**; A,B,C –** regression coefficients of each variables**;** $\mathbf{x_1, x_2, x_3}$ – variables; **Sp** – species density.

Tabel 1. Linear models of the distribution of birds in the Alcudia Valley

Characteristics	The model	R^2aj
Total density, ex/km.p.	1.395 + 0.0236 dia – 9.86e-03 sar + 8.379e-03 arb + 6.896e-05 vca + 2.896e-03 est – 1.027e-03 ove	0.173
Specific diversity, H	0.782 + 0.0156 dia + 4.37e-03 hhe + 1.509e-03 alt – 6.141e-03 sar – 8.469e-04 ove – 9.754e-04 vac + 4.526e-03 arb	0.202
Fringilla coelebs	- 0,4144 + 0,1243 har + 2.254e-04 vdm + 1.429e-03 alt – 1.86e-03 e + 7.326e-05 vdd	0.338
Parus caeruleus	0.6967 + 0,01450 arb + 3.673e-04 vdm - 1.025e-04 vca - 8.326e-03 sar + 0.01.343e-02 dia - 4.397e-03 hhe - 9.621e-04 ove	0.183
Emberiza calandra	0.3809 – 0.01118 arb + 4.274e-03 hhe - 1.232e-04 vcs + 5.344e-05 vca - 1.677e-04 vdm + 1.966e-03 n	0.206
Galerida theklae	0.876 – 4.87e-03 est + 2.227e-03 s – 4.228e-03 nar + 3.951e-05 vca - 4.172e-05 vbo - 1.03e-04 vdd + 0.113 hst – 5.848e-03 ehe	0.328
Sturnus unicolor	0.4428 – 8.86e-03 pen + 9.978e-05 vcs + 7.526e-03 arb – 1.1511e-03 v	0.144
Cyanopica cyana	- 1.138 + 0.01375 che + 2.587e-04 vdd + 4.67e-03 est + 1.786e-03 alt + 1.806e-04 vag	0.159
Passer domesticus	0.878 – 1.196e-03 alt + 0.057 hst	0.063
Turdus merula	1.359 - 2.289e-04 vdr – 9.917e-03 che + 1.705e-04 vdd	0.211
Hirundo rustica	0.7401 + 8.094e-05 vcs - 1.818e-04 vdm – 5.122e-03 pen – 7.592e-04 alt	0.110
Lanius senator	- 0.613 + 7.14e-03 che + 2.068e-03 est + 1.436e-03 n	0.076

***Nar** – number of trees within a radius of 50m; **sar** – crown surface, m^2; **arb** – arboreal coverage, %; **har** – trees height, m; **dia** – stem diameter at 1,5 m height, cm; **ast** – shrub coverage, %; **hst** – shrub height, m; **est** – their denseness, %: **che** – herbaceous coverage, %; **hhe** – grass height, cm; **ehe** – its denseness, %; **pen** – slope angle, %; - **vac** – the presence of cows, ex; **ove** – the presence of sheeps, ex; **vag** – 1/distance from the waters, m; **vbo** – 1/ distance from the forests, m; **vca** – 1/ distance from the fields, m; **vcs** – 1/ distance from the houses, m; **vdd** – 1/ distance from the dense dehesa, m: **vdm** - 1/ distance from the medium dehesa , m; **ddr** – 1/ distance from the rare dehesa, m; **alt** - altitude s.n.m, m; **n** – northern slope; **s** – southern slope; **e** – eastern slope; **v** – western slope: **R^2aj** - Multiply R-Squared – the degree of adjustment of the model.*

Therefore, the main characteristics of the avifauna, as the total density and the specific diversity depend primarily on the arboreal structure (stems diameter, arboreal coverage and crowns surface). The preference of the thick stems and the reduced crowns may be explained through different shaping of the crowns by the landowners. Not accidentally these variables do not correlate significantly among themselves. The specific diversity is determined by a wider range of variables including grass height, altitude, disturbance factors as the presence of sheeps and cows.

As is natural the forest species of birds like *Fringilla coelebs* and *Parus caeruleus* choose an appropriate environment (dia, arb, har, vdd, vbo), as well as those field or anthropogenic birds. Therefore, each species occupies a niche according to their biological needs. That is why the communities of birds, by some antagonistic preferences they annihilate each other.

The hierarchy of environmental variables appears more illustrative if we consider the number of species of birds affected by them. So we get the following hierarchy: arboreal structure (42 species of birds) - landform (29) - internal landscape (the different vicinity of dehesas) (22) - external landscape (the vicinity of forests, waters, etc) (19) - shrubs layer (13) - herbaceous layer (13) - disturbance factors (8).

In the arboreal structure we obtain the following hierarchy: crowns surface (most of is negative (9 of 11 species of birds)) – stem diameter (7) - degree of afforestation (7) – trees height (6) – numbers of trees/ha (6) - crowns denseness (3) – stem height (2). Shrub layer: denseness (7) – height (4) – coverage (2). Herbaceous layer: degree of coverage (7) – height (5) – denseness (1). Landform: altitude s.n.m (11) – western slope (5) – slope angle (4) – northern slope (3) – the presence of rocks (2) – southern slope (2) – eastern slope (2). External landscape – the vicinity of forests (6) – houses (6) – fields (4) – waters (3). Internal landscape: dense dehesa (9) – medium dehesa (9) – rare dehesa (2) – shrubs dehesa (2). Disturbance: cows (3) – sheeps (3) – goats (1) – roads (1).

Thus, in dehesa we determined the arboreal impact on the distribution of birds unlike forests where the avifauna is influenced mainly by trees height (MacArthur, MacArthur, 1961), where critical is the crowns surface and stems diameter. Our data confirm those of Extremadura (Pulido, Díaz, 1992) that the shrub layer does not affect the specific diversity of the avifauna, but only weakly the density. Unlike the paper cited, it demonstrates a good correlation between the qualitative structure of the avifauna and the arboreal coverage.

Bibliography

1. Campos, P., 1993. Valores comerciales y medioambientales de las dehesas espanolas. *Agricultura y Sociedad*, 66: 9-41.

2. Díaz, M., Pulido, F.J. y Marañón, T. 2003. Diversidad biológica y sostenibilidad ecológica y Económica de los sistemas adehesados. Ecosistemas 2003/3 (URL: http://www.aeet.org/ecosistemas/033/investigacion4.htm)

3. MacArthur, R. H. & MacArthur, R. W. 1961.On bird species divercity. ***Ecology.*** 42: 594 - 598.

4. Maindonald, J. & Braun, W.J. (2010). Data analysis and graphics using R. 3rd edn. Cambridge:Cambridge University Press.

5. Pulido, F. & Díaz, M., 1992. Relaciones entre la estructura de la vegetación y comunidades nidificantes de aves en las dehesas: influencia del manejo humano. *Ardeola*, 39: 63-72.

BIRDS' AGGREGATION FROM THE PARK "VALEA MORILOR" FROM CHISINAU, REPUBLIC OF MOLDOVA

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The gregarious behavior of birds is determined by the state of the ecosystems succession. Therefore, the park "Valea Morilor" from Chisinau in the last two decades of the last century was characterized by middle-aged coppices in full development. The park is relatively well maintained and cared out and has an artificial lake of about 50 ha in its center. Now the park has changed a lot in terms of coppices maturization, almost complete abandonment of its maintenance, lake drainage etc. These changes led to the "forestation" of the avifauna, advancement of tree species like eurasian nuthatch, treecreper and the withdrawal of those of field and of semi open spaces. Therefore this study serves as a link between the pioneering studies of I. Ganea and M. Litvak (1960), G. Gusan (1989), those of continuing the good tradition (Tibuleac, 1995; Vasilascu, 2005 etc) and those of future.

Data of this study were collected over 17 years in the period 1979 – 1995 in the park "Valea Morilor" from Chisinau, Republic of Moldova. Here dominated compact coppices of *Acer platanoides, Pinus sp*. being distributed and a wide range of other trees essences, also are enough brushes and open spaces. The observations were made almost regularly at least once a week throughout the entire year after established methods: - the recording of the aggregation structure in the moment of identification of the species belonging to its inside the trips in a stable circular route with the length of about 6 km. The flock was followed until the elucidation of the complete structure. In total were registered 12.797 flocks comprising 126.815 specimens of birds representatives of 35 species. It was registered as well as the stable and the temporal aggregations, as a principle of gregarious behavior served the communication and the interaction among birds of the same and of different species. To highlight the multiannual evolution of the flock structure the processing of data was made on two significant time intervals: 1979 – 1986 and 1987 – 1995. The annual climate peculiarities may eclipse these trends.

The results of the study allowed forming a comprehensive view about the quantitative and qualitative structure of the birds' aggregation in this habitat, their seasonal and multiannual evolution.

In the seasonal aspect of the birds' aggregation are more common to the cold period of the year, mostly from November till April (Table 1). Those migratory and of passage like mallard, common starling and chaffinch forms two peaks of the degree of aggregation: corresponding to the beginning and at the end of the winter. The black-headed gull appears in the opposition with the mallard in the middle of the winter. The sedentary species like tits presents three waves: at the beginning and the end of the winter and during the period of flight of the chicks from nests.

Table 1. The seasonal evolution of the index birds aggregation (ex/stol)

Lunile anului	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Anas plathyrhynchos			84,0	309,0	14,07	8,7	314,0	20,7				
Larus ridibundus			9,9	20,9	48,4	137,5	19,0					
Sturnus vulgaris	4,0		2,0	44,0	144,0	36,0	203,5	6,5	26,5	25,0		
Corvus frugilegus			10,5	64,1	2,2	9,7	3,8	2,8	3,0	2,0		
Turdus pilaris			0,5	1,5	76,5	6,5	62,5					
Passer montanus			7,8	14,8	20,1	3,8	4,6	4,9	3,1	5,7	4,3	
Regulus regulus	2,0	9,5	8,6	7,0	8,2	5,5						
Fringilla coelebs	3,3		6,2	5,2	1,8	9,8	7,1	4,7				
Parus major	3,3	2,0	3,0	3,0	2,2	1,5	1,9	1,3	1,4	2,0	2,4	4,3

The mixed flocks of various species of birds have a similar annual evolution. As the number of the species in the flock and as the number of the specimens present two waves – in the months September – October and one more wider in February – March. Mixed flocks contained in average 12.6 specimens of 3.0 species of birds. The participation quota of the birds is different (table 2), it shows a similar participation as in to those neighbouring trees habitats (Gusan, 1989). The most frequent as in the forests are the mixed flocks of insectivorous birds leading with the tits, although quite common in such flocks were participated crows. Quite often at the formation of the mixed flocks participate and the crows.

Table 2. Mixed flocks of birds.

Species	Quota pop., %	Quota par., %	Ex/stol
Parus major	58,3	19,6	4,2
Parus caeruleus	41,7	9,6	2,9
Pica pica	27,8	6,5	2,9
Corvus corone	25,0	5,1	2,6
Garrulus glandarius	19,4	2,2	3,3
Corvus frugilegus	19,4	10,7	6,9
Fringilla coelebs	16,7	15,4	11,5
Sitta europea	11,1	1,8	2,0
Regulus regulus	11,1	3,6	4,0
Parus palustris	8,3	2,2	1,4
Philoscopus colibitus	8,3	2,0	3,0
Passer montanus	8,3	8,9	13,3
Coccotrhaustes coccotrhaustes	8,3	2,2	3,3

Quota pop. – share of the entire population which participate in the formation of the mixed flocks; Quota par. – share of the giving species in the composition of the mixed flocks, which takes part.

Great tit participate more frequently in the formation of the mixed flocks with the blue tit (52% of the cases), followed by the chaffinch (24); eurasian nuthatch (19); magpie (16); chiffchaff (15) etc. The blue tit with great tit (73); chaffinch (23); gold crest (13); hawfinch (11); nuthatch (7) etc. Chaffinch: - with great tit (83) blue tit (33); jay (21); marsh tit (17); eurasian nuthatch (16) etc.

The results of the study shows contradictory trends in the multiannual evolution of the aggregation degree of the birds (table 3). Only the mallard suddenly increases the effectives in the flocks. Most of the species like black-headed gull, rook, tree sparrow, gold crest and goldfinch reduce this index. We suppose that these fluctuations are conditioned by the evolution of the species on regional or global level. Thus, mallard due to the sinantropization increases its number on the entire European continent, but tree sparrow due to the agriculture intensification reduces them. If we exclude the mallard the aggregation degree of the birds in general decreases during the study period.

Table 3. Multiannual evolution of the flocks (ex/stol)

Species	1979-1986	1987-1995		Total
Anas plathyrhynchos	62,7	217,1	139,9	
Larus ridibundus	50,0	25,9	38,0	
Sturnus vulgaris	18,3	17,0	17,7	
Corvus frugilegus	20,4	5,8	13,1	
Turdus pilaris	11,9	11,3	11,6	
Delichon urbica	6,3	8,7	7,5	
Passer montanus	9,7	4,8	7,2	
Regulus regulus	8,1	4,0	6,1	
Fringilla coelebs	6,2	4,6	5,4	
Passer domesticus	5,9	4,5	5,2	
Carduelis carduelis	5,7	2,3	4,0	
Hirundo rustica	5,0	2,3	3,6	
Corvus corone	4,6	2,0	3,3	
Media	10,7	14,4	12,5	
Media (excluding *Anas plat.*)	8,2	5,2	6,7	

Therefore this study describes a rather complex picture of the gregarious behavior at a medium segment of the ecosystem succession, it comes complete one of to those the neighboring trees habitats.

Bibliography

1. Ганя, И.М., Литвак, М.Д., Орнитофауна Кишиневского ботанического сада. «Тр.Ин-та биол. МФ АН СССР», 1960, т.1., с.131-135.

2. Гусан Г.З., Агрегации насекомоядных птиц Юго-Западной части СССР. Автореферат диссертации. Госкомприрода СССР, ВНИИ охраны природы и заповедного дела, М, 1989, 16 с.

3. Ţibuleac,T. *Avifauna parcului «Valea Morilor» din Chişinău* // Ocrotirea naturii : prezent şi viitor : Materialele conf. – Chişinău, 1995, p. 93-94.

4. Vasilaşcu N. *Diversitatea şi densitatea ornitofaunei în parcul urban „Valea Morilor".* //Anal. Ştiinţ. ale USM. Chişinău, 2005, p. 129-133.

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ORNITHOFAUNISTIC OBSERVATIONS ALONG THE MOLDOVA RIVER (ROMANIA)

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River Moldova has a total length of 205 km and gathers water from a large number of tributaries that drain the north-east of Moldovia. The catchment area is asymmetric in shape; the majority of tributaries originate in the eastern Carpathians and therefore join the river from the west (Putna, Suha, Suha Mare, Suha Mica, Rasca, Ozana). The Moldova has its source on the southern slopes of Culmea Alunisului (1295 m). From the source area up to where it leaves the mountains, at Paltinoasa village, the river covers 88 km with a catchment area of 1883 km^2 (i.e. 30% of its total catchment area of 4326 km^2). Approximately two-thirds of the river water originates from rainwater and meltwater, with the remainder from springwater. This explains the high discharge fluctuations recorded annually. Discharge increases downvalley as more tributaries join the river.

The vegetation displays an obvious vertical zonality. The forest zone occupies the area where precipitation exceeds 500 mm/year, and has several sub-zones. The conifer sub-zone at 1200-1600 m is dominant throughout the upper course of the Moldova where precipitation is 1000-1400 mm/year. The beech sub-

zone covers the hill area of 500-1200 m and where precipitation exceeds 600 mm/year. The oak sub-zone is the lowest forest zone and has a very restricted area. In the lowlands the wild vegetation consists of mesophyte and mesoxerophyte meadows as well as riparian areas.

The ichthyofauna is also "stratified" according to the specific zone that the river flows through. Thus, from the higher to the lower reaches, the following fish species can be found: *Salmo trutta fario, Thymallus thymallus, Cothus gobio, Leuciscus cephalus cephalus, Chondrostama nasus nasus, Phoxinus phoxinus phoxinus, Alburnus alburnus alburnus, Barbus poten*, etc.

Observations were made between September 2009 and February 2011. All phenological aspects were covered, including those related to migration. Observations were made along the Moldova both from a fixed point and walked transects. Thirty-seven species were observed, belonging to 9 orders: Anseriformes (3 sp), Charadriiformes (4 sp), Podicipediformes (1 sp), Ciconiiformes (2 sp), Coraciiformes (1sp), Accipitriformes (1sp), Piciformes(3sp), Columbiformes (2sp) and Passeriformes (20sp).

Table 1. Species recorded, their phenology and frequency.

No.	Species	Phenology	Frequency
1.	Tachybaptus ruficollis	SV, IW	R
2.	Ardea alba	SV, IW	Ac
3.	Ciconia ciconia	SV	R
4.	Anas platyrchynchos	PM, WV	C
5.	Anas querquedula	SV, P	Ac
6.	Anas crecca	WV, P	R
7.	Cygnus olor	PM	Ac
8.	Buteo buteo	PM	C
9.	Charadrius dubius	SV	R
10.	Actitis hypoleucos	SV	R
11.	Tringa ochropus	P	R
12.	Tringa glareola	P	Ac
13.	Larus ridibundus	PM	F
14.	Streptopelia decaocto	S	C
15.	Streptopelia turtur	SV	R
16.	Alcedo atthis	PM	C
17.	Picus viridis	S	C
18.	Picus canus	S	C
19.	Dendrocopos major	S	R
20.	Ripariа riparia	SV	C
21.	Motacilla alba	SV	F
22.	Motacilla cinerea	SV, RW	F
23.	Cinclus cinclus	S	R
24.	Oenanthe oenanthe	SV	C
25.	Turdus merula	PM	R
26.	Turdus pilaris	PM, WV	C
27.	Sylvia borin	SV	R
28.	Sylvia atricapilla	SV	R
29.	Muscicapa striata	SV	R
30.	Parus palustris	S	Ac
31.	Corvus monedula	S	C
32.	Corvus frugilegus	PM	F
33.	Charduelis chloris	S	R
34.	Garrulus glandarius	S	C
35.	Fringilla coelebs	PM	C
36.	Emberiza cia	S	Ac
37.	Miliaria calandra	PM	R

Legend: Phenology: SV – summer visitor; WV – winter visitor; S – sedentary species; PM – partial migrant; RW – rare winter visitor; P – species in passage; Frequency: R – rare; C –common; F – frequent; Ac – accidental.

A large number of species is strictly or partially associated with the water environment (*Tachybaptus ruficollis, Ardea alba, Anas querquedula, Alcedo atthis, Motacilla cinerea, Cinclus cinclus, Anas crecca*, etc.), whereas others occur within the agricultural and riparian areas (*Streptopelia decaocto, Picus viridis, Picus canus, Riparia riparia, Turdus merula, Turdus pilaris, Picus viridis, Picus canus, Sylvia atricapilla, Sylvia borin, Corvus monedula, Corvus frugilegus*, etc).

From a phenological point of view, the bird population along the Moldova is dominated by 14 species of summer visitors of which only *Tachybaptus ruficollis* can occasionally be seen in winter in the lowlands. Ten species are partial migrants which nest in the north but fly south in winter looking for pools of unfrozen water. During passage, especially in the lowlands, there are sporadic clusters of birds belonging to species such as *Anas plathyrhynchos, Anas crecca, Actitis hypoleucos, Tringa ochropus*. Most sedentary species belong to areas adjacent to the river, while *Cinclus cinclus* remains wholly in the riparian area.

From its source to where it leaves the mountains, the Moldova flows through densely inhabited areas, therefore the human impact is high. This is why over 90% of the species observed in this study are to be found along the middle-course and lower-course of the river.

References

Barbu, N., 1976, *Obcinile Bucovinei*, București, Editura Științifică și Enciclopedică.

Băcăoanu V., Martiniuc, C., 1970, *Cercetări geomorfologice asupra părții de sud a interfluviului Moldova – Siret*, Analele științifice ale Universității „Al. I. Cuza" Iași, secțiunea II, tomul XVI.

Vornicu V., 2009, *Cercetări privind ihtiofauna râului Moldova*, Teză de doctorat, Universitatea „Al. I. Cuza", Iași

ROLE OF FOREST AND RECREATIONAL PARKS IN FORMATION AND MAINTENANCE OF URBAN ORNITOFAUNA DIVERSITY

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The birds have an important role in nature and in human life. The existence of ecosystems is unconceivable without the presence of birds, which constitute one of the basic elements in biological diversity maintenance. By their activity the birds maintain the ecological balance in nature, regulating the number of insects and rodents harmful for agriculture and forestry. Bird diversity in anthropized territories is conditioned in great measure by the phytocenotic structure of green spaces.

In this paper we will refer to the role of green corridors, such as forest parks („Botanical Garden" and the park „La Izvor"), recreational parks ("Valea Trandafirilor", „Valea Morilor"), green spaces on boulevards and streets within Chisinau city, in formation, maintenance and richening of avifauna diversity from this area.

Short description of phytocenotic structure of studied ecosystems:

Botanical Garden is situated at Chisinau city limit and has a surface of 104 ha. It is formed by 17 sectors very different after the phytocenotic composition. At the entrance there are vigorous *Saphora japonica* trees, a alley of chestnut and silver spruce. In Rosarium various roses are planted, as well as decorative trees and bushes. Here is the Garden of trees with formed crown and the *Linarium*. The sector of vegetal resources is host for aromatic, medicinal, fodder, technical and spice plant groups.

The park „La Izvor" is from the category of forest parks and is situated at city limit zone. The surface of the park is about 163.6 ha and the floristic structure includes various tree and shrub deciduous and coniferous species. Their distribution is by sectors where some of the species are dominant: coniferous sector near the alleys, followed by forest belts of willow and poplar on pond edges, sector of locust, elm, oak with well developed shrub layer, sector of white poplar with also well developed shrub layer formed by brushwood of tree species.

The park „Valea Morilor" is situated in north-western part of the city near the centre and occupy the surface of about 120 ha, the lake occupying 36 ha. The alley around the lake is embellished by Italian poplar, acacia, Pagoda tree, honey locust, elm, maple species, white birch, maple, sweet chestnut, linden, mountain ash, red cedar etc. On the park territory are planted species of deciduous and coniferous trees, native species, plants and hybrids.

The park "Valea Trandafirilor" is situated between the sectors Centre and Botanica, occupy the surface of 148 ha and have various tree sectors alternating with open spaces and 3 lakes with the total surface of 10.85 ha. The park contains coniferous species, native, introduced species and hybrids.

The ornithological study of bird community diversity in above mentioned ecosystems didn't reveal significant variations between investigated biotopes in bird species diversity and density. For example, in the ecosystems from forest parks the diversity index Shannon-Wiener in breeding period is 2.80 in Botanical Garden and 3.03 the park „La Izvor", while in the recreation parks this index is almost similar – 3.04 in "Valea Morilor" park and 3.02 in "Valea Trandafirilor" park. The value of diversity index are rather close between forest and recreational parks, which is explained by the fact that both park types offer favorable living, feeding and nesting conditions for a large number of bird species.

The species diversity in two types of parks has certain resemblance, but there are also significant differences. In forest parks such species as *Phasianus cholchicus, Crex crex, Remis pendulinus, Corvus monedula, Asio otus, Arda cinerea* etc. can be met at breeding, while in la recreational parks these species weren't recorded. Thus, the forest parks, after their structure, can offer conditions closer to those from natural ecosystems. Therefore, this category of parks, situated mostly at city outskirts, have a great role in entering of wild species on urban territories, while the recreational parks contribute to further penetration of bird species to the centre of urban ecosystems, such as squares, alleys and other green spaces.

The species density in studied biotopes is rather high and does not vary much from one biotope to another. The highest values of bird density was registered in park „La Izvor" (672 ind./km^2) and the lowest value in the park „Valea Morilor" (427 ind./km^2). Avifauna abundance in studied biotopes is strongly connected to the structure and diversity of vegetation and to the structure of adjacent biotopes.

In the last 20 years there were registered more and more attempts of some bird species (*Phoenicurus ochruros, Columba palumbus, Corvus corax*) to integrate in biotopes from Chişinău city. The mentioned species have certain ecological requirements toward the habitat. But urban areas still do not satisfy their requirements. Nevertheless, the presence of these species in urban biotopes, including at breeding, prove that the urban environment is not so strange for them. Probably these species found some tangential resemblance similar to those of their natural environment. In this context we can conclude that urban areas provide favorable conditions for many bird species and the biotopes from urban area have the role of saving islands for many species of birds, thus contributing to the conservation of biodiversity.

COMPARISONAL TROPHY CHARACTERISTICS OF VOLOZHYNSKAYA AND PRIPYATSKAYA RED DEER *(CERVUS ELAPHUS)* POPULATIONS IN BELARUS

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Red deer is a valuable species for trophy hunting. The interest for deer hunting in Belarus has significally grown in ten years. At the same time shooting good trophy males can lead to antlers quality degradation in population, that can affect adversely on a long-time population expluatation perspective.

Statistical analisys of dependence between red deer antlers morphological parametres development allowed to estimate red deer populations throphy status on the Belarus territory. 166 trophies were measured to determine this dependence, on wich regression linear equations of trophy qualities dependence from separate morphological characteristics, set by CIC for red deer antlers estimation, were found. Equations found allow to determine red deer populations trophy status on Belarus territory.

The values of linear equations like CIC=kx+b (CIC – trophy value in system CIC points, x – morphological parameter, k and b – coefficients) coefficient are shown in the table below.

Parameter	$k \pm s_k$	$b \pm s_b$	p_k	p_b
Length of main beam, left, cm	1,64±0,078	26,85±7,593	0,0000	0,0005
Length of main beam, right, cm	1,66±0,080	24,19±7,747	0,0000	0,0021
Length of brow tine,left, cm	2,69±0,257	89,03±9,211	0,0000	0,0000
Length of brow tine,right, cm	2,35±0,236	101,10±8,450	0,0000	0,0000
Length of tray tine,left, cm	1,70±0,196	127,93±6,659	0,0000	0,0000
Length of tray tine,right, cm	1,83±0,187	123,24±6,411	0,0000	0,0000
Circumference of coronet,left, cm	6,35±0,446	29,77±10,900	0,0000	0,0070
Circumference of coronet,right, cm	6,57±0,448	24,19±10,956	0,0000	0,0286
Circumference of lower beam, left, cm	11,38±0,557	15,34±8,315	0,0000	0,0669
Circumference of lower beam, right, cm	11,30±0,514	15,36±7,734	0,0000	0,0487
Circumference of upper beam, left, cm	9,79±0,498	48,78±7,004	0,0000	0,0000
Circumference of upper beam, right, cm	8,56±0,528	65,11±7,501	0,0000	0,0000
Weight (dry) of antlers, kg	12,75±0,478	99,96±3,266	0,0000	0,0000
Inside span, cm	1,33±0,127	83,09±9,608	0,0000	0,0000
Number of left tine ends	12,59±1,087	104,79±6,983	0,0000	0,0000
Number of right tine ends	14,41±1,208	93,53±7,702	0,0000	0,0000

Notice: $k \pm s_k$ – coefficient k with mean error, $b \pm s_b$ – coefficient b with mean error, p_k – coefficient k significance level, p_b – coefficient b significance level.

Pripyatskaya and Volozhinskaya were chosen as model populations. They live in national park "Pripyatski" on the south and in Nalibokskaya Pushcha in the middle of Belarus. Antlers measurements, collected in 2011 in national park "Pripyatsky" (42 antlers) and in 2007-2008 in Nalibokskaya Pushcha in Volozhynski district Minsk region, were the materials of research.

System CIC points were calculated from each of the measurements, and the mean from each antler became sample variants of trophy status of each population. Each population trophy status general image came in while analysis results obtained. Besides, for the volozhynskaya population in the same way the hunted trophies (9 antlers pairs) was analyzed to determine the artificial selection direction of antlers trophy quality.

In national park "Pripyatski" among downcast antlers 24 (57%) have "no medal" mark and 18 (43%) have "bronze medal" mark. In volozhynskaya population 13 antlers (54%) have "no medal" mark, 9 (38%) have "bronze medal" mark and 2 (8%) have "silver medal" mark.

On the data obtained we can conclude that pripyatskaya population is little worse than volozhynskaya by means of their trophy qualities.

The founders of volozhynskaya population were red deers brought from national park "Belovezhskaya Pushcha" situated in southwestern Belarus. Whereas pripyatskaya population was created on the deers from Belovezhskaya Pushcha with significant addition of deers brought from Western Europe. But even those actions didn't allow to improve this species trophy qualities in national park "Pripyatski".

Among red deer trophies hunted in Nalibokskaya pushcha the distribution was following: "no medal" – 0, "bronze medal" – 4 (45%), "silver medal" – 3 (33%), "gold medal" – 2 (22%).

Trophy status and quality hunted antlers disproportion can be explained by following factors:

1. Young deers with potentially high trophy qualities have not reached maximal trophy development yet.
2. Not all hunted trophies were measured.
3. "The wrong way selection" takes place – males with high quality antlers are eliminated while males with low quality antlers survive and sire.

Data obtained concerning researched populations trophies show on antlers quality improvement necessity for preservation this populations long-time exploitation possibility.

INTROGRESSSIVE HYBRIDIZATION OF THE SABLE AND THE PINE MARTEN IN WESTERN SIBERIA

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Sable *Martes zibellina* - one of the most valuable hunting-target species of the forest zone of Siberia. The number of sable has declined sharply as a result of immoderate hunting at the end of the XIX century and was restored in the late XX century, due to a ban on production, reserves and the reintroduction. Small local population of sable remained in the territory of Western Siberia during the depression in the number, nevertheless, introduction more than a thousand individuals had been made to accelerate the restoration of populations. Nothing is known about the genetic consequences of re- introduction. In addition, the area of sable in Western Siberia and the Urals region overlaps with the area closely related species - pine

marten *Martes martes*. Sable and marten crossed with the advent of hybrids, named kidus. Kidus may be phenotypically closer to sable (atypical sable) or marten (atypical marten). It was proved that kidus is fertile when crossed with the original form. The frequency of abnormal specimens in some parts of Siberia may be more than 50% of all harvested animals. In recent years, numbers of sable increases and its habitat extends southward into the forest-steppe areas. This causes a reduction of the typical martens and increasing the number of hybrids.

This paper studies the genetic variability of the sable and martens in order to clarify the status of atypical individuals and search of molecular markers of hybridization, which can be used for studying microevolutionary processes in the zone of sympatry.

Sable, marten and their hybrids, obtained by hunters in 2008-09 and 2009-10 in the Middle Ob River region, were used as material for the research. A total number of animals was 147 individuals. Animals were divided into 4 groups according to the results of discriminant analysis of osteological features [Gashev, Ageshin, 2003].

The genetic variability of the sable and the pine marten from West Siberia was studied with using of 4 kinds of genetic markers: allozymes, microsatellites, ISSR-PCR fragments and RFLP of the cytochrome *b* gene. Proteins were extracted from muscle tissue. DNA was extracted from cardiac muscle, fixed in 70% ethanol. PCR was performed in thermocycler DNA Engine Dyad ® and Chromo-4 (Bio-Rad). We used PCR amplification protocols described in [Balmysheva, Solovenchuk, 1999; Koepfli et al., 2008; Kretschmer et al., 2009]. Electrophoretic separation of restriction fragments was performed in 2.5% agarose gel, ISSR-PCR-fragments - in 2% agarose gel, the fraction of microsatellites were analyzed by electrophoresis in 6% polyacrylamide gel, isoenzymes - in 7.5% polyacrylamide gel and 13% starch gel. To determine the sizes of alleles using molecular weight markers of DNA - plasmid pBR322, treated with restriction endonuclease *Hpa*II. Visualization of PCR products and restriction products was made by staining gels in a solution of ethidium bromide and observation under UV light. Population-genetic analysis was performed using the program POPGEN32.

Polymorphism of 32 allozyme loci was studied: *LDH-1,2*, SOD-1,2*, FEST-1*,PGI-1*, MDH-1,2*, G3PGH-1*, AAT-1*, ME-1,2*, MPI-1*, IDH-1,2*, CK-1,2*, PGM-1,2*, 6PGD-1*, ACO-1*, EST-1,2,3*, MY-1-8**. 22 loci from them were monomorphic and identical in sable, marten and hybrids. Differentiating loci could not be established. Proportion of polymorphic loci in marten - 9.4%, in sable and hybrids – 21.9%. Cluster analysis showed that the association of samples of sables and atypical sable, as well as martens and atypical martens occurs on a geographical basis - a samples of hybrids and parental species from one area to fall into one cluster. This argues in favor of contemporary hybridization. Low degree of differentiation in structural genes is the cause of easy hybridization of species.

Polymorphism of 3 microsatellite loci *Elu1, Elu2, Elu6* was studied. One locus (*Elu1*) is polymorphic in the genus *Martes* from Siberia. We identified 7 alleles of this locus. 5 of the most frequent alleles were common in the sable, marten and hybrids, 2 more rare alleles were found only in sable and hybrids. Thus, analysis of variability in microsatellite loci can not detect differences between the sable, marten and atypical individuals - presumably their hybrids. We detected differences only by the level of heterozygosity in microsatellite loci. The average heterozygosity (*Hobs*) is equal to 0.273 in a typical sable and 0.286 in marten, 0.340 in atypical sable and 0.417 in atypical marten. The average frequency of heterozygous genotypes is 1.5-2 times higher in kidus then sable and marten.

For restriction analysis of mtDNA cytochrome *b* gene, we used the endonucleases: *Hae*III, *Bst*NI, *Taq*I and sequences of primers from work [Balmysheva, Solovenchuk, 1999]. Restriction endonucleases *Bst*NI does not allow for interspecies differentiation of sable, as haplotypes A and B occur in sable in the Far East and in Siberian sables and martens. Restriction endonucleases *Hae*III revealed a haplotype C, which is characteristic for martens. This gaplotype was found not only in atypical martens, but in two specimens of a typical sable. At the same time, haplotype A, which is characteristic for the Eastern Siberian populations of sable, does not occur in the typical Western Siberian sable. However, this haplotype occurs in atypical martens - a hybrid of the sable and marten. Interestingly, the haplotypes of the eastern sable were also found in European populations of martens - in territory outside the present range of sable [Davison et al., 2001]. The authors consider it unlikely that the common haplotypes sable and pine marten are the result of an ancient polymorphism of these sister species and are inclined to the hypothesis of introgressive hybridization. Restriction endonucleases *Taq*I is more promising for differentiation. Haplotype B' is characteristic of the West Siberian sable, and haplotype C, which is characteristic for the marten has been identified by this restriction enzyme.

We identified 9 lines of complex haplotypes. Z30 and Z31 lines correspond to lines B and C in the Far Eastern populations of sable [Balmysheva, Solovenchuk, 1999]. Z5 line corresponds to the complex

haplotype CBA, line AK23 - complex haplotype AAC, AK29 - BBA, AC27 - CBB, UC1 - AAB for a sequence of restriction enzymes *Hae*III, *Bst*NI, *Taq*I. UC1 line is found only in the sable from the Urals, through Z5, Z30 and AK23 lines are common for sable and marten, although the frequency is different. Line AK23 is more typical for martens, and the line Z30 is more typical for sables. These two lines of ancient mtDNA were also found in eastern populations of sable [Malyarchuk et al., 2010]. The union of these lines occurs through a complex haplotype UC1, discovered in the Urals sable. Perhaps this haplotype marks the ancestral population whose descendants settled in West Siberia.

For ISSR-PCR analysis, we used 5 primers: $(AG)_8C$, $(GT)_8C$, $(TC)_8C$, $(AC)_8T$ and $(TG)_8A$. 46 bands were studied, 42 from them were polymorphic. Proportion of polymorphic ISSR-markers is 91.3%. Indicator of genetic variability is largest at the sable and decreases in the series: sable - atypical sable - atypical marten – pine marten. Calculation of Nei's index showed that these four groups are characterized by high genetic similarity. Sable and atypical sable are most similar. Atypical marten is closer to sable, than to the marten. This similarity may be due to close affinity of the studied species, and introgressive hybridization in the zone of sympatry, which, apparently, is symmetrical.

Analysis of allozyme, RFLP of the cytochrome *b* gene, ISSR-PCR and microsatellites showed low rate of differentiations of the sable and the pine marten in Western Siberia and confirmed the hybrid origin of atypical specimens of these species. Introgression of genes between sable and pine marten in Western Siberia is a massive, symmetrical, and, apparently, occurred in the past, and continues in the modern era. Hybrids (kidus) have elevated levels of heterozygosity and genetically closer to the sable, than the marten. In atypical martens mtDNA haplotypes of the eastern sable are presented. This may be a consequence of the reintroduction Barguzin sable in the last century.

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DEVELOPMENTAL INSTABILITY IN A CYCLIC POPULATION OF THE BANK VOLE (*Clethrionomys glareolus*) FROM THE MIDDLE URALS

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Developmental instability is widely used for indication of stress influences on the biota (Zakharov, 1987; Palmer, Strobeck, 2003, Van Dongen, 2006), in particular as a measure of animal well-being in natural populations. The level of fluctuating asymmetry (nondirectional variation between left and right sides of bilateral characters) serves as an indicator of developmental instability. However, the data about the interannual variability and the influence of population density on developmental instability in rodent are practically absent.

The aim is to study the influence of the population-demographic factors (sex, age, population density) on the mandible shape asymmetry in a cyclic population of the bank vole (*Clethrionomys glareolus* Schreber, 1780) in the Middle Urals locality (Visim State Biosphere Reserve, 57°22' N, 59°50' E).

We investigated 324 bank voles which were captured in 2001-2006 at the phases of "peak" (2001, 2004), "depression" (2002, 2005) and "growth" (2003, 2006) of the population cycles. Using the geometric morphometrics method (Rohlf, 2001), 12 landmarks were pointed twice on digital images of right and left mandibles (lingual view) and then the x- and y- coordinates of each landmark were calculated in Procrustes space. Asymmetry indices of each landmark were calculated on the basis of coordinate values for the left and right mandibles (Klingenberg, McIntyre, 1998). The rodent mandible is the complex structure divided developmentally and functionally (Atchley, Hall, 1991) into at least two regions (modules): module I includes an incisor area, module II includes a part of the ramus and arthrodial, coronoid, angular processes. The relevance of using the modular approach to studying the mandible asymmetry in *Clethrionomys* voles has been shown in the previous research (Yalkovskaya, El'kina, Borodin, 2008). The integral estimates of the modules asymmetry for each individual were calculated by averaging of asymmetry indices of corresponding landmarks: for module I – 5 landmarks, for module II – 7 landmarks.

Two-way ANOVA (factors: sex and age (3 cranial age classes according to the method developed by A. Razorenova (1952)) has shown that males and females of different age classes do not differ in the integral estimates of asymmetry of the each modules (P>0,237). Between-years differences were significant in the

module II (F(5;318)=3,70; P=0,003) that was determined by the high levels of the module II asymmetry in 2006 as compared to other years. The late summer-autumn generation of the bank vole contributed the most to asymmetry increase in 2006. It is important that after 2006 the regularity of the three-year cycle in the bank vole population was interrupted (in 2007, instead of the expected phase of «peak» the «growth» phase has repeated again). Probably, the sharp increase of the module II asymmetry in 2006 in the late summer-autumn generation which reproduces in the next year (after wintering), is determined by the processes which have led to disturbance of the three-year cycle of the population. The causes of asymmetry increases and their connection with the factors affecting the three-year cycles in the bank vole population demand further study.

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References

Atchley W.R., Hall B.K. A model for development and evolution of complex morphological structures // Biol. Rev. 1991. Vol. 66. P. 101–157

Klingenberg P.C., McIntyre G.S. Geometric morphometrics of developmental instability: analyzing patterns of fluctuating asymmetry with Procrustes methods // Evolution. 1998. Vol. 52. P. 1363-1375.

Palmer A.R., Strobeck C. Fluctuating asymmetry analyses revisited // Developmental instability: causes and consequences. New York: Oxford Univ. Press, 2003. P. 279–319.

Rohlf F.J. TPSdig. Version 1.23: Program. New York: State Univ. at Stony Book, 2001.

Razorenova A.P. Age variability in bank vole (*Clethrionomys*) // Moscow Society of Nature Investigators. 1952. Vol. 57(5). P. 23-29 [In Russian].

Van Dongen S. Fluctuating asymmetry and developmental instability in evolutionary biology: past, present and future // J. Evol. Biol. 2003. Vol. 19. P. 1727–1743.

Yalkovskaya L.E., El'kina M.A., Borodin A.V. Developmental instability of mandibular shape in voles *Clethrionomys*: modularity approach // 11th International Conference on Rodent Biology Rodens et Spatium, Myshkin, Russia, 24–28 Jul., 2008: Abstr. of oral and poster papers. Myshkin, 2008. P. 150.

Zakharov V.M. Asymmetry of Animals. Moscow. Nauka, 1987.161 p. [In Russian].

CRANIAL AND DENTAL MORPHOLOGICAL CHARACTERISTICS IN MURIDAE FROM THE URAL REGION

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We studied the Ural populations of *Apodemus*, *Mus* and *Sylvaemus* species based on morphological characteristics. Analysis of linear cranial and dental measurements revealed the high level of age variation. Sexual dimorphism in this characteristic was insignificant.

Between-population differences in cranium morphology of the studied species in the Ural region are rather weak, although they could be detected within the particular age groups in qualitative dental characteristics and scull proportions. The most distinct between-population differences were shown in measurements of parietal bone, mandibular and maxillary diastem, length and height of mandible.

Cranial morphological characteristics of taxa studied were determined by their ecological differentiation. Those differences among Muridae species reflected, first of all, the differences in their feeding adaptations.

The study was supported by the Russian Foundation for Basic Research (research grant 10-04-96102) and the Presidium Program of the Ural Division of the Russian Academy of Sciences (within the framework of the "Support for Young Scientists").

INVERTEBRATES

DATA CONCERNING THE DIVERSITY OF SCARABEOIDS (INSECTA, COLEOPTERA, SCARABAEOIDEA) FROM SLĂNIC MOLDOVA, BACĂU COUNTY

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Slănic Moldova is situated in the South-West side of Bacău County, in a narrow and long hollow, limited by high heights covered with beech and fir, in the Slănic creek valley (530 m altitude) (Albotă, 1983).

Geographically, the studied area belongs to Nemira Mountains and the Salt Mines of Slănic are characteristic for this valley – Slănic Moldova is a resort. There for, this locality is visited by numerous tourists – the habitats are characterized by a high level of human influence. The objective of this research work is to present some contributions to the knowledge of the diversity of scarabeoids from Slănic Moldova resort.

Material and Methods

The material analyzed in this paper was collected from Slănic Moldova, from the grasslands, during three years: 2004, 2005 and 2006. The insects were collected directly from the plants and from the soil. The material was identified in the entomological laboratories of "Ion Borcea" Natural Science Museum Complex of Bacău, using the specialty literature (Panin, 1957).

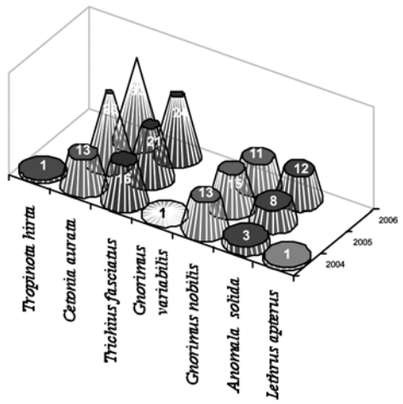
For studying the diversity of scarabeoids from Slănic Moldova, it was necessary to calculate some diversity indexes: Simpson Index (D), Shannon-Wiener Index (H), Equitability (E) (Varvara et al., 2001). The taxonomy and nomenclature used in this paper is in accordance with Fauna Europaea.

Results and discussions

The biological material collected in Slănic Moldova during the three years of study (2004-2006) was represented by 201 scarabeoid beetles. Systematically, these insects belong to 3 families (Geotrupidae, Rutelidae and Cetoniidae), 4 subfamilies (Lethrinae, Rutelinae, Trichiinae and Cetoniinae), 7 genera and 8 species (Tab. 1).

Table 1 The diversity of scarabeoids from Slănic Moldova (2004-2006)

No.	Family	Subfamily	Species	2004	2005	2006	Total	
							N	%
1	Geotrupidae	Lethrinae	*Lethrus apterus* (Laxmann 1770)	1	-	-	1	0.5
2	Rutelidae	Rutelinae	*Anomala solida* (Erichson 1847)	3	8	12	23	11.44
3	Cetoniidae	Trichiinae	*Gnorimus nobilis* (Linnaeus 1758)	13	15	11	39	19.4
4			*Gnorimus variabilis* (Linnaeus 1758)	1	-	-	1	0.5
5			*Trichius fasciatus* (Linnaeus 1758)	16	21	24	61	30.35
6		Cetoniinae	*Cetonia aurata* (Linnaeus 1761)	13	28	33	74	36.81
7			*Tropinota hirta* (Poda 1761)	1	-	-	1	0.5
8			*Oxythyrea funesta* (Poda 1761)	-	-	1	1	0.5
T	**3**	**4**	**8**	**48**	**72**	**81**	**201**	**100**



According to the data presented in table 1, three species: Lethrus apterus Laxman, Gnorimus variabilis L. and Tropinota hirta Poda were collected only in 2004. The other five species were identified for all the three years of study – the larger number of individuals were collected in 2006. But, the highest diversity was registered for 2004 (all the eight species) (Fig. 1).

Fig. 1 The numerical dynamic of the scarabeoid species identified for Slănic Moldova (2004-2006)

In order to study the diversity of scarabeoids from the studied area, it was necessary to calculate some diversity indexes: Simpson Index, Shannon-Wiener Index and Equitability with the help of data presented in table 2.

Table 2 Data necessary for calculate the diversity indexes for the species identified for Slănic-Moldova (2004-2006)

Nr. crt.	Specia	n	n-1	n(n-1)	$\log_{10}n$	$n\log_{10}n$
1.	*Cetonia aurata* L.	74	73	5.402	1,86923	138,32302
2.	*Trichius fasciatus* L.	61	60	3.660	1,78533	108,90513
3.	*Gnorimus nobilis* L.	39	38	1.482	1,59106	62,05134
4.	*Anomala solida* Erich.	23	22	506	1,36173	31,31979
5.	*Lethrus apterus* Laxmann	1	0	0	0	0
6.	*Gnorimus variabilis* L.	1	0	0	0	0
7.	*Tropinota hirta* Poda	1	0	0	0	0
8.	*Oxythyrea funesta* Poda	1	0	0	0	0
	Total	**201 N**	**193 Σ(n-1)**	**11,050 Σn(n-1)**	**6.60735 $\Sigma\log_{10}n$**	**340.5993 $\Sigma n\log_{10}n$**

For the scarabeoid species collected in the grasslands from Slănic-Moldova, the value of Simpson Index is 3.64. The author also calculated the Shannon-Wiener Index – 2.02194. The theoretic number of species that correspond to this last index is 6; but for Slănic-Moldova there have been identified 8 species of scarabeoids. Therefore, the value of equitability in this case is 75%: *Cetonia aurata* L. was very well represented (74 specimens – 36.81%). This species was followed by *Trichius fasciatus* L. (61 individuals – 30.33%) and *Gnorimus nobilis* L. (39 specimens – 19.4%). Other 4 species were represented by a single specimen (*Lethrus apterus* Laxmann, *Gnorimus variabilis* L., *Tropinota hirta* Poda and *Oxythyrea funesta* Poda – 0.5%).

Simpson Index:

$$D = \frac{N(N-1)}{\Sigma n(n-1)}, \qquad D = \frac{201 \cdot 200}{11050} = \frac{40200}{11050} = 3.64$$

Indicele Shannon-Wiener:

$$H(S) = \frac{K}{N}(N \cdot \log_{10} N - \sum_{n=1}^{S} n \cdot \log_{10} n),$$

$$H(8) = \frac{3.321928}{201}\left(201 \cdot \log_{10} 201 - \sum_{n=1}^{8} n \cdot \log_{10} n\right) = \frac{3.321928}{201}(201 \cdot 2.30319 - 340.5993)$$

$$H(8) = \frac{3.321928}{201}(462.94119 - 340.5993) = \frac{3.321928}{201}122.34189 = \frac{406.41094}{201} = 2.02194$$

Theoretic diversity:

$$H(S)_{max.} = K \cdot \log_{10} S, \quad H(8)_{max.} = 3.321928 \cdot \log_{10} 8 = 3.321928 \cdot 0.90309 = 3$$

Equitability: $E = \frac{S'}{S} \cdot 100, \quad E = \frac{6}{8} \cdot 100 = 75\%$

Conclusions

1. The diversity of scarabeoids from Slănic Moldova resort was studied in 2004-2006. The insects were collected from the grasslands (directly from the plants and from the soil).

2. For this area, the author identified 8 species. According to Fauna Europaea, these 8 species belong to 7 genera, 3 families (Geotrupidae Rutelidae and Cetoniidae) and 4 subfamilies (Lethrinae, Rutelinae, Trichiinae and Cetoniinae).

3. The diversity indexes calculated for the species identified for Slănic Moldova were: Simpson Index (3.64), Shannon-Wiener Index (2.02194), Equitability (75%). Two species were very well represented: *Cetonia aurata* L. (36.81%) and *Trichius fasciatus* L. (30.33%); 4 species were represented by a single specimen (*Lethrus apterus* Laxmann, *Gnorimus variabilis* L., *Tropinota hirta* Poda and *Oxythyrea funesta* Poda – 0.5%).

References

1. Albotă M. 1983 – *Munţii Nemira.* Ed. Colecţia Munţii noştri, Ed. Sport-turism, Bucureşti: 18-19; 20-24; 30-32; 42;

2. Panin S., 1957 *Fauna R.P.R. Coleoptera. Familia Scarabaeidae, vol. X, fasc. 4*. Ed. Acad. R.P.R. Bucureşti: 113-116; 261-285;

3. Varvara M., Zamfirescu Şt., Neacşu P. 2001. *Lucrări practice de ecologie – manual*. Ed. Univ. „Al. I. Cuza". Iaşi: 100-113.

ANALYSIS OF COLEOPTERAN COMMUNITIES FROM SESSILE OAK FOREST („PLAIUL FAGULUI" SCIENTIFIC RESERVE)

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The analysis of species abundance, of trophic relations and their dynamics, which includes the totality of quantity and quality of biocenotic elements, leads to the evaluation of active value of various groups of organisms in biocenosis and the the emphasizing of edificator species (Simionescu, 1983). In this context the studies concerning the structure and dynamics of insect communities are of great impostance, because they have a special role in ensuring of biosphere stability. More than 90% of insects are useful for human, amomg which are the representatives of order Coleoptera (Neculiseanu et al., 2000).

The forest of sessile oak is situated in the western part of Central Moldova Plateau ("Plaiul Fagului" scientific reserve), where the species *Quercus petraea*, *Fagus silvatica* are dominant and the subshrub vegetation formed by *Coryllus avellana* and *Sambucus nigra* (Natura rezervației "Plaiul Fagului, 2005"). Fauna and diversity of coleopterans from this type of wood are ratger poor studied until present (Baban & Neculiseanu, 2005; Baban, 2006).

Material and methods

Ies were accomplished in vegetation period of 2003-2005 in sessile oak forest gorun (*Quercus petraea*).

Forest coleopterans were collected by soil Barber traps, using vessels with volume of 700 ml. As fixating liquid the concentrated solution of concentrated solution of sodium chloride (NaCl) and acetic acid (CH3COOH) were used (Krijanovskij, 1965).

The collection of coleopterans was performed also according to standard methodology: collecting with enthomologic fillet, manual collecting from various plants, bushes, soil surface etc. In total durin 3 years of study about 2500 individuals were collected and analyzed.

The synecologycal analysis was performed by estimation of parameters (abundance, dominance, constance, index of ecological significance) and ecological indexes: index of ecological diversity, using Shannon index, modified by Mac Arthur, corrected by Lloyd and Ghelardi (Simionescu, 1983; Stan, 1995; Andreev, 2002).

Results and discussions

The forest of sessile oak is characterized by a high faunistic heterogenity. The fauna of coleopterans identified in this type of wood is represented by 35 species, from 20 genera and 4 families. The most numerous from species point of view was the family *Carabidae* (24 species with 11 genera), followed by family *Scarabaeidae* (5 species and 4 genera). In decreasing order follow the families *Silphidae* (4 species and 3 genera) and *Cerambycidae* – 2 species and 2 genera. During the studies the highest number of species and individuals were collected in 2005 (24 species, 338 individuals), and the lowest – in 2004 (18 species, 125 individuals).

The analysis of ecological parameters and indexes of coleopteran species collected during 3 years of observation in sessile oak forest is as follows:

The highest abundance (**A**) was registered in species *Carabus arcensis* Hbst. (67 individuals), followed by *Carabus ullrichi* Germ. (39), *Carabus cancellatus* Ill. (37) and *Geotrupes stercorosus* Scriba (37). The species *Agonum gracilipes* (Duft.), *Cychrus caraboides* (L.), *Oodes gracillis* Viila, *Pterostichus niger* (Schall.), *Nicrophorus vespilloides* Hbst., *Silpha carinata* Hbst. and *Xylodrepa quadripunctata* (Schreb.) were collected in a single individual.

In this ecosystem 4 eudominant species ($\mathbf{D_5}$) were registered – *Carabus arcensis* Hbst. (19.82%), *Carabus ullrichi* Germ. (11.54%), *Carabus cancellatus* (Ill.) (10.95) and *Geotrupes stercorosus* Scriba (10.95%), 3 dominant species ($\mathbf{D_4}$) (*Calosoma inquisitor* (L.) (7.40%), *Carabus excellens* Kr. (6.21%), *Carabus convexus* F. (5.33%)). 7 species were established as subdominant ($\mathbf{D_3}$), one specie as recedent ($\mathbf{D_2}$) – *Platynus assimile* Payk. (1.48), the rest of the species being subrecedent ($\mathbf{D_1}$).

The highest constancy was recorded for *Carabus arcensis* Hbst. (43.21%), followed by *Carabus cancellatus* (Ill.) (25.93%) and *Geotrupes stercorosus* Scriba (25,93%). At inferior limit 21 species were situated, having the values of constancy between 1.24-16.05% ($\mathbf{C_1}$).

Characteristic species ($\mathbf{W_4}$) for sessile oak forest is *Carabus arcensis* Hbst., with the value of ecological significance index of 8.57%, 14 species were accessorial ($\mathbf{W_3}$-$\mathbf{W_2}$), the other 9 species being accidental with the values between 0.003-0.03% (tab. 1.)

Table 1. Synecological analysis of coleopteran species from sessile oak forest (Reserve „Plaiul Fagului", 2003-2005).

No.	Species	A	D		C		W	
			%	Class	%	Class	%	Class
1.	*Carabus arcensis* Hbst.	67	19,82	D_5	43,21	C_2	8,57	W_4
2.	*Carabus ullrichi* Germ.	39	11,54	D_5	16,05	C_1	1,85	W_3
3.	*Carabus cancellatus* Ill.	37	10,95	D_5	25,93	C_2	2,84	W_3
4.	*Geotrupes stercorosus* Scr.	37	10,95	D_5	25,93	C_2	2,84	W_3
5.	*Calosoma inquisitor* (L.)	25	7,40	D_4	14,82	C_1	1,10	W_3
6.	*Carabus excellens* Kr.	21	6,21	D_4	16,05	C_1	0,99	W_2
7.	*Carabus convexus* F.	18	5,33	D_4	16,05	C_1	0,86	W_2
8.	*Molops piceus* (Pz.)	16	4,73	D_3	12,35	C_1	0,59	W_2
9.	*Carabus coriaceus* Kr.	14	4,14	D_3	14,82	C_1	0,61	W_2
10.	*Nicrophorus vespilloides* Hbs.	11	3,26	D_3	3,70	C_1	0,12	W_2
11.	*Abax paralellopipedus* (Pill.)	10	2,96	D_3	13,58	C_1	0,40	W_2
12.	*Abax parallelus* (Duft.)	9	2,67	D_3	8,64	C_1	0,23	W_2
13.	*Abax carinatus* (Duft.)	9	2,67	D_3	9,88	C_1	0,26	W_2
14.	*Pterostichus melanarius* (Ill.)	8	2,37	D_3	9,88	C_1	0,24	W_2
15.	*Platynus assimile* (Payk.)	5	1,48	D_2	7,41	C_1	0,11	W_2
16.	*Pterostichus melas* (Creutz.)	3	0,89	D_1	3,70	C_1	0,03	W_1
17.	*Nicrophorus fossor* Erich.	2	0,59	D_1	2,47	C_1	0,02	W_1
18.	*Agonum gracillipes* (Duft.)	1	0,30	D_1	1,24	C_1	0,003	W_1
19.	*Cychrus caraboides* (L.)	1	0,30	D_1	1,24	C_1	0,003	W_1
20.	*Oodes gracillis* Villa	1	0,30	D_1	1,24	C_1	0,003	W_1
21.	*Pterostichus niger* (Shall.)	1	0,30	D_1	1,24	C_1	0,003	W_1
22.	*Nicrophorus vespillo* (L.)	1	0,30	D_1	1,24	C_1	0,003	W_1
23.	*Silpha carinata* Hbst.	1	0,30	D_1	1,24	C_1	0,003	W_1
24.	*Xylodrepa quadripunctata* Sch.	1	0,30	D_1	1,24	C_1	0,003	W_1

** Numbering of species in table is performed in decreasing order of abundance*

At the same time it was established that the values of diversity indexes are varying during the entire vegetation period of studied years. In this type of wood the values of diversity index Shannon in 2003 were higher at the end of May – beginning of June (0.922); in summer period (July) it varies very little, while in autumn this index decreases (0.466). Simpson concentration increases (0.357) and the equitability is 0, which is explained by the fact that in autumn a small number of species containing only one individual were caught.

The same situation was observed in 2003-2005, when the decreasing of Shannon index values and of equitability occurs: in spring and in summer the indexes have similar values and in autumn they decrease (tab.2).

Table 2. Dynamics of Shannon diversity index, of Simpson concentration and of equitability in sessile oak forest (Res. „Plaiul Fagului")

Year	Spring (May-June)			Summer (July)			Autumn (September)		
	Ish	Is	ε	Ish	Is	ε	Ish	Is	ε
2003	0,922	0,123	0,589	0,830	0,202	0,231	0,466	0,357	0
2004	0,749	0,202	0,484	0,862	0,154	0,426	0,553	0,222	0,583
2005	0,845	0,167	0,382	0,625	0,267	0,245	0,600	0,217	0

* Ish – Shannon diversity index; Is –Simpson index; ε - equitability

Therefore, knowing that the value of the diversity index decreases with increasing of instability in some biocoenosis, we find that in 2004 the most stable conditions for the coleopteran cenoses were present compared with 2003 and 2005.

Conclusions

1. Fauna of coleopterans identified in sessile oak forest is represented by 35 species, from 20 genera and 4 families. The most numerous from species point of view was the family *Carabidae* (24 species with 11 genera), followed by family *Scarabaeidae* (5 species and 4 genera).
2. The highest abundance (**A**) was registered in species *Carabus arcensis* Hbst. (67 individuals), followed by *Carabus ullrichi* Germ. (39), *Carabus cancellatus* Ill. (37) and *Geotrupes stercorosus* Scriba (37).
3. During the years of study the decreasing of Shannon index values and of equitability occurs: in spring and in summer the indexes have similar values and in autumn they decrease.

Bibliography

1. **Baban E., Neculiseanu Z.** „Carabidele din rezervația „Plaiul fagului"". Craiova „Muzeul Olteniei", 2005. - p. 107-111.
2. **Baban E.** „Diversitatea coleopterelor din ecosistemele forestiere ale Podişului Moldovei Centrale". Craiova „Muzeul Olteniei", 2006. - p. 23-29.
3. Natura rezervației "Plaiul Fagului". Chişinău-Rădenii Vechi, 2005. - 431 pp.
4. **Neculiseanu Z. Z., Matalin A.** V. A catalogue of the ground-beetles of the Republic of Moldova (*Insecta*, *Coleoptera*, *Carabidae*), Sophia, 2000. - 164 p.
5. **Simionescu V**. Lucrări practice de ecologie. Iaşi, 1984. – 193 p.
6. **Stan Gh**. Metode statistice cu aplicații în cercetări entomologice // Buletin Informativ al Societății *Lepidopterilor* din România. 1995, nr. 6 (1-2), Bucureşti, 1995. - p. 67-96.
7. **Андреев А.** Оценка биоразнообразия, мониторинг и экосети. Кишинев, 2002, 167 стр.
8. **Крыжановский О.** Определитель насекомых европейской части СССР, 1965. – Том. II. – С. 29-77.

CONTRIBUTIONS TO THE KNOWLEDGE OF COLEOPTERAN FAUNA (COLEOPTERA: CARABIDAE, RHYSODIDAE, SILPHIDAE, SCARABAEIDAE, CHRYSOMELIDAE, CERAMBYCIDAE) FROM "PLAIUL FAGULUI" SCIENTIFIC RESERVE

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The problem of biodiversity conservation especially in protected by State areas is a national, as well as global problem.

The "Paliul Fagului" scientific reserve is located in the north-western part of Central Moldova Plateau at 70 km north-west from Chișinău. It is placed in geobotanical district of sessile oak, european oak and beech woods from the centre of Moldova and belong to the zone of deciduous forests. Depending on climatic, hydrological and relief conditions, here are formed certain vegetal communities, which belong to 5 vegetation types: forest, open land, aquatic, paludous and anthropogenic (Ursu, 2005, Natura rezervației „Plaiul Fagului", 2005). This area until present is rather poor stucies, although it contain the most rich and diverse coleopteran fauna.

The studies were accomplished in vegetation period of 2004-2006 in various types of biotopes of the reserve, using the standard entomological methods: collection with enthomological fillet, manual gathering from different plant species (trees, bushed herbaceous vegetation), from litter and soil.

Identification of collected coleopterans was realized on the basis of keys elaborated by Kryžanovskij (1965), Panin (1955), Freude et al. (1976), Lopatin, (1986), Ben'kovskiy (1999).

As result of researches new data were obtained regarding the species composition, structure and spreading of coleopterans in „Plaiul Fagului" scientific reserve. The identified coleopteran fauna in studied ecosystems is represented by 82 species belonging to 51 genera and 7 families.

Faunistic material included species from families *Carabidae*, *Rhysodidae*, *Silphidae*, *Scarabaeidae*, *Lucanidae*, *Chrysomelidae* and *Cerambycidae*.

The most frequent were the species from family *Carabidae* (30 species), *Chrysomelidae* (21 species), *Cerambycidae* (11 species) and *Scarabaeidae* (8 species). Family *Silphidae* was represented by 6 species, *Lucanidae* – by 3 species and family *Rhysodidae* – only by 2 species.

As concerning the trophic spectrum, it was established that the majority of the species are phytofagous

(46%) and zoofaggous (31%). Mixofagous, necrofagous and xilofagous species constitute 7% each, while coprofagous – only 2% .

During the reasearches for "Plaiul Fagului" scientific reserves 11 rare and treatened coleopteran species were registered: *Carabus intricatus* Linnaeus, 1761; *Carabus ullrichi* Germar, 1824; *Calosoma sycophanta* Linnaeu, 1758; *Lucanus cervus* Linnaeus, 1758; *Oryctes nasicornis* Linnaeus, 1758; *Gnorimus octopunctatus* (Fabricius, 1775); *Cetonischema aeruginosa* (Drury, 1770); *Prionus coriarius* (Linnaeus, 1758); *Cerambyx cerdo* Linnaeus, 1758; *Aromia moschata* Linnaeus, 1758; *Morimus funereus* Mulsant, 1863. Among these, the species: *Calosoma sycophanta* L., *Oryctes nasicornis* (L.), *Cerambyx cerdo* (L.) and *Morimus funereus* (Muls.) are included in the second edition of Red Book of Moldova (Cartea Roșie a Republicii Moldova, 2001), and the species *Cerambyx cerdo* L., and *Lucanus cervus* L. are protected in Europe, being included in annex II and III of Bern Convention. As to the rest of mentioned species, they was proporsed to be included in the 3rd edition of Red Book of Moldova.

INVERTEBRATES (COLLEMBOLA, COLEOPTERA) FROM *BRASSICA NAPUS* CULTURE IN COMPARATIVE ASPECTS BETWEEN THE REPUBLIC OF MOLDOVA AND ROMANIA

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This paper presents the results of scientific research obtained thanks to the financial support of the bilateral project between Republic of Moldova and Romania №10.820.04.16/RoA. Surveys have been conducted on the fauna of two groups of invertebrates (Collembola and Coleoptera) from the culture of rape (Brassica napus L.). For the research were selected two fields in the localities Troița Nouă and Băcioi from the Republic of Moldova and in one locality Singureni from România. Collections and extractions were made from the end of March till the end of May. Faunistic material was collected using Barber traps and manual methods. Extraction of invertebrates from the trap took place every 10 days and in total were made 6 times.

In both countries in the rape culture were collected over 1000 specimens of invertebrates of which 667 specimens (164 Collembola and 503 beetles) from the Republic of Moldova and the others from Romania.

As a result of taxonomic analysis of the collected invertebrates were registered 15 families of beetles (Carabidae, Histeridae, Silphidae, Staphylinidae, Scarabaeidae, Dermestidae, Cantharidae, Nitidulidae, Coccinellidae, Oedemeridae, Tenebrionidae, Meloidae, Cerambycidase, Chrysomelidae, Curculionidae) and 5 families of Collembola (Isotomidae, Entomobryidae, Hypogastruridae, Sminthurididae, Katiannidae) in both countries. Between the beetles the most numerous species were *Meligetis aeneus* (Fabricius, 1775) from family Nitidulidae, *Ceuthorinchus* sp., from Curculionidae and *Epicometis hirta* (Poda, 1761) from Scarabaeidae, these species being also the main pests of this crop. The dominant species of Collembola were *Entomobrya* sp, from family Entomobryidae and *Cryptopygus thermophilus* (Axelson, 1900) from Istomidae.

As a result of comparative analysis of coleopteran and collembolan fauna from two localities in the Republic of Moldova were found the presence of similar major pests in both rape fields, while edaphic fauna vary being formed by the complex of invertebrates typical for agrocenoses.

In the comparative aspects betwen the rape filds from Republic of Moldova and Romania the main group of phytophagus pests was similar with predominance of antofagous species such as *Epicometis hirta* and *Meligetis aeneus*. It is interesting that in the Barber traps of the rape culture the typical forest species of beetles *Carabus coriaceus* (Linnaeus, 1758) and *Valgus hemipterus* Linnaeus, 1758) were found. There were also some beetles species with high ecological plasticity *Coccinella septempunctata* (Linnaeus, 1758) and *Opatrum sabulosum* (Linnaeus, 1758).

DISTRIBUTUION RANGE OF THE CHEQUERED BUTTERFLY SCOLITANTIDES ORION (PALLAS, 1771) IN MEHEDINTI, (SOUTHERN ROMANIA)

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Scolitantides orion (Pallas, 1771) (Lepidoptera, Lycaenidae), is a very attractive butterfly, distributed across Europe but threatened in some areas. It has a characteristic biology, being facultative myrmecophylous and could be used as a interesting model for ethological, sozological and ecological studies. During the last years its populations in Mehedinti showed variations in number of individuals, voltinism, distribution area. We provide herein a distribution map of the butterfly and discuss the trends revealed by our 6 year fieldwork study.

The apparent trend has characteristics:
1 – fluctuations in populations' size; 2 – expansion of the distribution range.

DISTRIBUTION RANGE OF THE WEEVIL *AIZOBIUS SEDI* IN BANAT, (SOUTH-WESTERN ROMANIA)

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Aizobius sedi (Germar) is a steno-monophagous black weevil, feeding both as adult and larvae on Crassulacean leaves and stems. Its Romanian range is not documented until now. In a wider project investigating the potential herbivore pests of the medicinal plant Sedum telephium, we gathered data about the inferstation of the plants by this weevil. We hereby present a list of locations where *A. sedi* was found to inflict damage to native plants *S.telephium*, complemented by a gridmap in UTM projection system of the species infestation in Banat region. We also present some considerations about the chorology and ecology of the species with reference to biotic and abiotic factors involved in its local distribution.

Keywords: *Sedum telephium, Aizobius sedi,* Infestation, Banat, Romania

MONITORING OF ENTOMOPHAGE POPULATION RESISTENCE TO PESTICIDES USED IN THE NEW CULTIVATION TECHNOLOGIES OF AGRICULTURAL CROPS

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INTRODUCTION

Large scale introduction of the integrated systems into experience of plant protection, clear recommendations concerning possibilities of combined utilization of one or another pesticide in the integrated systems are necessary.

Side by side with the elaboration of new preparations and screening from the number of the available ones with a selective action, it is also necessary an utilization in the integrated systems of the entomophages which display a strong resistence to pesticides.

MATERIALS AND METHODS

Investigations have been carried out with imago and larvae of the *Coccinella septempunctata L.*, imago of the dominating species of the ground beetles which are found in all agrocenosis of the cultural crops as *Pseudoophonus rufipes* Deg., *Pterostichus cupreus* L., *Pt.sericeus* W., *Calosoma auropunctatum* Hbst. and *Trichogramma pintoi* Voeg. The species sensibility of different stages of development of the *Coccinella septempunctata* L. to herbicides used in the new technologies of maize growing, has demonstrated that 50% and 95% of larvae mortality is observed at concentration exceeding 1%.

RESULTS AND DISCUSSIONS

From the data presented in Table 1 follows that the concentrations investigated of the herbicides which exceed the recommended dozes for utilization against the weeds for 100 and 1000 times and the ones equal to 0.001-0.003 by a.m. even in such a case do not exert a toxic action except Eradicane. Different results were obtained by treating the adult individuals of this predator (Table 2).

As it can be seen from the data presented in Table 2, the adult predators possessing a high agility and searching activity are susceptible to a more extent action of the herbicides. However even in this case the concentrations causing an abnormally high mortality are beyond the recommended ones.

Table 1. After-action of the herbicides of the larval stage of the *C. septempunctata*

Kind of. action	The number of larvae, indiv					
	Control	Atrazine	Lasso	Ramrod	2.4 DA	Eradicane
0.1% solution of herbicides						
Living	30	30	29	30	30	30
Dead	0	0	1	0	0	0
Mortality,%	0	0	3	0	0	0
1.0% solution of herbicides						
Living	30	30	30	30	30	19
Dead	0	0	0	0	0	11
Mortality,%	0	0	0	0	0	37

Table 2. Herbicide action on the imago stage of the *C. septempunctata.*

Kind of. action	The number of imago, indiv					
	Control	Atrazine	Lasso	Ramrod	2.4 DA	Eradicane
0.1% solution of herbicides						
Living	30	27	23	29	30	26
Dead	0	37	1	7	0	0
Mortality,%	0	10	23	3	0	13
1.0% solution of herbicides						
Living	30	20	0	18	25	0
Dead	0	10	30	12	5	30

The herbicide action on the imago of the ground beetles of genus *Pterostichus* at the same concentrations is recorded as beeing feebly toxic. An exception from this group of herbicides is Eradicane, the its action of which caused the entirely mortality of the imago. The probit-analysis of the ground beetles imago of mortality data *Pt. cupreus* has demonstrated that SK-50 and SK-95 of Eradicane are equal 0,120 and 10,155 respectively, i.e. the range of these value are below the 1% concentration. The analogous picture is marked for the *Pt. sericeus*, *Pt. rufipes*, where the beetle mortality from the contact action of Eradicane ranged between 0,115 and 10,182% of probit-analysis.

Determination of species sensibility of one of largely encountered egg-eaters of many species of the defoliating moths *Trichogramma pintoi* to the investigated herbicides has demonstrated that the concentration of 0,012 ml/l for Lasso; 0,014 ml/l for Eradicane; 12 mg/l for Atrazine; 20 mg/l for Ramrod and 0,005 ml/l for 2.4 DA are feebly toxic, as they cause the mortality of the egg-eater at the range 13-20% as compared 2% in the control variant (Table 3).

Table 3. After-action of the herbicides on the imago stage of the *Trichogramma pintoi* Voeg**.**

Kind of. action	The number of individuals					
	Control	Atrazine 12ml/l	Lasso 0,012ml/l	Ramrod 20ml/l	2.4 DA 0,005ml/l	Eradicane 0,014ml/l
Living	612	516	323	827	280	325
Dead	49	130	50	177	66	58
Action,%	0	20,12	13,4	17,63	19,1	15,4

Consequently, mortality of the adult individuals of Trichogramma in the limits of 50% and 95% is possible only at concentrations of the used herbicides at dozes significantly abnormally high the recommended ones.

CONCLUSIONS

Large scale using herbicides Attrazine, Romrod, Eradicane, 2.4 DA and Lasso in the new maize growing technologies for grain are feeble toxic for the imago and larvae of the predator *Coccinella septempunctata* L.

The imago of the ground beetle of the dominating species *Pseudoophonus rufipes* Deg., *Calosoma auropunctatum* Hbst., *Pterostichus cupreus* L., *Pterostichus sericeus* W. are not susceptible to influence of the using herbicides as the value SK-50 and SK-95 are in the limits of the concentration 0.1 to 1% which exceed the recommended dozes for 100 and more times in experience.

For the egg-eater *Trichogramma pintoi* Voeg. the herbicides at the concentrations recommended for application are not toxic as the mortality of the adult individuals in the experimental variants is compared with the one in the control.

LITERATURE

1. Isaev L.I. Vliianie gerbicidov an vreditelei, vozbuditelei boleznei selskohoziaistvennyh kultur I poleznyh chlenistonogih. Moscow, 1984, "Zaschita rastenii", 12. p.48.

2. Merenuc G.V. Ecologichesakii aspect posledeistvii primenenia himicheskih sredstv zaschity rastenii. In: "Ohrana i racionalnoie ispolzovanie prirodnyh resursov Moldavii". Kishinev, 1984, p. 64-73

3. Franz J.M., Bogenschutz H., et all. Results of a joint pesticide test programme by the working group: Pesticides and Beneficial arthropods-Entomophaga, 1999, 25(5), p.p.231-236.

4. Gauz A.C., Misra K. Dynamics of microbial population in soil as influenced by simazine and ecological factors. Zbl. Bacteriol., 11, 2003, Bd. 133, H.4, s. 357-361.

COLORADO POTATO BEETLE (*LEPTINOTARSA DECEMLINEATA* SAY) OCCURRENCE MONITORING IN BELARUS

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High harmfulness of Colorado potato beetle (*Leptinotarsa decemlineata* Say) in potato agrocenosis in Belarus demands the systematic application of chemical methods of plant protection. But their intensive application promotes hazardous organism resistance formation. With the aim of substantiated and rational application of the insecticides there is a necessity of carrying out of potato agrocenosis phytosanitary monitoring in zone aspect, considering the fact that with the climate warming in last decades there was the changing of agroclimatic zones borders: disintegration of the northern zone and allocation of warmer one in the south of Polessie – a new zone (Melnik, 2004).

Colorado potato beetle occurence studying was carried out by the method of special routing investigation of potato plantings in the agricultural enterprises of northern, central, southern and new agroclimatic zones on the area 5990 ha, among them in 2002 – 200 ha (7 districts in 4 regions), in 2007 – 1856 ha (16 districts in 2 regions), in 2008 – 3563 ha (17 districts in 5 regions), in 2009 – 371 ha (9 districts in 2 regions) that has made accordingly 0,3 %, 4,3, 7,5 and 0,6 % from the planting area under culture in the republic. Number of the pest was defined by the method of recorded plants (plots) according to «The technique of researches on potato protection against diseases, pests, weeds and immunity» (1995).

Phytosanitary situation analysis has showed, that Colorado potato beetle occurred everywhere and appears practically on all surveyed potato plantings. It's revealed, that since the moment of the pest mass

invasions in Belarus (1960) the character of phytophage distribution in the republic didn't change. Now the phytophage in the northern zone colonizes 100% of surveyed areas, while 20 years ago – from 2 till 30, in the central zone colonized areas increasing from 10–50 till 92,3–100 is marked, in the southern and new zones – from 60 till 94,4–100%. The similar tendency, in our opinion, is caused by biological peculiarities of the development, ecological plasticity, genetic polymorphism, wide adaptive abilities of Colorado potato beetle.

According to the phenological observations the periods of appearance of potato phenophases and the pest development differed significantly in agroclimatic zones and was determined by air and soil temperature, amount of rainfalls, etc. In the southern and new zones potato phenophases transit is marked for 10–20 days earlier in comparison with the central and northern ones, accordingly, plantings colonization by the phytophage was for 1–2, during some years – for 3 weeks earlier in comparison with the central one and for 2–3 weeks and more – with the northern zone.

It is revealed, that during the years of researches in the southern and new zones a positive dynamics of plants colonization and pest number increasing in comparison with the northern and central ones is observed. So, during the period of plantings mass colonization, the phytophage number (imago, eggs and larva) in the northern zone varied in limits 8,1–9,8 c./recorded plant, in the central – 10,1–71,5, in the southern and new – 19,6–93,5 c./recorded plant, plant colonization warm 3,3–49,6%, 42,4–97,3 and 63,8–99,5% accordingly. Generalization of quantity indicators of climatic factors state in some periods of Colorado potato beetle life cycle (air temperature, HTK and SET) has showed, that the conditions for the pest development as a whole in the southern and new zones in comparison with the northern one, what promotes the phytophage accelerated development and generations amount increasing.

By means of phytosanitary monitoring of potato plantings, done in 2008–2010, while estimating 28 populations of Colorado potato beetle after before-planting treatment of tubers by the insecticides from the neonikotinoides group (prestige, CS, gaucho, DP, comandor, WSC, agrovital, CS, cruiser, SC, etc.) the death of the pest imago stage at 100% level is revealed.

Thus, the change of nature conditions in the republic makes the phytophage occurrence zonality, what determines the differentiated approach to the protection measures carrying out. Colorado potato beetle number regulation can be done with the insecticides application by different methods (before-planting treatment of tubers or spraying vegetative plants of potato) and action mechanisms, taking into consideration phonological terms and biological peculiarities of the pest development in different agroclimatic zones in the republic.

SPECIES DIVERSITY OF COLLEMBOLA (HEXAPODA) ALONG THE BANKS OF THE DNIESTER RIVER

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The faunistic and ecological researches of the river banks and floodplains using this small group of invertebrates present special interest (Čarnogurský, 1998; Sterzynska & Ehrnsberger, 1999; Sterzynska & Pilipiuk, 1999; Russell et al., 2004; Tronstad et al., 2005). The bank of rivers and floodplains are in a permanent transformation. The spring river floods or abundant rains increase greatly the water level and transcend the usual bank limit, bringing to the banks biogenic elements such as fine particle of organic matter.

The Dniester River is the most economically important waterway of Moldova with its surface area of 72100 km^2 and the length of 1362 km. Its beginning is situated in the Carpathian mountains and flows into the Dniester Lyman. Towards the Dniester's mouth, the composition of bottom gradually alters from calcareous, shingly sand to sand, silty sand and silt with different texture.

The Dniester River is unique because of its geographical and transboundary position and the broad spectrum of habitats including petrophyte and Mediterranean types of forests, *Populus alba*, *Pinus nigra* and *Robimia pseudoacacia* plantations, the rocky slope of calcareous canyons, small lakes, meadows, large flooded areas and agricultural fields.

The first result of the study of Collembola along the banks of the Dniester River was published in 2004. Since then several papers including the biotopic, faunistic and ecological analysis have been done (Busmachiu, 2004, 2006). The study was supported by the projects № 08.820.08.02 BF and 10.820.08.07 BF.

The faunistic material were collected in the localities and habitats listed below:

1. The petrophyte community on the rocky slope of calcareous canyons near the localities Butuceni, Camenca, Orheiul Vechi, Mărcăuți, Lalova, Raşcova, Saharna, Sărăteni, Tătărăuca Nouă, Țipova, Unguri and Vîşcăuți.
2. The banks of the river covered with herbaceous plants and trees plantations near the towns Soroca and Rezina; villages Cocieri, Goieni, Gura Bîcului, Holercani, Otaci, Malovata and Naslavcea.
3. Flooded areas expanded through dozens of kilometres along numerous meanders with paludous vegetation, natural forest on the base of oak, as well as meadows on alluvial soil near the villages Copanca, Crocmaz, Iagorlîc, Leuntea, Olaneşti and Talmaza.
4. Spot of natural steppe - xerophilous ecosystem occurs near the village Răscăieți.
5. Natural forest with elements of Mediterranean flora adapted to xerothermic conditions near the village Grădinița.

Collembola were collected during 2001-2010 years. The soil samples were taken from a 25 cm^2 surface area and 10 cm depth. The extraction was made using flotation method and then fixed in 70-80 % ethyl alcohol. The species of Collembola from the open habitats, meadows and from aquatic plants were also collected by exhauster and fixed immediately in alcohol. Collembolan specimens were mounted on permanent slides and identified according to the basic keys and some modern systematic works.

As a result of investigation, 138 species of Collembola belonging to 66 genera and 17 families have been found in different habitats situated along the banks of the Dniester River. That is more than half of the species of this group cited from the Republic of Moldova (Bușmachiu, 2010). The highest number of registered collembolan species were from the families Entomobryidae (33 species), Neanuridae (19), Isotomidae (18), Hypogastruridae (15), Onychiuridae (13) and Tullbergidae (11). Two families, Sminthuridae and Katiannidae, were represented by 5 species, when the families Tomoceridae, Odontellidae and Dicyrtomidae only with 3 species each. The other collembolan families such as Brachystomellidae, Cyphoderidae, Sminthurididae and Neelidae have only two found species, while Poduridae and Arrhopalitidae only one species each.

In the petrophyte forests, there were found such species as: *Ceratopysella engadinensis*, *Schoettella ununguiculata*, *Morulina verrucosa*, *Pseudachorutella assigilata*, *Superodontella* sp., *Tetrodontophora bielanensis*, *Pseudosinella imparipunctata*, *Orchesella orientalis*, *O. multifasciata*, *Sphaeridia pumilis* and *Ptenothrix leucostrigata*.

From the moist soil along the bank and aquatic herbs, we sampled the following hygrophilous species – *Friesea afurcata*, *Anurida ellipsoides*, *Stenaphorura denisi*, *Ballistura schoetti, Isotomurus palustris* and epineustic species *Podura aquatica*, *Sminthurides aquaticus*.

The typical species for calcareous soil and moss on calcareous soil are: *Kalaphorura paradoxa*, *Thalassaphorura tovtrensis*, *Protaphorura pannonica*, *Jevania weineriae*, *Orchesella maculosa*, *Xenylla uniseta*, *Folsomides angularis* and *F. marchicus*. Some species, such as *Stachia populosa*, *Isotomodes productus*, *Folsomides parvulus* have been found only in open xerothermophilous steppe habitats.

In the litter of natural forests, trees plantation and under low shrubs the following 15 species were found: *Ceratophysella succinea*, *Pseudachorutes subcrassus*, *Deutonura albella*, *Neanura moldavica*, *Pogonognathellus flavescens*, *Tomocerus minor*, *Orchesella albofasciata*, *O. pseudobifasciata, Entomobrya atrocincta*, *E. multifasciata*, *E. quinquelineata*, *Pseudosinella octopunctata*, *P. horaki*, *Heteromurus major* and *Folsomia quadrioculata*.

Collembola are highly diversified ecologically and also habitat-restricted' taxa, so the presence of rare and unique collembolan species as well as new described, indicate the importance and conservation value of the Dniester River ecosystems'.

REFERENCES

Busmachiu G. 2004. Biotopical distribution of Collembola in the riverbank of transboundary Dniester River. In: Integrated management of natural resources in the transboundary Dniester River basin. Proceedings of the International Conference.Chișinău: 67-69.

Busmachiu G. 2006. The structure of collembolan communities in the riverside zone of the Lower Prut. Collection of Scientific Articles. Bender: 142-146.

Busmachiu G. 2010. Checklist of springtails (Collembola) from the Republic of Moldova. Travaux du Muséum National d' Histoire Naturelle "Grigore Antipa". Bucureşti. 53: 149-160.

Čarnogurský J. 1998. Influence of the simulated flood on the collembolan communities in the former seasonally flooded Danubian forest near the Gabčikovo. Soil Zoology in Central Europe. České Budějovice: 13-17.

Krawczynski R. 2006. Succession of Collembola in the post-mining landscape of Lower Lusatia. Hannover. 201 pp.

Russell D., Hauth A., Fox O. 2004. Community dynamics of soil Collembola in floodplains of the Upper Rhine Valley. Pedobiologia. 48: 527-536.

Sterzynska M., Ehrnsberger R. 1999. Diversity and structure of Collembola communities in wetlands. Proceedings of 5th Central European Workshop on Soil Zoology. Ceske Budejovice: 325-334.

Sterzynska M., Pilipiuk I. 1999. Communities of soil fauna (Enchytraeidae, Collembola) in Biebrza river basin. Soil Zoology in Central Europe. České Budějovice: 335-342.

Tronstad L., Tronstad B., Benke A. 2005. Invertebrate seedbanks: rehydration of soil from an unregulated river floodplain in the south–eastern US. Freshwater Biology. 50: 646-655.

BIOLOGIC PARTICULARITIES OF *APIS MELLIFERA CARPATICA* BEE FROM REPUBLIC OF MOLDOVA

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Analysis of the situation in the country in recent years demonstrates that the productive potential of bee industry is used below the possible. This is explained by the fact that traditional technology of genetic growth and amelioration of bees is limited at present, only at some phenotypic selection methods, without determining the purity of race. So far, there is no common standard recognized by countries where are spread bees of *Apis mellifera Carpatica* race, which would define clearly biological characteristics of this race, for recognition of its purity. In order to elucidate these features, we have done a number of researches on bee colonies from local populations in Central area of Moldova.

Outdoor morphometric characteristics were studied according to evaluation methods described in zootechnic Rule of bee colonies bonitation, growth and certification of genitor beekeeping material [2]. The research ranged particularities that characterize the race such as: bee behavior in hive by opening and examining the honeycomb, the specific capacity of honey, skin color, tube length, cubital index, discoidal dislocation, queen prolificacy, winter and disease resistance (hygienic instinct) and brood viability. Data from research results were processed according to statistical and biometric methods after Плохинский Н. А. (1969) and compared with known literature data in country and abroad.

Research results have shown that a big part of biological characteristics of *apis mellifera carpatica* bees from moldovian colonies coincide with the characteristics described by researchers from Romania [3,4], Ukraine [9], Russia [6,7]. Of them are, first, behavior characteristics and specific of covering honey (table).

Thus, by opening of the nest, Apis mellifera Carpatica bees of local populations have a gentle behavior, are not irritable, dont bite (except for certain cases, depending on climatic conditions and harvest) and dont follow people. Most beekeepers, by opening the hive, do not use special protective equipment, except mask. When examining the comb, bees do not leave it, but still moving quietly on the honeycomb surface. Bees from researched populations have mixed specific of honey covering, predominantly white (dry). In most comb, between surface of stored honey in cell and its wax cap is a air layer that gives to cells a white color, known by beekeepers as specific dry caps of honey. However, in some combs there is also wet caps, characterized in that between honey surface from the cell and its cap is no air layer, which gives a wet image to honey covering.

On skin color, in our research it is dark brown, which coincides with the characteristics of romanian researchers. Some individuals have pale yellow stripes in abdominal region. However, beekeepers researchers from Ukraine and Russia states that the teguments color of *Apis mellifera* Carpatica bees is gray. In this context, we consider that gray color of the bee populations from these countries is a result of contact and cross with the race *Apis mellifera* Kaukasika. Gray color, are genetically dominant to the brown, spread throughout the bee population in these countries and can not be a character of purity of *Apis mellifera* Carpatica race.

Table 1. Biological characteristics of *Apis mellifera Carpatica* bees, according to various sources of information.

Nr	Name of characteristic	Our data	Ю.Субботин, 1969 (Молдавия)	Г. Билаш, Н.Кривцов, 1991 (Россия)	В.А.Гайдар, Л.И.Боднарчук (Ukraina)	L.A. Marghitas (Romania)
1	Behavior at hive opening	calm	calm	calm	calm	calm
2	Behavior at comb examination	quiet	quiet	quiet	quiet	quiet
3	Behavior at honey	mixt, preponderant white (dry)	mixt, preponderant white (dry)	mixt, preponderant white (dry)	mixt, preponderant white (dry)	mixt, preponderant white (dry)
4	Teguments color	dark brown	brown	gray	gray	brown
5	Tromp length, mm	6,47 ± 0,01	6,54	6,5 - 7,0	6,5-6,9	6,3-6,4
6	Cubital index, %	41,1 ± 0,4	45,7	45 - 50	37-43	40 - 45
7	Discoid dislocation, %: pozitive neutral negative	 70,7 ± 2,6 28,4 ± 2,6 0,9 ± 2,6	-	 100 - -	 < 80 > 5	 70 30 -
8	Queens prolificacy before harvest, egs/24 hours	1689 ± 13	-	1100-1800	1100-1800	1600-2100
9	Winter resistance,%	80,1 ± 1,5	-	satisfactory	good	good
10	Disease resistance, %	76,8 ± 0,7	-		-	-
11	Brood viability, %	85,1 ± 0,3	-		-	85-95

Tube length values of Apis mellifera Carpatica bees from local populations, according to our research made recently, and previous researches done by other authors [7], falls within average limits from 6,47-6,54 mm, with maximum up to 6,8 mm. These parameters are somewhat higher compared to characteristics of this bee breed published in sources from Romania [3,4] and somewhat lower compared to characteristics of this breed from Russia and Ukraine. We consider that tube length up to 7,0 mm, as indicated in bonitation instructions of bee colonies from Russia and Ukraine for chaacteristics of *Apis mellifera Carpatica* race, is, also, a sign of influence of Apis mellifera Kaukasika, which has the longest tube between all *Apis mellifera* races, and has on average about 7,0 mm. Based on researches made along many years, working bees tube length, as a standard of *Apis mellifera Carpatica* from local population, was made,according to the Zootechnic Rule of bee colonies bonitation, growth and certification of beekeeping genitor material, within 6,4 - 6,8 mm.

Cubital index of *Apis mellifera Carpatica* bees from local populations, according to our researches recently made, also pevious researches made by other authors [7], falls within the average limits from 41,1 - 45,7% which corresponds to values of bee population from Romania, is smaller than the values set as a standard of instructions of *Apis mellifera Carpatica* bee colonies from Russia and a bit higher than standards from Ukraine.

After discoid dislocation characteristics *Apis mellifera Carpatica* bee race from local populations are much like those of race *Apis mellifera Ligustica* (Italian). Positive discoid dislocation was observed in 70,7% of colonies, neutral dislocation was 28,4% of colonies and negative - only at 0,9% of colonies, so it almost doesn t exist. According to information of Г. Билаш, Н. Кривцов (1991), *Apis mellifera Carpatica* bee breed of Russian population has 100% positive discoid dislocation, confirming that these populations have genotypes and biological features distinct from bee populations in our country.

Queens prolificacy of *Apis mellifera Carpatica* from local population is big enough and coincides with characteristics from all countries where this race bees are grown, and is on average 1689 - 1783 egs/24 hours. Overwinter resistance of *Apis mellifera Carpatica* bee colonies from local population is good, averaging 80-90% in dependence of weather and their preparation for winter by beekeeper.

Disease resistance (hygienic instinct) of *Apis mellifera Carpatica* bee colonies from local populations is quite satisfactory and it is on average 76,8 – 95,8 %. Comparative information on disease resistance and brood viability, could not be found in literature accessible to us.

Viability of *Apis mellifera Carpatica* bee brood from local population is quite high and it is on average 85,1 - 97,1%, which corresponds on average, with characteristics of bee colonies from Romania.

Given to results of researches mentioned above we can make following conclusions:

1. The main biological features of *Apis mellifera Carpatica* race from local population are: gently by opening the hive, quiet at honeycomb examination , specific of honey covering- mixed with predominent dry (white), teguments color - dark brown, tube length - 6,47 - 6,57 mm, cubital index - from 41,1 - 45,7%, positive discoid dislocation - 70,7% and neutral - 28,4%, queens prolificacy - 1689-1783 egs/24 hours good overwinter resistance - 80-90%, high disease resistance - from 76,8 - 95,8%. , good brood viability - 85,1 -97,1%.

2. After opening the nest and examining the honeycomb, specificity of honey covering and queens prolificacy, *Apis mellifera Carpatica* bees from local populations are similar to those from neighboring countries (Romania, Ukraine, Russia).

3. After teguments color, tube length and discoid dislocation, the *Apis mellifera Carpatica* bees from local populations resemble with those from Romania, differing only by size of the tube.

4. *Apis mellifera Carpatica* bees from local populations differ from the populations of neighboring countries (Ukraine, Russia) by teguments color, tube length, cubital index and discoid dislocation.

5. Yellow stripes on *Apis mellifera Carpatica* bees testify about a certain genetic influence of *Apis mellifera Ligustica* (Italian) in evolution of local bee population.

6. Local populations of *Apis mellifera Carpatica* bees have good overwinte resistance, disease resistance and brood viability.

BIBLIOGRAPHY

1. Cebotari Valentina. *Program de conservare si ameliorare a albinelor din Republica Moldova.* Realizari si perspective in cresterea animalelor. Simpozion stiintific international, Chisinau, 2006, p. 328-330.

2. Cebotari Valentina, Buzu Ion. *Zootechnical norms regarding the honeybee colonies evaluation, breeding and certification of genetic material in beekeeping*. Contemporary Science Association. Proceedings of the 1st International Animal Health Science Conference: The Beekeeping Conference. Addleton Academic Publishers, ISBN 978-1-935494-10-2. Library of Congress Control Number: 2010918363, New york, 2010, pag. 26-30.

THE CATALOGUE OF ROMANIA DIPLOPODS COLLECTION, COLLECTED AND STUDIED BY TRAIAN CEUCA

DELIA CEUCA

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Amongst the numerous scientific collections that the Cluj-Napoca Zoological Museum hosts in its patrimony there is the T. Ceuca Diplopods collection. Three parts compose this collection: Diplopods of Romania, Diplopods of other countries and microscopic formations, represented by Gonopods, these being the fundamental pieces, used to determine the species. Herein below we are going to illustrate exclusively the Romanian collection.

The collection territory represented the most various areas of the country, from Tarna-Mare to Mangalia, from Sulina to Moldova-Nouă, from the marine landscapes to the alpine plateau including the cave zones. Collected material study result was represented by numerous scientific papers, and, following its inventory, a systematic catalogue was drafted, comprising 31 species, 4 genres, 5 subgenres, 4 subspecies and one family, all new for science. View the format of this communication, limited in respect to explanatory details concerning the herein above assertions, please refer to the *in extenso* paper, to be published, for further details and complete data hereof.

The role of this presentation is, on one hand to embody a compact explanation of what Romanian Diplopods mean – species studied by a single author – and, on the other hand, to emphasize the contribution brought to the knowledge development on this fauna group.

CAVES DIPLOPODS OF ROMANIA, ECOLOGY AND GEOGRAPHICAL DISTRIBUTION, STUDIED AFTER THE „TRAIAN CEUCA" COLLECTION

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The caves offer equilibrated environmental conditions, ever since ancient time part of the Epigean fauna entered their milieu. This was due to the fact that outside environment became, at one point, unsuitable for the survival of different species. Among those species were also the Diplopods. Once inside this milieu, several adaptation changes occurred, which intervened in the phonotypical aspect of certain individuals, such as: body depigmentation, total or partial disappearance of the eyes. Still, these changes cannot be considered as compulsory criteria of species acknowledgement. For example, not all depigmentated and blind species are cavern species, this phenomenon just illustrating the suborder *Polydesmoidea*, which comprises only white and blind species.

The Troglobiont species, perfectly adapted and never seen at surface, present different phonotypical features. Take, for example, *Orobainosoma hungaricum orientale* Tăb. 1965, the ocelli are in various numbers, and *Romanosoma bîrtei* Ceuca 1967, presents 3 ocelli on each side of the head, and *Apfelbeckiella dobrogica* Tăb. 1966, presents a slight tendency for depigmnetation.

Whereas the Troglophiles that are not permanent inhabitants of the caves, *Typhloiulus (Ty.) strictus* (Latz. 1882) is the only species that enters perfectly the strict patterns of a cavern live element, for it does not present ocelli and it has a tainted-white body, grey-yellow, the rest of the species being completely blind.

The phenotype aspects of the Trogloxene species – sporadically found in caves and never reproducing herein – are wide-ranging. For instance, the colours variety ranges from *Polydesmus (S.) griseoalbus dumitrescui* (Neg. & Tăb.) – white or yellowish - to *Strongylosoma palipes* (Oliv. 1972) – having an auburn-brown almost black pigmentation. Ocelli are present to 6 species and this aspect is especially highlighted as a difference. The *Nopoiulus venustus* (Meinert, 1868), *Cylindroiulus boleti* (C.L.Koch 1847), *Cylindroiulus luridus* (C.L.Koch 1847) and *Unciger transsilvanicus* (Karsch 1881) have variable ocelli, depending on the specie, and *Leptophyllum nanum* (Latz. 1884) and *Pachyiulus hungaricus* (Karsch 1881) present specifically individualized aspects.

Whereas the 27 cavern Diplopods studied, 12 are Trioglobiont (out of which 6 endemic for our country, 2 endemic only for Zalion and Grota Haiducilor caverns, 2 endemic only for the S-W caves, 1 specie endemic for Valea Cernei and North Oltenia, 1 specie endemic only for Apuseni Mountains caves), 7 are Troglophiles and 8 Trogloxenes.

DATA REGARDING THE ALIEN/INVASIVE SPECIES OF INSECTS PRESERVED IN THE HERITAGE OF THE OLTENIA MUSEUM CRAIOVA (I)

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INTRODUCTION

The biological invasions caused by "alien" or non-native species, along with the pollution, the damage and the fragmentation of the habitats, the overexploitation and the climate change contribute to the phenomenon of the biodiversity regression. They affect not only the local biodiversity and ecosystem diversity, but also the human health.

A species is considered "foreign", non-native, alien or exotic when artificially reaches in areas outside its native habitat, where they adapt and grow, sometimes to the detriment of native species, sometimes being able to disrupt the ecological balance.

The researches undertaken by over 1,500 experts from 15 research institutions in various countries in the project DAISIE (Delivering Alien Invasive Species Inventories for Europe) have created a database on alien species introduced by humans (intentionally or not) after 1500,the year of the beginning of the great intercontinental explorations and massive introduction of alien species in Europe. Of the 1577 species of invertebrates, a number of 1306 are insect species included in 16 orders. Most of the species belong to the following orders: Coleoptera, Homoptera, Hymenoptera, Lepidoptera şi Diptera.

Following investigations, Teodorescu et al. (2006) identified 96 non-native insect species in Romania, of which 43 are considered to be invasive species.

The purpose of this paper is to publish the scientific data held by non-native/invasive insects from the museum heritage in order to complete information on their distribution in Romania.

MATERIAL AND METHODS

The material analyzed in this paper consists of insects preserved in ancient fund of the entomological heritage of the Oltenia Museum Craiova (established in the period 1951-1979). The species were determined and reviewed over the years by Ion Firu, Bella Kis, Aurora Stanescu and Cornelia Chimișliu.

For each species we presented earlier mentions from the museum heritage (in chronological order of the publishind dates of the papers, indicating collection sites and years), the analyzed material, the number of specimens and the origin of species. The collection sites are listed alphabetically, and collection dates in chronological order of years and months of collection.

Abbreviations:

- County names: CS – Caraş Severin; DJ – Dolj; GJ – Gorj; MH – Mehedinți; OT – Olt.

-**Other abbreviations:** spec. = specimen; specs. = specimens.

RESULTS AND DISCUSSIONS

After processing the material (166 specimens), we have identified 9 species included in 5 orders, collected from 26 collecting sites, during 1951-1979.

Collecting sites: Amărăștii de Jos (DJ), Baia de Aramă (MH), Baia de Fier (GJ), Băile Herculane (CS) Bârza (OT), Bibești (GJ), Bistreț (DJ), Bucovăț (DJ), Budieni (GJ), Căpreni (DJ), Ciuperceni (DJ), Craiova (DJ), Craiova (Obedeanu) (DJ), Craiova (Park) (DJ), Fărcașu (OT), Guțu (MH), Jiana (MH), Leamna (DJ), Malu Mare (DJ), Melinești (DJ), Poiana (MH), Preajba (DJ), Prunet (DJ), Rânca (GJ), Secui (DJ), Târgu Jiu (GJ).

Orthoptera Order

Of the 183 species identified in the Romanian fauna (Iorgu et. al., 2008, cit. Iuşan, 2009), two species are listed as invasive species: *Calliptamus italicus* (Linnaeus 1758) and *Dociostaurus maroccanus* (Thunberg 1815) Teodorescu et al., 2006). Originating in Central Asia, the two species are widespread throughout the country, especially in pastures.

Calliptamus italicus (Linnaeus 1758)

Previous reports from the patrimony: Togănel & Chimișliu, 2005-Baia de Aramă (1964).

Examined material – 6 specs.: Căpreni 1 spec. 25.VIII.1964; Craiova 1 spec. 05.VIII.1966; 1 spec. 27.VIII.1966; 1 spec. 20.VIII.1979; Craiova (Obedeanu) 1 spec. 10.VIII.1973; Prunet 1 spec. 15.IX.1975.

Origin: Central Asia; alien invazive species crop pest (Teodorescu et al., 2006).

Other species with tendencies to expand their area in Romania (not yet classified as invasive insects) are mediterranean species *Pezotettix giornae, Oecanthus pellucens* present nowadays in the central and eastern Romania României (Iogu & Pisică, 2006 cit. Iuşan, 2009) Both species are present in the museum heritage.

Pezotettix giornae (Rossi 1794), Acrididae Family

Previous reports from the patrimony: Togănel & Chimișliu, 2005-Craiova (Obedeanu) (1975).

Examined material - 9 specs.: Bucovăț 6 spec. 27.X.1975; Craiova 2 specs. 07.X.1966; Craiova (ParK) 14.VIII.1967.

Oecanthus pellucens (Scopoli 1763), Gryllidae Family

Examined material - 8 specs.: Guțu 05.IX.1967.

Heteroptera Order

Heteroptera are represented in Romania fauna by nearly 1000 species, but very few of them are non-native species.

Eurygaster integriceps Puton 1881, Scutelleridae Family

Examined material - 39 specs.: Amărăștii de Jos 1 spec. 15.VII.1969; Craiova 1 spec. 17.VI.1960; 1 spec. 08.V.1964; 1 spec. 01.X.1972; 1 spec. 01.X.1975; 1 spec. 15.VII.1975; 2 specs. 15.VII.1978; 29 specs. 10.VII.1979; Prunet 1 spec. 31.VII.1979; Secui 1 spec. 27.VII.1975.

Origin: Central Asia; alien invazive species crop pest Teodorescu et al., (2006).

Homoptera Order

Stictocephala bisonia Kopp & Yonke 1977 syn. *Ceresa bubalus*

Examined material – 19 specs.: Craiova 3 specs. 09.IX.1970; 4 specs. 05.IX.1972; 2 specs. 24.VII.1973; 2 specs. 23.IX.1973; 1 spec. 18.VIII.1974; 1 spec. 11.IX.1974; 1 spec. 16.IX.1975; Malu Mare 1 spec. 01.VIII.1975; Melinești 1 spec. 10.VIII.1974; 1 spec. 01.IX.1974; Prunet 1 spec. 26.VIII.1974; Secui 1 spec. 01.VIII.1975.

Origin: North America. In Europe it was introduced in 1912, in Hungary. In Romania it is dispersed in all regions (Teodorescu et al., 2006).

Coleoptera Order

This order is represented in Romania by approx. 6.500-7000 species, of which 2% are non-native species(Rakosy, 2009). Over 50% of non-native beetles are related to the storage of food and wood.

Leptinotarsa decemlineata (Say 1824), Chrysomelidae Family

Examined material – 73 specs.: Amărăștii de Jos 6 specs. 17.VII.1969; Baia de Fier 1 spec. 31.VII.1966; Bârza 1 spec. 29.V.1967; Bistreț 1 spec. 20.IX.1968; 6 specs. 21.IX.1968; 1 spec. 20.VII.1969; 24 specs. 21.VII.1969; Budieni 1 spec. 25.VI.1961; Căpreni 1 spec. 13.VII.1967; Craiova 4 specs. 05.VI.1964; 1 spec. 17.VII.1969; 2 specs. 25.IX.1969; 15 specs. 28.IX.1969; 1 spec. 10.V.1975; 1 spec. 20.V.1975; Craiova (Obedeanu) 1 spec. 01.V.1974; Fărcașu 1 spec. 28.VI.1971; Leamna 1 spec. 05.VII.1967; Melinești 1 spec. 15.VI.1967; Preajba 1 spec. 22.VI.1973; Poiana 1 spec. 1960; Târgu Jiu 1 spec. 24.V.1964.

Origin: Central and Northern America, was signaled for the first time in Europe in 1876 in Bremen; In Romania was signaled for the first time in Săpânța in 1952 (Perju et al., 2009); alien invazive species crop pest Teodorescu et al., (2006).

Rakosy (2009) includes this species in the category of invasive species, whose presence in Romania must be verified. In Dolj County is a very common species and produces damage to the potato and eggplant crops.

Anoxia (Protanoxia) orientalis (Krynicky 1832) - Melolonthidae Family

Previous reports from the patrimony: Chimișliu, 2000a - Bârza (1964); Bistreț (1967); Craiova (1951, 1962, 1967, 1968), Rânca (1962); Chimișliu, 2000b - Bistreț (1963), Craiova (1971); Craiova (Obedeanu) (1974, 1975), Ciuperceni (1976); Craiova (Park) (1964, 1965, 1966, 1968), Chimișliu Cornelia & Eugenia Botu, 2000 - Cerneți (1972).

The species was mentioned in Oltenia by Marcu since 1928.

Origine Middle Asia. In Europe this species entered in 1890, and in Romania, in 1955 (Teodorescu et al., 2006).

Blitopertha lineata (Fabricius 1798) - Rutelidae Family

Previous reports from the patrimony: Chimișliu, 1990-1993 - Băile Herculane (1965), Esekioi (1965).

Origin: Africa (Tunisia). In Europe, it is mentioned in 1903 (Teodorescu et al., 2006).

Dictyoptera Order

Blatta orientalis Linnaeus 1758, Blattidae Family

Examined material – 15 specs.: Bibești 1 spec. 07.VII.1977; 1 spec. 10.VI.1978; Bistreț 1 spec. 20.VII.1969; 1 spec. 21.VII.1969; Craiova 1 spec. 06.VI.1958; 2 specs. 05. VI.1964; 1 spec. 05.VI.1965; 1 spec. 14.VIII.1967; 1 spec. 16.VI.1968; 1 spec. 23.VI.1971; 1 spec. 01.VII.1971; 1 spec. 12.VII.1975; 1 spec. 20.VII.1979; Jiana 1 spec. 30.VI.1957.

Origin: Tropical regions (Teodorescu et al., 2006). The species is living in Europe from several hundred years (Rakosy, 2009).

CONCLUSIONS

The 166 analyzed specimens belong to a number of 9 species included in 5 orders. Most of the collecting sites are from Dolj County (14), followed by: Gorj County (5), Mehedinți County (4), Olt County (2) and Caraş Severin County (1).

The obtained data bring new informations regarding the distribution of the 9 species in 5 counties from the south-west of Romania.

REFERENCES

Chimișliu Cornelia. 1990-1993. *Catalogul Colecției de Coleoptere "N. A. Săvulescu" conservată la Muzeul Olteniei Craiova***. Oltenia. Studii și comunicări. Științele Naturii. Muzeul Olteniei Craiova. 9-12: 14-23.**

Chimișliu Cornelia. 2000a. *Specii din subfamilia Melolonthinae* **(***Insecta: Coleoptera: Scarabaeidae) cunoscute în coleopterofauna Olteniei***. Oltenia**. **Studii și comunicări. Științele Naturii. Muzeul Olteniei Craiova**.**16.: 141-146.**

Chimișliu Cornelia 2000b. *Catalogul familiei Scarabaeidae (Coleoptera: Insecta) din Colecția entomologică "I. Firu" conservată la Muzeul Olteniei Craiova.* **Studii și comunicări. Științele Naturii. Muzeul Județean Satu Mare. I: 495-502.**

Chimișliu Cornelia & Eugenia Botu. 2000. *Specii de scarabeide (Insecta: Coleoptera: Scarabaeidae) conservate în colecțiile Secției de Științele Naturii a Muzeului Regiunii Porților de Fier Drobeta Turnu- Severin*. **Oltenia**. **Studii și comunicări. Științele Naturii. Muzeul Olteniei Craiova**.**16.: 147-152.**

Iușan Claudiu. 2009. *Specii invazive de ortoptere din România.* Neobiota din România. Eds. Rakosy L., Momeu Laura. Presa universitară Clujană. Cluj-Napoca: 127.

Marcu O. 1928. *Contribuții la cunoașterea coleopterelor Olteniei.* **Arhivele Olteniei. VII. sept.-dec. nr. 39-40: 473-487.**

Perju T., Bodis Ilonka, Crișan Mihaela, Teodor L.A. 2009. Neobiota din România. Eds. Rakosy L., Momeu Laura. Presa universitară Clujană. Cluj-Napoca: 114-123.

Rakosy L. 2009. *Insecte invazive, a căror prezență în România trebuie verificată***. Neobiota din România. Eds. Rakosy L., Momeu Laura. Presa Universitară Clujeană. Cluj-Napoca: 124-126.**

Teodorescu Irina, Manole T., Iamandei Maria. 2006. The maina alien/invasive insects species in Romania. Romanian Journal of Biology. Zoology. Edit. Academiei Române. Bucharest. 51(1-2): 43-61.

Togănel Florentina & Chimișliu Cornelia. 2005. *Ortoptere (Insecta: Orthoptera) din colecția entomologică a Secției de Științele Naturii a Muzeului Olteniei Craiova:* Oltenia. Studii și comunicări. Științele Naturii. Muzeul Olteniei Craiova. **21**: 67-72 .

***. DAISIE European invazive Gateway Alien Specii (http://www.europe-aliens.org/ [accesed to August, 2011].

PRELIMINARY DATA ABOUT DIURNAL LEPIDOPTERA (LEPIDOPTERA, RHOPALOCERA) FROM THE NATURAL PARK OF THE LOWER PRUT FLOOD PLAIN

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Introduction

The Natural Park The Lower Prut Flood Plain has been founded on the grounds of Govern. Dec. 2151/2004 regarding the establishing of the regime of protected natural area for new zones.

The Prut River, forms a border between Romania and the Republic Moldova. On the territory of Galati County, the Prut flows on a distance of 122 km, forming the gate to the Reserve Biosphere of the Danube Delta. The Lower Prut Flood Plain is situated to the South- East of Galati County. The vegetation includes wet meadows, swampy meadows, willow forests and gallery forests.

Material and methods

The field research was undertaken in 2009 and 2010 from May to September, during 10 field excursions in various points of the Park including Pochina Lake and Vlăşcuța Lake that are natural protected areas. The butterflies were collected with the insect net.

Result and discussions

During the 2 years research there were identified 29 species of butterflies belonging to 5 families: Hesperiidae, Papilionidae, Pieridae, Lycaenidae and Nymphalidae (table 1). *Heteropterus morpheus morpheus* (Pallas, 1771)- Hesperiidae Family

Material: 3 specimens 25.VI.2009 Tulucesti

-Is was never before mentioned for Moldova (Romania). Inhabits wet and swampy meadows, swampy forests (Székely, 2008). Is a localized species, considered endangered and protected by Annex 3B, 4B of Habitats Directive.

-Red List category: Endangered species (EN).

Lycaena dispar rutila Werneburg, 1864 -Lycaenidae Family

Material: 12 specimens: 04.IX.2009 Mata Radeanu si Pochina (3); 18.IX.2009 Vladesti (5); 27.V.2010 Vladesti (2); 06.V.2010 Vlascuta (1); 08.VI.2010 Mata Radeanu (1).

- is a localized species that inhabits swampy meadows, wet meadows, lakesides and flood areas (Székely, 2008).

Table 1. Systematic list of butterflies identified in the Natural Park The Lower Prut Flood Plain

Crt. no.	Species	No. Ind.	Collecting points	Red list categ
	Hesperiidae Family			
1	*Carcharodus alceae alceae* (Esper, 1780)	1	Şovarca	LC

2	*Carcharodus floccifera floccifera (Zeller, 1847)*	1	Ghimia	NT
3	*Pyrgus malvae malvae* (Linnaeus, 1758)	4	Vlascuta	NT
4	*Heteropterus morpheus morpheus* (Pallas, 1771)	3	Tulucesti	EN
	Papilionidae Family			
5	*Papilio machaon machaon* (Linnaeus, 1758)	1	Tulucesti	NT
	Pieridae Family			
6	*Anthocharis cardamines cardamines* (Linnaeus, 1758)	1	Vlascuta	LC
7	*Pieris brassicae brassicae* (Linnaeus, 1758)	2	Tulucesti	LC
8	*Pieris rapae rapae* (Linnaeus, 1758)	2	Vlascuta	LC
9	*Pontia edusa edusa* (Fabricius, 1777)	9	Vlascuta, Ghimia,Cotul Chiului, Vladesti, Mata Radeanu	LC
10	*Colias erate erate* (Esper, 1803)	9	Vlascuta, Ghimia,Sovarca, Vladesti, Mata Radeanu	NT
11	*Colias croceus croceus* (Fourcroy, 1785)	8	Ghimia, Vlascuta,Cotul Chiului.	LC
	Lycaenidae Family			
12	*Lycaena phleas phleas* (Linneaus, 1761)	8	Tulucesti, Vlascuta, Mata Radeanu, Vladesti.	LC
13	*Lycaena dispar rutila* (Werneburb, 1864)	12	Mata Radeanu, Vladesti. Pochina, Vlascuta.	VU
14	*Lycaena thersamon thersamon* (Esper, 1784)	1	Vlascuta	VU
15	*Celastrina argiolus argiolus* (Linnaeus, 1758)	6	Tulucesti, Vlascuta,Vladesti	LC
16	*Pseudophilotes schiffermüelleri schiffermüelleri* (Hemming, 1929)	1	Vlascuta,	NT
17	*Polyommatus thersites thersites* (Cantener, 1835)	4	Vladesti, Vlascuta,Cotul Chiului.	DD
18	*Polyommatus icarus icarus* (Rottemburg, 1775)	8	Vlascuta,	LC
19	*Polyommatus bellargus bellargus* (Rotemburg, 1775)	1	Mata Radeanu	LC
	Nymphalidae Family			
20	*Argynnis pandora pandora* (Denis&Schiffermuller,1775)	1	Tulucesti	VU
21	*Issoria lathonia lathonia* (Linnaeus, 1758)	2	Cotul Chiului	LC
22	*Vanessa atalanta atalanta* (Linnaeus, 1758)	1	Vlascuta	LC
23	*Vanessa cardui cardui* (Linnaeus, 1758)	8	Ghimia, Valscuta, Vladesti, Cotul Chiului	LC
24	*Nymphalis antiopa antiopa* (Linnaeus, 1758)	1	Sivita	LC
25	*Melitaea phoebe phoebe* (Denis&Schiffermuller,1775)	5	Valscuta, Vladesti, Cotul Chiului	LC
26	*Apatura metis metis* (Freyer, 1829)	6	Tulucesti, Cotul Chiului, Sivita, Ghimia, Vlascuta, Vladesti	VU
27	*Lasiommata megera megera* (Linnaeus, 1767)	11	Vlascuta, Vladesti, Sovarca, Cotul Chiului	LC
28	*Coenonympha pamphilus pamphilus* (Linnaeus, 1761)	9	Vlascuta, Vladesti, Sovarca, Mata Radeanu	LC
29	*Maniola jurtina jurtina* (Linnaeus, 1758)	4	Tulucesti, Valscuta, Cotul Chiului	LC
	TOTAL	**130**		

EN=endangered: VU=vulnerable; NT=near threatened; LC=least concern; DD=data deficient.

-Red List category: Vulnerable (VU). Is a protected species included on the lists of Habitats Directive 3A, 4A and Red Data Book of European Butterflies.

Pseudophilotes schiffermüelleri schiffermüelleri Hemming, 1929 -Lycaenidae Family

Material: 1 specimens 06.V.2010 Vlascuta.

-is a localized and myrmecophile species that inhabits bush areas and meadows (Székely, 2008).

-Red List category: Near threatened (NT). This species in included also on the lists of Red Data Book of European Butterflies as a protected species.

Apatura metis metis (Freyer, 1829)- Nymphalidae Family

Material: 6specimens: 25.VI.2009 Tulucesti, Sivita (4); 12.VI.2009 Cotul Chiului (2).

-is a very localized species that inhabits gallery forests and swampy forests, lakesides and willow forests (Székely, 2008).

-Red List category:Vulnerable (VU). It is included on the lists of Bern Convention and Habitats Directive (3A, 3B, 4A) as a protected species.

As it concern the presence on the Red List of Romanian butterflies, the species founded in the studied area belongs to the following categories: 65,6% are least concern species, 13,8% are near threatened species, 13,8% are vulnerable species, 3,4% are endangered species and 3,4% are data deficient species.

Conclusions

The diurnal lepidopterofauna of the Natural Park The Lower Prut Flood Plain includes populations of butterflies characteristic to the ecological conditions of the area (wet and swampy meadows, gallery and willow forests) like: *Heteropterus morpheus, Lycaena dispar rutila, Apatura metis, Nymphalis antiopa* and also populations of ubicvist butterflies without special ecological requirements: *Maniola jurtina, Vanessa cardui, Vanessa atalanta, Issoria lathonia, Pieris brassicae and Pieris rapae.*

References

Rákosy L., Goia M., Kovács Z., 2003 - *Catalogul lepidopterelor României/Verzeichnis der Schmetterlinge Rumäniens*. Soc. Lepid. Rom, Cluj-Napoca, 446 p.

Székely L, 2008- *The Butterflies of Romania/ Fluturii de zi din Romania*. Brastar Print Brasov, 262 p.

FAUNA MITES OF HERBACEOUS PLANTS IN THE TERRITORY OF THE REPUBLIC OF MOLDOVA

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The material was generalized to study the fauna of mites on 17 species of herbs. Counting of mites in samples, determination the species were done using microscopes MBS-10. Host plants are determined conform to the key of Gheideman T.S.

Mites fauna of herbaceous plants consisting of 22 species, of which one species is specified for the first time for the fauna of the Republic of Moldova. Mite Cryptognathus sp.n. belongs to the family Cryptognathidae and marked a marker *.

Faunistic complexes of mites were found on these herbaceous plants: ***Hieracium pilosella* L.**(Asteraceae) - *Bryobia redicorzevi;* ***Medicago lupulina* L**. (Papilionaceae) - *Aculus schechtendali;* ***Mentha piperita* L**. (Lamiaceae) – *Typhloctonus tuberculatus*, *Typhlodromus tiliarum, Seiulus aceri*; ***Thlaspi perfoliatum* L**. (Brassicaceae) - *Tydeus californicus*, *Typhloctonus formosus*; ***Draba nemorosa* L.** (Brassicaceae) - *Tydeus caudatus*, *T. californicus*, *Typhloctonus formosus*; ***Polygonum lapathifolium* L.** (Polygonaceae) - *Triophtydeus immanis;* ***Fragaria vesca* L.** (Rosaceae) **-** *Anthoseius rhenanus, A. tortor, Phytoseius juvenis, Acotyledon redikorzevi;* ***Poterium sanguisorba* L.** (Rosaceae) **-** *Anthoseius halinae, A. pirianykae;* ***Rorippa austriaca* (Cranz) Bess** (Brassicaceae) **-** *Tydeus californicus, Tetranychus* (*Tet.*) *urticae;* ***Crocus reticulates* Stev. ex Adam.** (Iridaceae) - *Tydeus californicus*, *Triophtydeus flatus;* ***Artemisia absinthium* L.** (Asteraceae) - *Schizotetranychus fraxini*; ***Chelidonium majus* L.** (Papaveraceae) - *Schizotetranychus fraxini*; ***Urtica dioica* L.** (Urticaceae) - *Schizotetranychus fraxini*, *Phytoseius juvenis;* ***U. bioila* L**. (Urticaceae) - *Tetranychus* (*Tet.*) *urticae;* ***Salvia nutans*** L. (Lamiaceae) – *Tarsonemus ellipticus;* ***S. nemorosa*** L. (Lamiaceae) - *Phytoseius juveni, P. echinus;* a moss **-** *Amblyseius tauricus, Cryptognathus sp.n.**.

Faunistic complexes mites herbaceous plants are composed of the species which have different trophic specialization. Most of them represented by predatory mites and phytophagous. Below is a list of common mites species and their trophic specialization.

Mites herbaceous plants of the Republic of Moldova

Species of mites	Plant families	Trophic specialization
Anthoseius rhenanus	Rosaceae	predator
A. tortor	Rosaceae	predator
A. halinae	Rosaceae	predator
A. pirianykae	Rosaceae	predator

Amblyseius tauricus	a moss	predator
Phytoseius juveni	Rosaceae, Urticaceae, Lamiaceae	predator
P. echinus	Lamiaceae	predator
Typhloctonus tuberculatus	Lamiaceae	predator
T. formosus	Brassicaceae	predator
Typhlodromus tiliarum	Lamiaceae	predator
Seiulus aceri	Lamiaceae	predator
Tydeus caudatus	Brassicaceae	phytophagous
T. californicus	Brassicaceae, Iridaceae	phytophagous
Triophtydeus immanis	Polygonaceae	mikofag
T. flatus	Iridaceae	mikofag
Schizotetranychus fraxini	Asteraceae, Papaveraceae, Urticaceae	phytophagous
Tetranychus (*Tet.*) *urticae*	Brassicaceae, Urticaceae	phytophagous
Bryobia redicorzevi	Asteraceae	phytophagous
Aculus schechtendali	Papilionaceae	phytophagous
Acotyledon redikorzevi	Rosaceae	phytophagous
Tarsonemus ellipticus	Lamiaceae	mikofag
*Cryptognathus sp.n.**	a moss	predator

The migration of mites herbaceous plants bordering woodlands noted the presence of rare species of fauna of Moldova: *Typhloctonus tuberculatus, Typhlodromus tiliarum, Seiulus aceri, Anthoseius halinae, A. tortor, A. pirianykae, Tarsonemus ellipticus, Amblyseius tauricus, Cryptognathus sp.n..*

Conclusion

1. Mites fauna of herbaceous plants consisting of 22 species, of which one species (Cryptognathus sp.n.) is specified for the first time for the fauna of the Republic of Moldova.

2. Faunistic complexes of ticks were found in 17 species of herbaceous plants.

3. Rare species of mites found: *Typhloctonus tuberculatus, Typhlodromus tiliarum, Seiulus aceri, Anthoseius halinae, A. tortor, A. pirianykae, Tarsonemus ellipticus, Amblyseius tauricus, Cryptognathus sp.n.*

MITES FAUNA (PARASITIFORMES ET ACARIFORMES) AND THEIR DISTRIBUTION IN THE MEMBERS OF THE FAMILY FAGACEAE OF MOLDOVA

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According to the Land Cadastre on January 1, 2010 the total forest area of Republic of Moldova amounted to 462.7 thousand hectares, of which 302.2 thousand hectares - of forest. Mites **Fagaceae** trees are important in food webs of forests of the Republic of Moldova. The purpose of this research was to identify the fauna and distribution of mites in different habitats (forest, plantation protection, dendrological park "Tsaul") to: *Fagus sylvatica* L., *Quercus robur* L., *Quercus petraea* (Mat.) Liebl., *Quercus pubescens* Will., *Quercus borealis* Michx., *Quercus polycarpa* Schur., *Quercus palustris* Moench., *Quercus macrocarpa* Michx., *Quercus dalechampii* Ten., *Castanea sativa* Mill.

Herbaceous plants and inhabiting those mites are listed below: FORESTS - ***Fagus sylvatica* L.** - *Typhloctonus formosus, T. sguamiger, Tydeus caudatus, T. praefatus, T. californicus, Typhlodromus cotoneastri, T. pilosus*, Amblyseius andersoni, A. dacus*, A. finlandicus, A. herbarius, Schizotetranychus (E.) fraxini, S. pomeranzevi, S. orientalis, Tarsonemus hermes, T. virgineus, T. bilobatus, T. talpae, Paralorryia lena, P. mali, P. ferula, Anthoseius rapidus, Triophtydeus immanis, T. flatus, Paraseiulus soleiger, Phytoseius severus*, P. juvenis*; ***Quercus robur* L.** - *Schizotetranychus (E.) fraxini, S. orientalis, S. latifrons, S. tiliarium, S. prunicola, S. pomeranzevi, S. rajae, S. uncatus exignuus*, Paralorryia ferula, P. lena, P. mali, P. formosa, Allonychus braziliensis, Kampimodromus aberrans, K. marzhaniani, Typhlodromus cotoneastri, Anthoseius inopinatus, A. caudiglans, Amblyseius finlandicus, A. andersoni, A. reductus, A. rademacheri, A. nemorivagus, A. astutus, Paraseiulus soleiger, Phytoseius salicis, P. juvenis, P. spoofi, Seiulus simplex, S. subsimplex, Tydeus praefatus, T. obstinatus, T. diversus, T. caudatus, T. kochi, T. wainsteini, Triophtydeus flatus, T. immanis, Pronematus anconai, Tarsonemus naegelie, T. talpae, T. lobosus, Cenopalpus pulcher, Amphitetranychus viennensis, Panonychus ulmi, Tetranychus lonicerae, Cheletomorpha epidopterorum, Zetzellia mali*; ***Quercus petraea* (Mat.) Liebl.** - *Amblyseius finlandicus, Tydeus elinguis, Triophtydeus flatus, Paralorryia lena, P. ferula, Typhloctonus formosus*; ***Quercus pubescens* Will.** - *Paralorryia ferula, P. lena, Amblyseius finlandicus, A. obtusus, A. kazachstanicus*, Kampimodromus marzhaniani, Typhlodromus pyri, Zetzellia mali, Tydeus wainsteini, T. maturus, Triophtydeus flatus, Acotyledon agilis*, A. michaeli*, Schizotetranychus (E.) pomeranzevi*; FOREST PROTECTION PLANTATIONS - ***Quercus borealis* Michx**. - *Tydeus californicus, Pronematus sextoni, Zetzellia mali, Amblyseius finlandicus, A. tauricus, Typhlodromus cotoneastri, Paraseiulus soleiger*; ***Quercus robur* L**. *Tydeus californicus, Paralorryia ferula, Cenopalpus pulcher, Schizotetranychus (E.) prunicola, Amblyseius finlandicus, Typhlodromus cotoneastri, Zetzellia mali*; PARK - ***Quercus polycarpa* Schur.** - *Amblyseius finlandicus*; ***Quercus palustris* Moench.** - *Amblyseius finlandicus, Tydeus heterosetus*; ***Quercus macrocarpa* Michx**. - *Amblyseius finlandicus, Anthoseius caudiglans*; ***Quercus dalechampii* Ten.** - *Amblyseius finlandicus, Typhloctonus formosus, Schizotetranychus (E.) ulmicola*, Paralorryia ferula, Triophtydeus flatus, Anthoseius caudiglans*; ***Castanea sativa* Mill.** - *Amblyseius finlandicus, Bdella taurica**.

The studies have shown that faunal complexes mites are unique for each type of host plant diversity, conservation and the emergence of new species for the fauna of Moldova: *Typhlodromus pilosus* Chanteius, 1959, *Phytoseiulus severus* Wainstein et Vartapetov, 1972, *A. dacus* Wain., 1972, *Anthoseius kazachstanicus* Wain., 1961, *Schizotetranychus (Eotetranychus) ulmicola* Reck, 1948, *Acotyledon agilis* (Canestrini, 1988), *A. michaeli* (Oudemans, 1924) - marked a marker *. The following table provides a general list of species of ticks (71), habitat and trophic specialization.

Mites plant family Fagaceae

Species of mites	Forest	Forest protective plantation	Park	Trophic specialization
ORDIN ACARIFORMES Fam. Tarsonemidae Kramer, 1877				
Tarsonemus bilobatus Suski, 1965	+			mikophagous
T. hermes Suski, 1965	+			mikofag
T. lobosus Suski, 1965	+			mikofag
T. naegelie Suski, 1965	+			mikofag
T. talpae Schaarschmidt, 1959	+			mikofag
T. virgineus Suski, 1969	+			mikofag
Fam. Tydeidae Kramer, 1877				
Tydeus caudatus (Duges, 1834)	+			phytophagous
T. californicus (Banks, 1904)	+	+		phytophagous
T. diversus Kuznetzov, 1973	+			mikofag
T. elinguis Kuznetzov, 1973	+			mikofag
T. heterosetus Kuznetzov et Petrov, 1984			+	mikofag
T. kochi Oudemans, 1928	+			mikofag
T. maturus Livschitz, 1973	+			mikofag
T. obstinatus Livschitz, 1973	+			mikofag
T. praefatus Kuznetzov et Zap, 1973	+			mikofag
T. wainsteini Kuznetzov, 1973	+			mikofag
Paralorrya ferula (Baker, 1944)	+	+	+	mikofag
P. formosa Livschitz, 1972	+			mikofag
P. lena Kuznetzov, 1973	+			mikofag
P. mali (Oudemans, 1929)	+			mikofag
Triophtydeus immanis Kuznetzov, 1973	+			mikofag
T. flatus Livschitz, 1973	+		+	mikofag
Pronematus anconai Baker, 1944	+			mikofag
P. sextoni Baker, 1968		+		mikofag

Fam. Bdellidae Dudes, 1834				
Bdella taurica Kuznetzov et Livschitz, 1975			+	predator
Fam. Stigmaeidae Oudemans, 1931				
Zetzellia mali (Ewing, 1917)	+	+		predator
Fam. Cheyletidae Leach, 1815				
Cheletomorpha epidopterorum (Sch, 1794)	+			predator
Fam. Tetranychidae Donnadieu, 1975				
Panonychus ulmi (C. L. Koch, 1836)	+			phytophagous
Allonychus braziliensis Mc Gregor, 1950	+			phytophagous
Schizotetranychus pomeranzevi Reck,1956	+			phytophagous
S. prunicola Livschitz, 1960	+	+		phytophagous
S. fraxini Reck, 1948	+			phytophagous
S. rajae Wainstein, 1954	+			phytophagous
S. orientalis Begljarov et Mitrofanov, 1973	+			phytophagous
S. uncatus exignuus Wainsrein, 1956	+			phytophagous
S. ulmicola Reck, 1948*			+	phytophagous
S. latifrons Wainstein, 1954	+			phytophagous
S. tiliarium Herman, 1804	+			phytophagous
Amphitetranychus viennensis (Zach,1920)	+			phytophagous
Tetranychus lonicerae Begljarov et Mitrof., 1973	+			phytophagous
Fam. Tenuipalpidae Berlese, 1913				
Cenopalpus pulcher (Can. et Fanz., 1876)	+	+		phytophagous
Fam. Acaridae Leach, 1816				
Acotyledon agilis (Can., 1988)*	+			phytophagous
A. michaeli (Oud., 1924)*	+			phytophagous
ORDIN PARAZITIFORMES Fam. Phytoseiidae Berlese, 1916				
Amblyseius andersoni (Chant, 1957)	+			predator
A. astutus (Begljarov, 1960)	+			predator
A. finlandicus (Oudemans, 1915)	+	+	+	predator
A. herbarius (Wainstein, 1960)	+			predator
A. nemorivagus Athias - Henriot, 1961	+			predator
A. obtusus (Koch, 1839)	+			predator
A. dacus Wain., 1972*	+			predator
A. rademacheri Dosse, 1958	+			predator
A. reductus Wainstein, 1962	+			predator
A. tauricus Livschitz et Kuznetzov, 1972		+		predator
Typhloctonus formosus (Wainstein, 1958)	+		+	predator
T. sguamiger (Wainstein, 1960)	+			predator
Typhlodromus cotoneastri Wain., 1961	+	+		predator
T. pilosus Chanteius, 1959*	+			predator
T. pyri Scheuten, 1857	+			predator
Anthoseius caudiglans (Schuster, 1959)	+		+	predator
A. kazachstanicus Wain., 1961*	+			predator
A. inopinatus Wainstein, 1975	+			predator
A. rapidus (Wan. et Arut., 1968)	+			predator
Kampimodromus aberrans (Oudemans, 1930)	+			predator
K. marzhaniani Arutunjan, 1969	+			predator
Phytoseius juvenis Wan. et Arut., 1970	+			predator
P. salicis Wainstein et Arutunjan, 1970	+			predator
P. spoofi (Oudemans, 1915)	+			predator
Phytoseiulus severus Wainstein et Vartapetov, 1972*	+			predator
Seiulus simplex Chant, 1956	+			predator
S. subsimplex Arutunjan, 1972	+			predator
Paraseiulus soleiger (Ribaga, 1902)	+	+		predator

On a variety of mites are distinguished 63 species in the forest. Feature a small fleet diversity of mites (8) and protective forest plantations (10) is small in their area. The results show the value of the plant species in the dissemination, distribution, and structure of the fauna of mites in Moldova.

THE FAUNA OF MITES (ACARIFORMES ET PARASITIFORMES) APHYLLOPHOROID MACROMYCETES (CORIOLACEAE ET FOMITOPSIDACEAE) OF THE REPUBLIC OF MOLDOVA

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Introduction

This paper reflects the research of fauna and trophic affinity mites on *Trametes (Coriolus) versicolor* Quél., *Trametes (Coriolus) gibbosa* Fr. and *Fomitopsis pinicola* Karst. In the Republic of Moldova to study the fauna of mites on mushrooms neglected by researchers.

Material and methods

Saprotrophs mushrooms gathered in the reserve "Codrii" on dead wood and stumps of deciduous trees: 1. *Trametes (Coriolus) versicolor* - a perennial fruiting body, sitting, with concentric winding thin colored bands and changing color from blue-brown to brown, ocher-yellow, often with a light green edge and base. 2. *Trametes (Coriolus) gibbosa* - fruiting body sitting, cork texture, surface zonal, leather-yellow, brownish with age and covered by the touch of reddish brownish or reddish spots. Annual species grows on the trunks of imbricate tiers (vertical lines). 3. *Fomitopsis pinicola* - Perennial fruiting body, sitting, kopytoobraznoe, pincushion. The surface of the caps of various colors, from red-orange to brown and almost black near the base of the fungus, often brilliant by the presence of resinous substances (fig. 1, 2, 3).

Figura 1. *Trametes (Coriolus) versicolor* Quél.

Figura 2. *Trametes (Coriolus) gibbosa* Fr.

Mites collected from mushroom fruit bodies and places of attachment to the wood of *Quercus robur* L. and *Ctrasus avium* (L.) Moench. The species composition of mites was determined under a binocular microscope Leica CME. Photos made camera Leica D-LUX 3.

Results and discussions

The fauna of mites and fungi families Coriolaceae of Fomitopsidaceae represented families Tydeidae Kramer, 1877, Cunaxidae Thor, 1902, Laelaptidae Berlese, 1892, Ascidae Oudemans, 1905.

Figura 3. *Fomitopsis pinicola* Karst

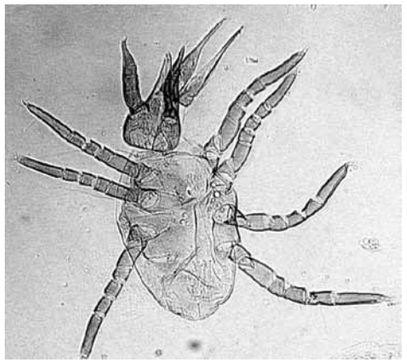

Figura 4. *Cunaxoides sp.n.*

Identified phytophagous mites *Triophtydeus immanis* Kuz., 1973, *T. flatus* Liv., 1973 (Tydeidae) and predatory mites, which have a high search activity and voracity. Predatory mites *Cunaxoides. sp.n*., *Laelaps* C.L.Koch, 1836 and *Asca von Heyden*, 1826 first discovered in Moldova (fig. 4, 5, 6).

Figura 5. *Laelaps* C.L.Koch

Figura 6. *Asca von Heyden*

The author expresses his gratitude to the staff of the reserve «Codrii» Manik Theodora in identifying mushrooms.

Conclusions

1. The fauna of mites on aphyllophoroid macromycetes represented by 5 species. 2. First recorded in the Fauna of Moldova 3 species of mites - *Cunaxoides. sp.n*., *Laelaps* C.L.Koch, 1836 *и Asca von Heyden*, 1826.

References

1. Culicova L. Review of the fauna of mites plant Moldova // Analele științifice ale Universității de Stat din Moldova. Seria "Științe chimico-biologice. Chișinău, 2005, c. 174 - 177.

GENUS *DORCADION* IN ROMANIA: AN OVERVIEW

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The genus *Dorcadion* includes longhorn beetles that inhabit grasslands with meso- to xerophylic vegetation, from steppe and forest-steppe areas to high altitude meadows. For this reason many species could be good indicators of unaltered grassland habitats. The diversity of the genus is high, more than 40% of European Cerambycidae representing *Dorcadion* taxa (with *Iberodocadion* included as a subgenus).

Unfortunately, the genus *Dorcadion* represents the perfect candidate to enter the so-called species extinction vortex (Gilpin & Soulé 1986) as species of this genus present the three premises leading to a high vulnerability: low dispersal power, restraint geographic distribution and ecological specialisation. Most species extinct during the past decades are insects and it is estimated that in the next 50 years for every million insect species existing on Earth, 57000 will become extinct (Dunn 2005). The world biodiversity crisis is in fact an insect biodiversity crisis, but this is largely ignored. Several *Dorcadion* species are declared vulnerable and included in red lists in countries such as Switzerland, Germany, Poland, Ukraine, Hungary, Spain (e.g. Baur 2002; Mazur 2004; Verdu & Galante 2005) and one subspecies endemic to Hungary is included in Anexes II and IV of UE Habitat Directive. The high vulnerability of this species is due to the almost complete destruction of natural meadows in the steppe and forest-steppe zones by overgrazing or their transformation in agricultural lands but also to overgrowing of the remaining habitats with woody plants as the result of secondary succession or inadequate afforestations (Mazur 2004). Unfortunately this is the case all over Europe and Romania is not an exception.

According to Panin & Savulescu (1961) in Romania occurs 11 species of *Dorcadion*. Recently a new species of this genus was described from Romania and Bulgaria (Sama, Dascălu & Pesarini 2010) and another one is confirmed to be present in our fauna after more than 100 years since the last publication - quite surprising as European Cerambycidae are one of the best known groups of insect. There are no studies regarding the spatial distribution, habitat requirements or studies that quantify the influence of habitat fragmentation and hence spatial and genetic isolation of populations on species' fitness. Such studies are imperiously necessary because: (1) for several species Romania represents the limit of the distribution area, this type of distribution making the species extremely vulnerable locally - *Dorcadion e. equestre*, *D. holosericeum*, *D. pusillum*; (2) other taxa are endemic in our country - *D. pusillum berladense*, found only in several localities from S-E Romania and *D. l. litigiosum*, with very limited distribution only in Dobruja; (3) other species have a restraint distribution area, the main effectives being present on Romanian territory - *D. murray* (distributed only in Romania and several localities in Serbia) and *D. equestre transsylvanicum*. Another threatened species is *D. decipiens*, included in the Hungarian red book; its presence in our country being uncertain.

Even if there are no official data, our preliminary information suggest that many of these species are threatened. Without a systematic research regarding the rate of population decline and habitat loss, part of them might disappear in the future from the natural inheritance of our country (local extinction) or, in the case of endemic species, a global extinction might take place.

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References

Baur, B., Zschokke, S., Coray, A., Schläpfer, M. & Erhardt, A. (2002) Habitat characteristics of the endangered flightless beetle *Dorcadion fuliginator* (Coleoptera: Cerambycidae): implications for conservation. *Biological Conservation* 105: 133-142.

Dunn, R. R. (2005) Modern Insect Extinctions, the Neglected Majority. *Conservation Biology* 19(4): 1030-1036.

Gilpin, M. E. & Soulé, M. E. (1986) Minimum viable populations: processes of species extinction. In: Soulé M. E. (eds.). *Conservation biology: the science of scarcity and diversity*. Sinauer, Sunderland, MA, pp. 19–34.

Panin S. & Săvulescu N. (1961) Insecta. Coleoptera, Fam. Cerambycidae, Fauna R.P.R. X(5), Ed. Academiei R. P. R., București, 523 pp.

Mazur, M. (2004) *Dorcadion scopoli* (Herbst, 1784). In: Glowacinski Z., Nowacki J. (eds.) *Polish Red Data Book of Animals, Invertebrates*. Varsovia.

Verdú, J.R. & Galante E. eds. (2005) *Libro Rojo de los Invertebrados de España*. Dirección General de Conservación de la Naturaleza, Madrid, 410 p.

Sama, G., Dascalu, M.M, Pesarini, C . Description of *Dorcadion gashtarovi* n.sp. (Coleoptera, Cerambycidae) from Romania and Bulgaria with review of the closely related species. 2010, North West. J. of Zoology, 6(2), p. 286-293

AQUATIC BUGS (INSECTA, HETEROPTERA) FROM THE REPUBLIC OF MOLDOVA

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Aquatic (water) bugs are the important component of insect fauna in the reservoirs and playing an appreciable role in aquatic biocoenoses. As consumers, they (in the majority part) are predators and eat various water invertebrates, caviar and larves of the fishes, the insects which have fallen off in water, on the other hand – serve a forage reserve for fishes and other water animals (Kanyukova, 2006).

Before our researches of the information on water bugs of Republic Moldova occured only in several faunistic works: Bezvali, 1932; Jansson, 1986; Slastenenko, 1928. In our first work (Derzhansky, 1984) the list including 31 species of aquatic bugs has been published. Results of further investigations on regional water bugs are reflected in various articles on their fauna (Derjanschi, 1995, 2009; Derjanschi, Matocq, 2005; Derzhansky, 1987, 1997) and ecology (Derjanschi, 2008; Derzhansky, 1993).

Below the final list reflecting a state of the condition of a level of scrutiny of aquatic bugs fauna, in view of all taxonomics variations of occured in recent years is resulted (Aukema, Rieger, 1995).

Family NEPIDAE

Nepa cinerea Linnaeus, 1758; *Ranatra (Ranatra) linearis* (Linnaeus, 1758)

Family CORIXIDAE

Micronecta (Micronecta) griseola Horváth, 1899; *M. (Dichaetonecta) pusilla* (Horváth, 1895); *M. (D.) scholtzi* (Fieber, 1860) (=*meridionalis* A.Costa); *Cymatia coleoptrata* (Fabricius, 1777); *C. rogenhoferi* (Fieber, 1864); *Callicorixa praeusta* (Fieber, 1848); *C. denticeps* Thomson, 1869; *Corixa punctata* (Illiger, 1807); *Hesperocorixa linnaei* (Fieber, 1848); *Paracorixa concinna* (Fieber, 1848); *Sigara (Helicorixa) stagnalis* (Leach, 1817); *S. (Pseudovermicorixa) nigrolineata* (Fieber, 1848); *S. (Retrocorixa) semistriata* (Fieber, 1848); *S. (R.) limitata* (Fieber, 1848); *S. (Sigara) striata* (Linnaeus, 1758); *S. (S.) assimilis* (Fieber, 1848); *S. (Subsigara) falleni* (Fieber, 1848); *S. (Vermicorixa) lateralis* (Leach, 1817)

Family NAUCORIDAE

Ilyocoris cimicoides (Linnaeus, 1758)

Family APHELOCHEIRIDAE

Aphelocheirus (Aphelocheirus) aestivalis (Fabricius, 1794)

Family NOTONECTIDAE

Notonecta (Notonecta) glauca Linnaeus, 1758; *N. (N.) viridis* Delcourt, 1909; *N. (N.) lutea* Müller, 1776

Family PLEIDAE

Plea minutissima Leach, 1817

Family MESOVELIIDAE

Mesovelia furcata Mulsant et Rey, 1852; *M. thermalis* Horváth, 1895

Family HEBRIDAE

Hebrus (Hebrus) pusillus (Fallén, 1807); *H. (Hebrusella) ruficeps* Thomson, 1871

Family HYDROMETRIDAE

Hydrometra gracilenta Horváth, 1899

Family VELIIDAE

Microvelia (Microvelia) reticulata (Burmeister, 1835); *M. (M.) buenoi* Drake, 1920 (=*umbricola* Wrobl.); *Velia (Plesiovelia) caprai* Tamanini, 1947

Family GERRIDAE

Limnoporus rufoscutellatus (Latreille, 1807); *Aquarius paludum* (Fabricius, 1794); *Gerris (Gerris) lacustris* (Linnaeus, 1758); *G. (G.) odontogaster* (Zetterstedt, 1828); *G. (G.) argentatus* Schummel, 1832; *G. (G.) thoracicus* Schummel, 1832

Thus, in the fauna of insects of Republic Moldova, at the given stage of its studying, the ecological group of water bugs is presented by 40 species from 11 families.

References

Aukema B., Rieger Chr. Catalog of Heteroptera of the Palaearctic Region. V. I. Amsterdam, 1995. 222 p.

Bezvali V. Hemipteres de Bessarabie. – Bull. Muz. de Istor. Natur. din Chișinău. 1932, 4. P. 45-52.

Derjanschi V. Completare la fauna heteropterelor (Hemiptera) din R.Moldova. – Bul.A.Ş. R.M. Ştiin.biol. şi chim. 1995, 4. P.32-33.

Derjanschi V. Investigation of bug fauna (Hemiptera: Heteroptera) by light traps in Republic of Moldova. – Muzeul Olteniei Craiova. Oltenia. Studii și comunicări. Științele Naturii, vol. XXIV. Craiova, 2008. P. 65-70.

Derjanschi V. Heteropterian diversity (Insecta, Heteroptera) in the „Prutul-de-Jos" Scientific Reserve. – Muzeul Olteniei Craiova. Oltenia. Studii și comunicări. Științele Naturii, vol. XXV. Craiova, 2009. P. 74-77.

Derjanschi V., Matocq A. Contribuții la cunoașterea faunei heteropterelor (Insecta, Hemiptera) din Republica Moldova. – Anal. şt. Univ. Stat. Moldova. Ser."Şt. chim.-biol.", 2005. P. 182-183.

Derzhansky V.V. The fauna of aquatic bugs (Heteroptera) from Moldavia. – Izv. of Academy of MSSR. Ser. biol and chem. scien. 1984, 2. P. 74-75. [In Russian]

Derzhansky V.V. News and rares species of bugs (*Heteroptera*) from Moldavia. – Izv. of Academy of MSSR. Ser. biol and chem. scien. 1987, 3. P.46-49. [In Russian]

Derzhansky V. Flight of bugs on light traps in Moldavia. – Uspechi entomologii v SSSR / Materials of the X Congres of U.E.S., 11-15 September 1989. St.-Petersburg, 1993. P. 119-120. [In Russian]

Derzhansky V.V. List of the Heteroptera of the Republic of Moldova. St.-Petersburg. 1997. 22 p.

Jansson A. The Corixidae (Heteroptera) of Europe and some adjacent regions. – Acta entomol. Fenn. 1986, 47. 94 p.

Kanyukova E. V. Aquatic and semiaquatic bugs (Heteroptera: Nepomorpha, Gerromorpha) of the fauna of Russia and neighbouring countries. Vladivostok: Dal'nauka, 2006. 297 p. [In Russian]

Slastenenko E. Note on *Aphelocheirus aestivalis* in the Dniester. – Russk. gidrobiol. zhurnal, 1928, 7(10-12). P. 263-264. [In Russian]

PERMACULTURE AND ENERGY EFFICIENT TECHNOLOGIES

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Energy-saving technologies developed in Australia 20 years ago. Permaculture is studying the relationship of nature and modern agriculture, high yields in a small area, the rational selection of crops in different soil types to meet the essential needs of man.

The aim - to create a system, which is environmentally and economically viable.

The problem - the use of the characteristic qualities of crops, combined with the natural characteristics of landscapes.

Principles:

1. Cultivation of crops with minimum tillage, the use of earthworms in the open field and greenhouses.
2. The multifunctional use of plants: planting trees on slopes to prevent landslides, basketry and so on.
3. Use and conservation of water: drip irrigation (outdoors, greenhouse), rain water (artificial pond bottom is lined with foil and pump the warm water fed to the beds).
4. Preservation of solar energy: batteries on the roof of the house, hand-held lanterns with solar batteries, solar oven.
5. Sowing (planting) of cultivated plants in their compatibility to take into account (Table 1).
6. The use of green manure - compost and fermentation.
7. Design: Vertical layout and helter-skelter, location of trees, shrubs and herbaceous plants, combined with the boulder.
8. Use of environmental conditions (microclimate) of a certain place for the conservation of natural resources, building a wall on the north side of the field and garden.
9. Energy efficient planning for house& settlement (zones & sectors & elevation planning).
10. To reduce the cost of production.

Table 1 Compatibility of cultivated plants

Cultivated Plants	Companion	Antagonist
Asparagus	Tomatoes, parsley, basil	
Beans	Potatoes, carrots, cucumbers, cabbage, corn, corn, strawberries, celery	Onions, garlic
Beet	Onions, kohlrabi	Polish bean
Different types of cabbage	Potatoes, celery, fennel, chamomile, peppermint, sage, rosemary, beets, onions	Tomatoes, strawberries, beans Polish
Carrots	Peas, lettuce, onion, rosemary, sage, tomatoes	Dill
Celery	Leeks, tomatoes, beans, cabbage	
Cereals	Potatoes, peas, beans, cucumbers, squash, zucchini	
Cucumbers	Beans, grains, corn, peas, radish, sunflower	Potatoes, aromatic herbs
Eggplant	Beans	
Leek	Onions, celery, carrots	
Lettuce (chive)	Carrot, radish, radishes, strawberries, cucumbers	
Onions, garlic	Tomatoes, beets, lettuce, strawberries	Peas, beans
Parsley	Tomatoes, asparagus	
Peas	Carrots, turnips, radishes, cucumbers, corn, beans - most vegetables edge of the field	Onions, garlic, potatoes
Potatoes	Beans, corn, cabbage, eggplant, zucchini. Marigolds, marigolds - planted in the corners of the site	Squash, pumpkins, tomatoes, cucumbers, sunflowers, raspberries
Pumpkin	Grain	Potatoes
Radish (radish)	Peas, lettuce, cucumbers. Nasturtium, nasturtium - are planted along the edge of the beds	
Spinach	Strawberry	
Squash, pumpkin	Nasturtium, corn	
Sunflower	Cucumbers	Potatoes
Tomatoes	Onions, parsley, asparagus, carrots. Marigolds, marigolds, nasturtiums - are planted along the edge of the beds peas	Kohlrabi, potatoes, fennel, cabbage
Turnip	Beans	
Strawberry	Spinach, borage, salad	Cabbage
Soybean	Planted with various plants	
Polish bean	Grain. Savory, satureya - planted on the	Onions, beets, kohlrabi

The author - the only representative of Moldova participated in the period from 1999 to 2002 in the drafting of The Devon Permaculture Education Project in Great Britain (Department for International Development) in Braziers College and Wales.

The author has used in the experiments energy-saving technologies in the following cultivated plants: potatoes - raw potatoes ground laid out at a distance of 30 cm from one another and filled with straw on top 15 - 20 cm layer of cultivated plants (squash, cabbage, parsley, etc.) grew from weeds.

The problem of plant protection products were bare slugs, which were collected by arms, because they do not use chemicals, planted crops companion. In the fields left areas with naturally growing shrubs and herbaceous plants, where the nesting birds that destroy insects. In the climatic conditions of Britain (Wales) vegetables - tomatoes, cucumbers, peppers, grapes grown in greenhouses, using drip irrigation.

Permaculture - a conscious design and maintenance of agricultural ecosystems, which differ in stability and resilience of natural systems.

A special thanks, I extend my project managers George Sobol, Patsy Garrard and Andrew Langford.

Literature

1. Rodale Prcss. Organic gardening and farming // Wallingford, 1972, p. 30.

2. Patsy Garrad & George Sobol. Terra Firma – permaculture design & teaching // Croydon, 1998, p. 50.

INFLUENCE OF BIOLOGICALLY ACTIVE SUBSTANCES OF PLANT ORIGIN ON ENTOMOPHAGES

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Increase of productivity of agricultural plants is one of the main tasks of the soil management. However deterrence of harmful organisms' population by means of the intensive application of chemical means led to a decrease in species diversity in agricultural ecosystems. As a result, they turned into mono-specific and thus instable ones. It was one of the reasons of considerably increased population density of some phytophage species that did not cause any significant damage to agricultural crops before. One of the striking examples is the increased harmfulness of *Heliothis armigera* Hbn. (*Lepidoptera: Noctuidae*) in conditions of Moldova.

In these circumstances, orientation to alternative protection means that allow to obtain biologically adequate agricultural products with minimal damage to biological and agricultural cenosis is required.

One of the perspective alternative means is the application of plant extracts containing the biologically active substances with insecticidal, acaricidal, antifeedant and deterrent properties. Earlier as a result of the laboratory researches and field testing, it was established that the biologically active substances, contained in the extracts of *A.altissima*, *V.vinifera* and *Juniperus* sp., had a high insecticidal (48,1-100%) and antifeedant (1-2 points) activity against larvae of *Leptinotarsa decemlineata* Say (*Coleoptera*, *Chrysomelidae*). There arose the necessity to define the influence of these plant extracts on useful entomofauna.

The objective of our researches consisted in an assessment of influence of the biologically active substances extracted from the species *Aillanthus altissima* (Mill.) Swingle (*Simaroubaceae* family), *Vitis vinifera* L. (*Vitaceae* family) and *Juniperus* sp. (*Lamiaceae* family) on some entomophage species.

Collection, drying and crushing of plant raw material, as well as extraction of the biologically active components was carried out according to the standard methods [1, 2]. The extracts were tested at a concentration of 2,5% of dry substances (hydroalcoholic solution) in a dose of 7,5 l/ha. As a standard 0,1% extract of *Veratrum lobelianum* Bernh. (a.s. - amount of alkaloids on conversion to protoveratrine 40 g/l) and the insecticide "Confidor-Maxi 70WG" were used. Testing of the extracts was carried out on potatoes of "Lord" variety with medium maturation time and tomatoes (seed planted) of "Rio-Grande" and "Orion" varieties with medium maturation time.

Influence of the extracts on *Chrysopa carnea* [*Chrysoperla carnea*] Steph. (Neuroptera: *Chrysopidae*), *Coccinella septempunctata* Linnaeus (*Coleoptera*: *Coccinellidae*) and *Zicrona caerulea* (L.) (*Heteroptera*: *Pentatomidae*) has been detected. Population of plots for the 1st, 3rd, 7th, 14th, and 21st day was considered according to the standard methods [2]. The obtained results were processed by means of the method of one-factor dispersive analysis using Microsoft Excel package.

Results

As a result of our field tests, it was established that the population of entomophages (*C.carnea*, *C.septempunctata*, *Z.caerulea*) within the plots treated by means of the plant extracts remains at the control level and definitely significantly exceeds the number in the chemical standard (1,2-3,2 times).

Thus, as a result of records, it was not detected the destruction of larvae or imagoes of *C.carnea* and *C.septempunctata* after the treatment of potato bushes by means of plant extracts. Besides, the presence of recent ovipositions, laying of normal larvae and further normal nutrition, development and pupation of larvae of both predator varieties were noted.

According to our observations, the population of entomophages of *C.septempunctata* and *C.carnea* on potato bushes treated by means of the extracts was at the same level as in the control during the 21st day of reporting period. Thus, three days after the treatment average number of *C.carnea* in the control and in the test was 0,1 eggs per bush, but 7 days after the number of eggs in the test and in the control reached to 0,3 eggs per bush. The number of larvae of *C.septempunctata* in the chemical standard was 0,15 individuals per bush after the 7th day, whereas their number in the test and in the control reached to 0,35-0,45 individuals per bush.

At the same time, a day after treatment there was no imago or larva of *C.carnea* and *C.septempunctata* at the standard plot, as well as there were not noted the new cases of oviposition by these species of insects during the first 6 days. New ovipositions of *C.carnea* in the chemical standard were observed only on a 7 day after the treatment (0,07 eggs per bush).

Two weeks after the treatment the number of entomophages in the test as well as in the control increased. The number of *C.carnea* in the control and in the test was at the average 0,9-1,0 eggs per bush, and ladybirds (*C.septempunctata*) – 2,3-2,9 larvae and pupa per bush. At the same time, in the chemical standard the number of eggs of *C.carnea* was 1,2 times lower and the number of larvae and pupas of *C.septempunctata* - 1,8 times lower than in the control and in the test.

Simultaneously, it was established that during the development of the first generation of Colorado potato beetle on potatoes only a few individuals of imagoes and larvae of *Z.caerulea* were observed. As well there was established that at 100 registration plants at the average from 1 till 3 ovipositions of *Z.caerulea* are occurred. However, the number of *Z.caerulea* within all plots (except for the standard plot) has considerably increased by the beginning of the development of the second generation of Colorado potato beetle. It was detected that imagoes and larvae of *Z.caerulea* prefer to eat larvae of *L.decemlineata* of younger ages. Our observations showed that imagoes of *Z.caerulea* not only eat on treated plants, but also copulate and oviposit in these conditions. It was determined that 21 days after the treatment the number of larvae and imagoes of *Z.caerulea* within plots treated by means of plant extracts exceeds 2 times those in the chemical standard and was definitely compared with the control.

As a result it was noted that on potato bushes treated by means of extracts of *A.altissima*, *V.vinifera* and *Juniperus* sp., as well as the plant standard of *V.lobelianum*, the number of entomophages remains at the same level as in the control and significantly (1,2-3,2 times) exceeds the number of entomophages in the chemical standard.

Thus, we determined that the treatment of potato bushes using the plant extracts does not reduce the number of entomophages of *C.carnea*, *C.septempunctata* and *Z.caerulea*, that allows to regulate the number of an insect harmful for *Solanaceae* - Colorado potato beetle - and keeping the natural balance of the ecosystem.

Bibliography

1. State Pharmacopoeia of USSR. The 11th Edition. Moscow: Medicine, 1989. Page 386.
2. D. Elisovetskaya, T. Nastas. The biologically active substances of plant origin as ecologically safe protection means (Биологически активные вещества растительного происхождения в качестве экологически безопасных средств защиты). In: "Biological plant protection – a basis of ecosystems stabilizing". Material Report for the International Research and Practice Conference, All-Russian Research Institute of Biological Plant Protection, Krasnodar, 2008, Edition 5, pages 337-339.

THE DIVERSITY OF PARASITE FAUNA IN CATTLE OF VARIOUS AGES IN THE REPUBLIC OF MOLDOVA

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The parasitosis in animals are largely spread (reaching sometime the level of 100%) and cause the considerate economical prejudices in zoo technical sector. The presence of pathogenic agents of parasite diseases in animals provoke essential changes in metabolism, digestive system, negatively influences the capacity of food assimilation that provoke attenuation of the organism, decrease of milk production and body weight gain, perforating the skin (Hipodermosis), and in some cases – even the death of the animals. One of the important factor is that parasitic diseases are dangerous not only for animals but also for humans, some of these diseases could not be treated. The presence and circulation of pathogenic agents in the organism of humans and animals considerably reduces the immunologic resistance of their organisms, that provokes during vaccination process the crisis in immune response, while becoming sensibilized for pathogenic agents of infections that lead further to various important consequences for public health but also for national economy (Bondari, 1995; Safiulin, 1997; Zgardan et al., 1999; Erhan et al., 2007; etc.).

In order to evaluate the diversity of parasitizes, the probes from cattle of different ages and from households placed in the central and northern part of Republic as well those purchased by the Meat-packing Plant from Chişinău city.

The results of the conducted parasitological study on cca 800 cattle revealed that young cattle (23-25 months) purchased from the households have been more frequently infested with sarcocysts (76,2%), dicrocelium (54,5%) and strongiloidosis (50,0%), and adult cattle – with sarcocysts (97,3%), echinococcus (68,0%), dicrocelium (57,6%) and fasciola (48,8%), while the extensivity of mixt invasion was nearly 100%. Calves aged up to one month have been infested with eimeria in 29,2% cases, aged 2-4 months - 67,6%, 6-8 months - 71,9%, 12-14 months - 79,0%, 23-25 months - 55,7%, and adult cattle have been infested in 40,3% of cases. Up to now, 4 species of eimeria have been established: *Eimeria bovis, E. zuernii, E. smithi şi E. ellipsoidalis. E.bovis* seems to be dominating in fauna of eimeria species.

Comparing the literature data on conducted in 1960-1970 parasitological research in Moldova with results of proper recent research data, there was established that no essential modifications of the level of infestation in cattle, yet the extensivity of some parasitizes (mostly biohelmintosis), have been increased.

Unfortunately, in veterinary practice the parazitosis are considered as monoinvasion, and the parasitic associations remain unexaminated properly. The results of the own investigations show that phenomena of poliparasitism formed by 6 species, in which the following associations are dominating: fascioles, dicrocelium, echinococcus, strongiloides, eimeria and sarcocistes, in 6,8% cases, of 5 species of parasits (fascioles, dicrocelium, strongiloides, eimeria, sarcocistes) - in 10,6% of cases, from 4 species (dicrocelium, strongiloides, eimeria, sarcocistes) - in 18,5%, from three species (most frequently the following association have been formed: strongiloides, eimeria and sarcocistes; dicrocelium, eimeria and sarcocistes; fasciole, dicrocelium and sarcocistes etc.) – in 34,1% of cases and from two species of parasits (dicrocelium and strongiloides, fascioles and echinococcus, strongiloides and eimeria etc.) - in 23,6% of cases.

As the parasitological research show, helmint-protozoic parasitocenosis are quite commonly spread in cattle and these could be used in realization of treatment and profilactics measures in households of the Republic of Moldova.

The preliminary calculations of the annual economical losses on the republican caused by the parasitic diseases of cattle, according to scientific estimations and data related only to descries in milk production in cattle and loss of daily weight in young cattle reveals about 1,6 milliards of Moldovan lei. These losses may be prevented only through implementation of a complex program of prophylactic and combating measures applied to parasite diseases. Certainly that economical losses caused by parasitic diseases in domestic are not significant. Being this said, the generalization of experimental data related to the losses caused to zootechnical sector requires continuous monitoring necessary for the decision making on the prophylactic and treatment measures. The losses provoked by parasitic diseases in animals with those related to public health are hardly to compare. Many of such invasions are hardly diagnosticated in humans, are not identified during long period of time and practically not treated successfully, that finally cause invalidity and even death of humans.

In this way, the changes that appeared in the zootechnic sector, the dislocation of the cattle from the complexes and farms to the private sector, along with their pasturing on the limited spaces common for diverse species and diverse ages animals have essentially contributed to an increase of extensivity of invasions with various parasitic agents. The conducted investigations allow to conclude that cattle are exposed to high level of infestation by various species of endoparasites in the form of mono- and polyinvasions, and in some cases it reaches 100%. The effective methods of prophylactics and treatment may be elaborated only after a profound research of the sistematics, biology and ecology of parasite fauna, the types of interconnections between the parasitocenosis components as well as their influence on the hosting organism.

INTEGRATED TAXONOMY AND SMALL PARASITIC WASPS

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We argue that without an integrated approach to microhymenoptera taxonomy it is difficult to achieve a realistic classification at species level. This is especially important for parasitoid species used in biological control, where a reliable and rapid identification is the basis for choosing the appropriate species and assessing the outcomes of such programs. Recent studies are evidence that many parasitoid species that where traditionally considered polyphagous, polymorphic and widespread have been shown by molecular,

allozyme, cytogenetic and morphometric studies to represent complexes of more or less host specialized cryptic species (e.g. Bernardo et al. 2008; Dawah et al. 2002; Gebiola et al. 2009; Kankare et al. 2005). Using several genera in Eupelmidae, Encyrtidae (Chalcidoidea) and Scelionidae (Platygastroidea) as model groups we discuss the problem of cryptic species, their discovery and recognition. A cytogenetic investigation of the European *Eupelmus* (*Macroneura*) (Fusu 2008a,b) lead to the discovery of several cryptic species and this finding was further investigated using allozyme electrophoresis, morphometric and host preference data (Fusu 2010). Current research in this direction includes addition of more molecular data using DNA sequence analysis and a comprehensive revision of the subgenus in Europe based on an integrated approach. From this example and those mentioned above it seems that cryptic species, in the sense that they are overlooked or wrongly synonymysed (not that they are indistinguishable morphologically), are quite frequent among parasitic hymenoptera. An interesting situation is that of the superfamily Platygastroidea where there are very few studies involving combined use of genetic, morphological and biological data but there is strong evidence that species concepts (especially in the Palaearctics) lack a solid base. Beside the lack of reliable morphological characters, primary types of many species are not yet located; although this is a serious problem in many other groups, it is especially severe in Platygastroidea, where many species where described by J.J. Kieffer, whose specimens are scattered all other the world. From these reasons modern authors have diverging and sometime clearly wrong opinions on the identity of many taxa. For example in the genus *Macroteleia* from the 22 described Palaearctic species only three have been synonymysed (Kononova & Kozlov 2008), which is rather odd for a group with such a high variability and lack of reliable diagnostic characters. Clearly, this group needs an integrated taxonomic approach in order to be adequately resolved.

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References

Bernardo U., Monti M.M., Nappo A.G., Gebiola M., Russo A., Pedata P.A., Viggiani G. 2008. Species status of two populations of *Pnigalio soemius* (Hymenoptera: Eulophidae) reared from two different hosts: an integrative approach. Biological Control 46:293–303.

Dawah H.A., Al-Haddad F.H., Jervis M.A. 2002. Morphological and biological characterization of three closely related species of *Pediobius* Walker (Hymenoptera: Eulophidae). Journal of Natural History 36:423–433.

Fusu L 2008a. A cytogenetic investigation of a polyphagous species: first evidence that *Eupelmus vesicularis* is complex of species with different life histories and ecological preferences. Abstr Bookl BEPAR Workshop 5–6 June 2008 Inst Evol Biol Univ Edinb, UK.

Fusu L. 2008b. The usefulness of chromosomes of parasitic wasps of the subfamily Eupelminae (Hymenoptera, Chalcidoidea, Eupelmidae) for subfamily systematics. European Journal of Entomology 105:823–828.

Fusu L. 2010. Species status of two colour morphs of *Eupelmus vesicularis* (Hymenoptera: Eupelmidae) as revealed by allozyme electrophoresis, morphometric and host preference data. Journal of Natural History 44 (17-18): 1113-1129

Gebiola M., Bernardo U., Monti M.M., Navone P., Viggiani G. 2009. *Pnigalio agraules* (Walker) and *Pnigalio mediterraneus* Ferrière and Delucchi (Hymenoptera: Eulophidae): two closely related valid species. Journal of Natural History 43:2465–2480.

Kankare M., Stefanescu C., van Nouhuys S., Shaw M.R. 2005. Host specialization by *Cotesia* wasps (Hymenoptera: Braconidae) parasitizing species-rich Melitaeini (Lepidoptera: Nymphalidae) communities in north-eastern Spain. Biol J Linn Soc. 86:45–65.

Kononova S. V., Kozlov M. A. 2008. [Scelionids of the Palearctic (Hymenoptera, Scelionidae). Subfamily Scelioninae]. Tovarishchestvo Nauchnykh Izdanii KMK, Saint Petersburg, 489 p.

Polaszek A., Manzari S., Quicke D.L.J. 2004. Morphological and molecular taxonomic analysis of the *Encarsia meritoria* species-complex (Hymenoptera, Aphelinidae), parasitoids of whiteflies (Hemiptera, Aleyrodidae) of economic importance. Zool Scr. 33:403–421.

THE SCELIONIDS (HYMENOPTERA, *SCELIONIDAE*) FROM THE REZERVATION "CODRII"

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The reservation "Codrii" represents the eastern border of the deciduous forests of Central-european type, in which are present all the typical forest ecosystems. The results of investigations in this area allowed obtaining more detailed information about the fauna and the diversity of family *Scelionidae*, which has a particular importance to the destruction of many forest pests even from the egg stage.

The study on the family *Scelionidae* was prepared on the basis of the material collected during 6 years of the vegetation period of several biotopes as: meadows, flood plains, selvedges, adjacent stations.

The species from family *Scelionidae* were collected by using the traditional entomological method, the entomological net and exhauster. On the territory of the reservation "Codrii" from the family *Scelionidae* were identified 31 species from 11 genera. The following species were identified: *Scelio inermis* (Zetterstedt, 1838), *Scelio rugosulus* Latreille, 1908, *Probaryconus spinosus* Kieffer, 1908, *Psilanteris bicolor* Kieffer, 1908, *Gryon fasciatus* Priesner, 1951, *Gryon exculptus* Forster, 1861, *Gryon muscaeformis* Nees, 1834, *Eremioscelio ukrainica* Kozlov&Kononova, 1990, *Idris coxalis* Kieffer, 1912, *Trimorus pallidimanus* Kieffer, 1908, *Trimorus arenicola* Thomson, 1859, *Trimorus autumnalis* Thomson, 1859, *Trimorus bohemicus* Masner, 1962, *Teleas rugosus* Kieffer, 1908, *Teleas reticulatus* Kieffer, 1908, *Teleas lamellatus* Szabo, 1956, *Teleas quinquespinosus* Szabo, 1956, *Platytelenomus danubialis* Szeleny, 1939, *Trissolcus grandis* (Thomson, 1860), *Trissolcus rufiventris* (Mayr, 1908), *Trissolcus viktorovi* Kozlov, 1968, *Trissolcus flavipes* (Thomson, 1860), *Trissolcus djadetshko* (Rjachovsky, 1959), *Trissolcus volgensis* (Viktorov,1964), *Trissolcus simoni* (Mayr, 1879), *Telenomus chloropus* (Thomson, 1860), *Telenomus acrobates* Giard, 1895, *Telenomus punctatissimus* (Ratzeburg, 1844), *Telenomus tetratomus* Thomson, 1860, *Telenomus hofmanni* Mayr, 1879, *Telenomus heydeni* Mayr, 1879.

Most of the species were found in meadows and selvedges, the species *Scelio rugosulus* Latr., *Trimorus pallidimanus* Kieff., *Trimorus arenicola* Thom., *Trissolcus grandis* (Thom.), *Telenomus acrobates* Giar., *Telenomus chloropus* (Thom.) were present in all the studied biotopes with the greatest numbers of samples.

ASSESSMENT OF THE STORED PRODUCT MOTHS BIOLOGICAL CONTROL TECHNOLOGY

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The damage caused by the insects to the agricultural products has a great economic importance. There have been undertaken numerous and various investigations, relating to this issue, therefore, it was realized a series of synthesis papers of general and systematic nature concerning to this group of insects. Studies on the biology and ecology of the incest pests of the stored cereal products have been published by Evans, 1987. A major concern in the protection of the stored agricultural products is the biological control of the insect pests. A series of the scientific papers have been elaborated by many authors on the use of the parasitic hymenoptera in the biological control of the insect pests of the stored agricultural products. To control the complex of flour pests there have been performed the experiments with three species of *Trichogramma - T. deion, T. ostriniae, T. pretiosum* in the laboratory conditions for control of *Plodia interpunctella* (Mattheew J. M. Greishop, P. Flinn J. Nechols, F. James, 2008). The researches on application of the biological protection of stored pests control with the different species of entomophages - *Trichogramma pretiosum* and *Bracon hebedor* have been realized by Brower, 1988, 1990. The works of these authors demonstrated the real possibility of application of the entomophages (*Trichogramma* and *Bracon*) in the control of the moth product pests as one of the main elements of the integrated protection of the stored food products. The approach to the integrated protection strategy of the stored food products is well reflected in the work of the authors Todiraş V., Tretiacov T., Balan Iu., 2009.

There is a large complex of the pests in the warehouses: *Calandra granaria L.*, *Sitophilus granarius L.*,

Acarus siro L., Sitotroga cerealella O., Tinea granella L., Plodia interpunctella H., Ephestia elutella H., Ephestia kuhniella Z. etc. Against these pests are used the different control methods: biological, chemical controls, fumigation, the use of pheromones, acoustic methods, thermal methods, application of plant products, gamma radiation, animal pests etc.

The objective of the studies: Evaluation of the application technology of *Trichogramma pintoi* V. and other elements of biological protection in control of the stored product moths.

During the years 2009-2010 the experiments were carried out in grain warehouse from Chisinau. The evidence of the pests in storage was carried out on the entire surface of the investigated territory by means of application of the main techniques for monitoring inspections: inspections, sampling, temperature monitoring, and usage of pheromone traps.

In order to determine the presence and numerical density of the various species of moths in the grain store were mounted the pheromone traps for: *Ephestia kuhniella* Zell., *Plodia interpunctella Hubn*. and *Ephestia elutella Hubn.* The monitoring of the moths by using of the pheromone traps (Fig. 1) during the storage of cereal products was carried out from 18th of May till 20th of May 2010. As a result of records of moths from traps, the following species were found out in the warehouse: *Ephestia kuhniella,* which vary from 8.0 till 80.0 individuals and *Plodia interpunctella* from 1.0 till 5.0 individuals in a pheromone trap at the Mill No.1. At the mill No. 2 *Ephestia kuhniella* from 7.0 till 86.0 individuals were caught in a trap, *Plodia interpunctella* varied from 1.2 till 3.0 individuals. In the elevator (grain store) *Ephestia kuhniella* were caught in a trap in average from 2.0 till 10.0 individuals, *Plodia interpunctella* varied from 5.0 till 79.0 individuals. In the flour storage were caught in a trap from 17.7 to 109.0 *Ephestia kuhniella* individuals, but the *Plodia interpunctella* varied from 3.0 till 7.0 individuals. In elevator No. 2 - wheat warehouse, which served as a control - were caught in a trap from 3.0 till 9.0 *Ephestia kuhniella* individuals, *Plodia interpunctella* varied from 19.0 till 139.0 individuals. The difference of the average is essential. *Ephestia elutella* was not captured in the pheromone traps. In the flour mills predominate *Ephestia kuhniella*, but in the elevator - *Plodia interpunctella*. The average temperature from the 18th of May till the 20th of august 2010, varied from 18.5ºC to T = 28°C.

Determination of the numerical density of moths in the cereal products storehouse.

To identify the strategies that would ensure the protection of the stored cereals stocks, the first requirement is the knowledge of the diversity of the pests existing in storehouse. To realize this program of the moths control with *Trichogramma pintoi* was necessary to determine the species and numerical density of moths' complex from the gain storehouse from Chisinau. To determine the density of moths' complex (number of larvae) within the grain warehouse and the wheat elevators were collected of 9 samples from the different places in each store for every record.

Determination of the numerical density of moths in the grain mill was made according to Todiraş V., Tretiacov T., Balan, I., (2009).

For *T. pintoi* the biological indices were: a prolific female-31.9-a female egg, exclusion of the individuals - 91.6%, female share -60.4%, static criterion of the quality -17.4.

After determining of the pest density it was determined the biological efficacy of *T. pintoi* in the control of moths *Ephestia kuhniella* and *Plodia interpunctella* in storehouses. The entomophage *T. pintoi* was used as one of the important elements in the integrated protection of cereal products. Entomophage *T. pintoi* was launched in capsules. The records of the bags of cereal products, walls, windows, equipment in the warehouse were realized, and then *T. pintoi* launched. During experiments, *T. pintoi* has been launched six times and were realized seven records before and after the launch of the moths *Ephestia kuhniella* and *Plodia interpunctella*.

The biological efficacy of *T. pintoi* after each launch was determined taking into consideration the number of moth larvae from the samples of wheat flour. The biological efficacy of *T. pintoi* was determined by the formula:

E = 100 – B/A x 100, where: E - biological efficacy expressed in % compared with the control; A - the average number of pest in control;

B – the average number of pest in experiments(Îndrumări metodice …, 2002).

The biological efficacy after six launches of *T. pintoi* varied from 16.67% to 71.4% within the Mill No.1. The biological efficacy of *T. pintoi* varied from 20.0% to 68.5% within the Mill No. 2. Within the elevator No.1 (grain store), the biological efficacy of *T. pintoi* varied from 27.50% to 73 3%.

In the control (flour mill and elevator No.2), where the entomophage has not been launched, the efficacy was not reported. The biological efficacy of *T. pintoi* increased after each start until the end of the experiments.

When comparing the efficacies of *T. pintoi* at the mill No.1, N2, Elevator No.1 and control (where the entomophage has not launched), the difference of the average was significant: (T_d = 2.88-10.40)> ($T_{0.05}$ = 2.12) after sixth launches.

Our results demonstrate that the release of *Trichogramma pintoi* into commodity storages could play an important role in population suppression of stored product moth populations, especially as part of an integrated control program.

BIBLIOGRAFY

1. Brower, J. H. The natural occurrence of the egg parasite *Trichogramma,* on almond moth eggs in peanut storages. Journal of the Georgia Entomological Society. 1988, no. 19, p. 285-290.
2. Brower J. H., Press, J. W. Interaction of *Bracon hebetor* (*Hymenoptera: Braconidae*) and *Trichogramma* pretiosum (*Hymenoptera: Trichogrammatidae*) in suppressing stored product moth populations in small in-shell peanut storages. Journal of Economic Entomology. 1990, vol. 83, no.3, p. 1096-1101.
3. Evans D. E. The influence of rate of heating on the mortality of Rhyzopertha dominica (F.) (*Coleoptera: Bostrichidae*). Journal of Stored Products Research. 1987, no. 23, p. 73-77.
4. J. Mattheew, M. Greishop, P. Flinn, J. Nechols, F. James . Effect of fine-grain habitat complexity on egg parasitism by tree species of *Trichogramma* Kansas State University, Department of Entomology, 123 West Waters Hall, Manhattan, KS66506-4004, USA, 2008, p. 34-38.
5. Todiraş V. Tretiacov T., Balan Iu. „Protecţia integrată şi asigurarea calităţii produselor agroalimentare depozitate", Chişinău, 2009, p. 10-16.
6. „ Îndrumări metodice pentru testarea produselor chimice si biologice de protecţie a plantelor de dăunători, boli si buruiene în Republica Moldova „ Centrul de Stat pentru Atestarea produselor Chimice şi Biologice de Protecţie şi Stimulare a Creşterii Plantelor, Chişinău, 2002 (F.E.P.„Tipografia Centrală"), p. 31-45.

APIS MELLIFERA AND THEIR PRODUCTS BIOINDICATORS OF ENVIRONMENT

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Apis mellifera has an enormous importance, for maintaining balance of natural and anthropogenic ecosystems, economic and social role of benefits resulting from pollination and valuable products offered by them (pollen, propolis, honey, wax, royal jelly etc.)

This group of insects participates in the pollination of 250 000 plant species, provides pollination about 130 of agricultural plants and increasing their productivity with 30%. Indirectly, many species of animals live due plants pollinated by bees.

So, importance is paramount and we are obliged to conserve widely the natural pollination, to protect our food, survive. Albert Einstein once said: "If the bee disappears from the surface of the earth, man would have no more than four years to live".

In recent decades, worldwide situation of this species became alarming. Massive loss of bee colonies has become a major problem of modern world. This issue is addressed by European parliament, which made that each country to favor its own thesis, to explain the sudden disappearance of bees. Scientists try to reveal the mystery disappearance of bee colonies, apparenttly no clear cause, they named this phenomenon colony collapse disorder (CCD). Colony collapse disorder is the name given to the mysterious decline of honeybee populations around the world beginning around 2006, which affect more than 30 percent of bee colonies in the United States and more than 20 percent in some European countries. In the Republic of Moldova is not registered massive depopulation.

To investigate the degree of threat of pollinators disappearance has been invested enormous amounts. According to a report by the World Watch Institute, one third of the domestic bee populations have already disappeared and the same fate awaits wild bee species. Probable, causes of colony collapse disorder are pesticides, bee-viruses, stress, intensive agriculture, electromagnetic radiation, climate change etc.

Currently, it pays special attention to the ecological problem and beekeeping development. In many countries, including developed, more recently the focus on the concept of environmental biomonitoring using bees. It is a new direction for use of these insects, which includes a broad spectrum of disciplines such as beekeeping, botany, medicine, veterinary toxicology, radioecology and allows us to characterize local ecological situation. That is, by assessing the health of bee colonies and quality of the physico-chemical parameters of derived products, it is estimated that the environmental pollution in cities, airports, industrial zones in many countries (Germany, France, Italy at al).

Biomonitoring will give us an insight into the impact of all abiotic and biotic factors in an ecosystem. Honey bees can cover an area of up to 12 square kilometers in their quest for food, and are continuously exposed to contaminants present in the area surrounding the apiary for the duration of their foraging activity. Biomonitoring can provide a representative overview of the composition of the pollution burden, thus producing a picture of the environmental conditions in the harvest area. Honeybees absorb pollutants directly from water or the air, or indirectly via the nectar and pollen they collect, in this way honeybees become a dangerous source of bee products pollution (Кулаков В. Н., Русакова Т.). Honeybees and their products (honey, pollen, propolis, wax at al) can supply a suitable amount of biological material to be easily sampled and analyzed throughout the year (Crane, 1975). Apis mellifera has been the subject of various investigations and may bee considered an "ideal bioindicator" as defined by Stocker (1980). Effective of environment biomonitoring through apis mellifera have been demonstrate over the years by many worldwide researchers (V. Balestri, G. Celli, O. Гробов, Ш. Омаров at al).

Several characteristics make the honey bee a "reliable ecological detector": it is almost ubiquitous organism, with modest food requirements; its body is covered with hairs, which make to hold the materials and substances it comes into contact with; it is highly sensitive to most plant protection products, revealing when they are improperly spread through the environment (during flowering, in the presence of wind etc.); its very high rate of reproduction and relatively short average lifespan, continuous regeneration; its great mobility and wide flying range allows a vast area to be monitored.

It was demonstrate that apis mellifera, foragers in particular, are good biological indicators that quickly detect the chemical impairment of the environment by the high mortality (in the case of pesticides) and the residue presence in their body or in beehive products. (in the case of pesticides, heavy metals and radionuclides).

For about twenty years a research group at the "Guido Grandi" department of Entomology of the University of Bologna has been study the use of honey bees as bioindicators of pesticides, also heavy metals and radionuclides in many areas of Italy. They demonstrate one more time that honey bees are extremely sensitive to pesticide.

Use of pesticides in agriculture carries a global character. Decades of intensive use of pesticides which have an extraordinary chemical stability (ex. DDT, lindane at al) already prohibited, are found in the arable layer and over 30-40 years after use in agriculture, leaving hundreds of traces contaminated with pesticides, from this and their persistence in bee products (pollen, propolis, honey). In 2009 P. Medrzycki demonstrates that foragers, at higher temperatures are much more susceptible to intoxication by pesticides. About bee honey as an environmental bioindicators of pesticides are reflected in paper by G.Balayrianis and P. Balayrianis, (2008)

Heavy metals present in the atmosphere can be deposited on the hairy bodies of bees and be brought back to the hive with pollen, or may be absorbed together with the nectar of the flowers, or through the water or the honeydew. Concentration of heavy metals in honey plants may increase or decrease in relation to their content in the soil, and the body of the bees may be higher or lower than in plants. During the processing of nectar into honey, heavy metal content in it decreases, in their quite a bit of wax, and propolis in much the same as in the environment or higher (E. K. Eskov, 2001). About honey bee and they products as potential bioindicators of heavy metals contamination are reflected in their papers (K.C. Jones, 1986; M. Enrique, at al, 2001; M. Perugini, 2011 at al).

Using bees to study radioactivity is recognized in many countries. Radioactive substances have been detected in honey since 1908 by French chemist Allen Kaia. Plants are able to concentrate radioactive substances tens and hundreds times more than in the environment. Almost all plants species actively assimilate radioactive phosphorus and iodine (O. Гробов). Distribution of radioactive isotopes in the hive, show a higher accumulation in propolis, then in pollen, bees body and honey.

Conclusions: In our country, a medium developed one, the biomonitoring through apis mellifera is welcome, because we can test all environmental sectors (soil, vegetation, water, air) are sampled by honey bees. Finally, a variety of materials are brought into the hive (nectar, pollen, honeydew, propolis and water), that easily are sampled and analyzed throughout the year, and we can quickly detect the chemical impairment of the environment without many costs. Also, biomonitoring is an important alternative of instrumental methods.

References

1. Conti M. E., Botrè F. Honeybees and Their Products as Potential Bioindicators of Heavy Metals Contamination Environmental Monitoring and Assessment, 2001, Volume 69, Number 3, Pages 267-282

2. Balestra V., Celli G., Porrini C. Bees, honey, larvae and pollen in biomonitoring of atmospheric pollution Aerobiologia ,1992,Volume 8, Number 1, , P. 122-126,

3. Raeymaekers B. A Prospective Biomonitoring Campaign with honey bees in a district of Upper-Bavaria (Germany). Environmental Monitoring and Assessment, 2006, Volume 116, Numbers 1-3, P. 233-243

4. Jones K.C. Honey as an indicator of heavy metal contamination // Water Air Soil Pollution. 1987. V. 33. № 1/2. P. 179–189.

5. Гробов О.Ф. Пчелы индикаторы окружающей среды // Пчеловодство. 1989. № 12. С. 2–5.

COXIELLA BURNETII AND *BORRELIA BURGDORFERI* SENSU LATO IN TICKS FROM MOLDOVA AND GERMANY

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In Europe, the most important tick-borne bacterial diseases are Lyme disease and Q-fever. Lyme disease is caused by spirochetes of the *Borrelia burgdorferi* sensu lato (*B. burgdorferi* s. l.) complex, while Q-fever is caused by the rickettsia *Coxiella burnetii* (*C. burnetii*). The main arthropod vectors of these pathogens are ticks of the genera *Ixodes (I.)* and *Dermacentor (D.)*.

Investigations of the last years showed that many of the tick-borne diseases are able to be transmitted as mixed infections. The ecology and distribution of Q-fever and Lyme disease are not explored enough on the territory of Germany and Moldova, while this region represents a good research model for examination of ecology of ixodid tick-transmitted disease foci in respect to anthropogenic stress conditions.

Therefore 282 ticks of different species (*D. marginatus* [N= 48], *D. reticulatus* [N= 37], *I. ricinus* [N= 197]) were sampled at different places of Moldova in autumn 2010. In spring 2011 further 583 ticks (*D. marginatus* [N= 81], *D. reticulatus* [N= 78], *I. ricinus* [N= 355] and *Haemaphysalis inermis* [N= 24]) were sampled. Pools of these ticks (5–10 ticks per pool) were investigated by PCR for both agents. DNA of *B. burgdorferi* s. l. was detected in 31 pools of *I. ricinus* and 1 pool of *D. marginatus*. All samples were negative for *C. burnetii*-specific DNA. The tick samples from Germany (Lower Saxony) are still under investigation.

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BIOACOUSTICS OF TWO NEWLY RECORDED BUSH-CRICKETS IN THE HISTORICAL REGION OF MOLDAVIA: *ISOPHYA PIENENSIS* AND *ISOPHYA SICULA* (INSECTA: ORTHOPTERA)

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Currently there are 46 species in Europe known to belong to genus *Isophya* Brunner von Wattenwyl, 1878 and 16 of these have been found in Romania, 4 being endemic: *Isophya harzi* Kis, 1960, *Isophya dobrogensis* Kis, 1994, *Isophya sicula* Orci, Szövényi & Nagy, 2010 and *Isophya ciucasi* Iorgu & Iorgu, 2010.

During author's regular field research in Orthoptera in the past years, the bush-crickets *Isophya pienensis* Mařan, 1952 and *Isophya sicula* Orci, Szövényi & Nagy, 2010 were surprisingly found in the Moldavian Carpathian Mountains.

Sound recordings were taken indoors with an Edirol R-09HR digital recorder, having a frequency response of 20-40.000Hz. Sound terminology follows Heller et al. 2004: calling song - song produced by an isolated male, syllable - the sound produced by one complete up and down stroke of the forewings, impulse - the highly damped sound arising as the impact of one tooth od the stridulatory file.

1. Isophya pienensis Mařan, 1952

Material. 3 ♂♂ 2♀♀, Bistricioara, Neamț county, 01.07.2011.

Bioacoustics. The calling song is a group of 2 or 3 syllables, repeated after several seconds or minutes. Each syllable consists of a series of 95-105 impulses, lasting for about 450-510 ms at 24°C. Sound amplitude decreases gradually in the last 20-30 impulses. Song spectrographic analysis reveals frequencies between 14-29 kHz. Maximum frequency amplitude is located at 19 kHz (Fig. 1 a, c, e).

Discussion. The species' distribution area includes Austria, Czech Republic, Slovakia, Poland, Ukraine and Romania. In Romania it was known only from Maramureş and the Transylvanian part of Eastern Carpathians; probably, the species has the easternmost distribution area limit near the lake Izvorul Muntelui. No high variation was detected between the songs of the Moldavian individuals and the sounds produced by individuals from Central Europe (description in Heller et al. 2004).

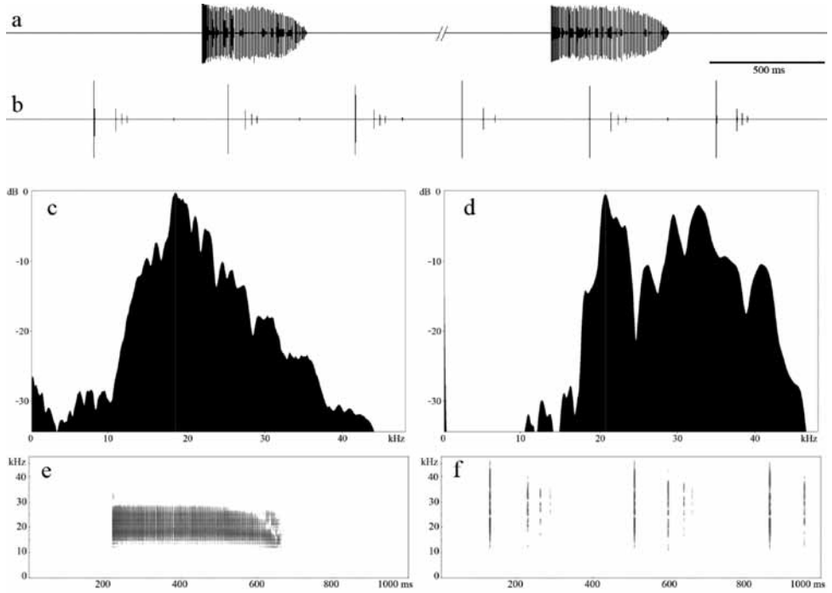

Fig. 1. Sound analysis in the two bush-crickets: a, b - oscillogram; c, d - spectrum; e, f - spectrogram. a, c, e - *Isophya pienensis*; b, d, f - *Isophya sicula*.

2. Isophya sicula Orci, Szövényi & Nagy, 2010

Material. 1♂ 1♀, Vânători Neamț Natural Park, 25.06.2006; 1♂, Vânători Neamț Natural Park, 04.07.2010.

Bioacoustics. The song consists of a long series of very short syllables, each syllable being formed by 3-5 impulses and lasting for 140-160 ms at 27°C. After-clicks have also been recorded as occurring after 80-110 ms. In a syllable the sound amplitude gradually decreases from first to last impulses. Spectrographic analysis reveals that in a syllable the sound frequencies range between 12 and up to more than 40 kHz, with highest peaks at about 21 and 33 kHz (Fig. 1 b, d, f).

Discussion. Recently described from a small area - Harghita Mountains, *Isophya sicula* is surely one of the most interesting endemic species in the Eastern Carpathians. It's presence in the Moldavian Subcarpathians, across the whole range of the Eastern Carpathians at about 100 km NE from Harghita Mountains raises some questions on this species' distribution area. Songs in the studied individuals are very similar, noticing only the variably higher number of impulses forming a syllable in the Moldavian specimens (compared with original song description in Orci et al. 2010).

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References:

Heller, K. - G., Orci, K. M., Grein, G. & S. Ingrisch (2004): *The Isophya species of Central and Western Europe (Orthoptera: Tettigonioidea: Phaneropteridae)*. Tijdschrift voor Entomologie 147: 237-258

Orci, K. M., Szövényi, G. & B. Nagy (2010): *Isophya sicula sp. n. (Orthoptera: Tettigonioidea), a new, morphologically cryptic bush-cricket species from the Eastern Carpathians (Romania) recognized from its peculiar male calling song*. Zootaxa 2627: 57–68

SOIL ANIMALS' ROLE IN ECOLOGICAL BALANCE'S MAINTAINING

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Soil is housing and shelter for many organisms, it prevents from overheating, and from exposure to cold, protects from predators, living on the earth's surface. The soil can serve as a shelter, due to the fact that temperature and humidity in it are much less susceptible to sharp fluctuations than on earth's surface. This soil feature is especially useful during abrupt weather changes' periods that mark Moldova's spring and autumn.

Home and shelter function is more clearly revealed when related to animals that use several habitats, one of which happens to be soil (for example, common vole, ground squirrel, yellow ground squirrel, hamster, marmot, chipmunk etc.). These animals' characteristic feature is that usually they get basic food on ground's surface. Soil is where they hide from predators and weather and create food reserves. Many hibernate in cold season.

Space occupied by the underground structures of animals can be considerable. Thus, in forests with high numbers of moles, conducting most of his life in the soil, the area of their salable up to 1 / 3 of the total forest area and volume - up to 15% of 10-cm soil layer.

Using soil as housing and shelter, many animals have certain requirements for them, thus providing knowledge of many agricultural pests ecology. Thus, the necessary conditions of existence of a safe ground squirrel is an open space near normal, low ground cover with high content of late dry plants, mainly solid, but not much turf soil, providing the building burrows.

Human activities strongly influences the distribution of other malignant agricultural pest - the hamster. Hamster is not afraid of people, he settles more readily on the fields. With the expansion of the square field increases the area of habitat of the rodent and the harm caused to them. The hamster is not only eats the crop plants, but also makes huge stocks of products in their underground larders. It burrows can be found up to 16 kg of food. And in his food warehouse stores only clean grain.

Thus, knowledge of the ecology of rodents, using soil as a dwelling, is essential for timely prevention of damage they can cause crop plants. In addition, this knowledge is important because some inhabitants of the soil are carriers of pathogens and infectious diseases. For example, a small ground squirrel is a carrier and disseminator of such diseases as plague. It is therefore important to anticipate the impact on the inhabitants of the underworld will have economic activities. Known, for example, significant migration of rodents with strong irrigation of areas.

Also note that in addition to widespread rodents, subterranean apartment used by many other vertebrate animals. Can not usually get along without an underground shelter fox, rabbit and other forest dwellers. Some vertebrates actively use burrows dug by the regulars of underground labyrinths. So, home ground squirrels use lizards, snakes, birds. As housing land is actively used, and many invertebrates. For such creatures, like earthworms, this feature is evident in their suspended animation in the dry and winter. At this time, worms, curled into a ball, are in the diapause in extensions of their moves, which are usually located at a depth of 20 - 50 cm, while larger species may be at greater depths.

Actively use the land as a dwelling, many insects. Many invertebrates are widely used as a dwelling burrows of certain rodents. So, in burrows of ground squirrels, except the owners, live spiders, woodlice, flies, beetles. In the cold season here is their winter refuge, and in the summer - a place of salvation from the heat. Fleas, flies and some beetles there and reproduce by laying eggs in the dung gophers. Many insects are held in the soil only a certain phase of development. For example, cicadas lay their eggs under the bark of thin twigs or leaf cuttings. The larvae of the same after their exit from the egg falls to the ground and burrow into the soil often to a depth of 1 m, where is their further development [3].

The cases considered the use of soil as a "dwelling" suggests that the fourth (by V.V. Dokuchaev) kingdom of nature can be compared to the densely populated underground city where they live and its permanent residents, and those who work in the suburban area (for food on the ground), and those who are in the soil, only a limited time, as its guest [2].

The soil is capable of self-purification of her unusual microorganisms - that its sanitary function. Therefore, violation of environmental protection under the influence of various toxicants represents a threat to all of the soil fauna, violates the biodiversity in ecosystems [1].

The biological activity of soil - the most accurate indicator of soil quality and soil condition, which is used in detailed soil investigations.

Bibliography

1. Вернадский В.И. Философские мысли натуралиста. М.: Наука, 1988, -с. 520.
2. Докучаев В.В. Русский чернозем. М.: ОГИЗ—СЕЛЬХОЗГИЗ, 1936, -с. 558.
3. Зенкевич Л.А. Жизнь животных. Том 3. Беспозвоночные. М.: Просвещение, 1969, -с.637.

THE DISTRIBUTION OF THE SAPROXYLIC BEETLE IN MANAGED FORESTS OF THE MAIN FOREST-FORMING SPECIES

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The study of the saproxylic beetle complex in managed forests is important for the assessment of these forests compared. Traditionally forests located in protected areas have more attention. But in the managed forests the most common type of research is a forest pest monitoring, which involves only a narrow part of the insect inhabitants of dead wood. But the role of the rest of this complex are often not considered, although they have a significant impact on the stability of the forest ecosystem as a whole and can be used to monitor their condition.

The studies of insects inhabiting of dead wood were carried out in managed forests Shchuchin and Grodno districts of the Grodno region (Belarus). All dead wood was divided into 5 stages of decomposition on the base of the visual features. Insects were collected by hand under the bark of dead trees and snags, as well as damaged rotten wood. The 100 cm, 50 cm and 25 cm long circular pallets were laid on the bark covered dead wood logs (depending on the diameter of the trunk and the opportunity to lay the pallet). The dust from the logs of the late stages of decomposition was sifted by soil sieves. All insects were fixed in 70 % ethanol. Totally more than 500 specimens of 43 insect species were collected (Table).

Family **Boridae** is represented by one species *Boros schneideri* (Panzer, 1795), it is marked in the Grodno region, under the bark of pine trees at the first stage of decomposition. This species is rare and protected in most European countries. Its association with undisturbed pine forests making it one of the best indicators of the pine plantations. Another advantage of this type is not a difficult identification of adults and larvae.

The beetles of the family **Cerambucidae** in our collections are represented by 7 species. Long-horned beetles are xylophagous and relates to the technical pests of wood. Their distribution in logs is clearly expressed between deciduous and coniferous species because they inhabit woody debris on the first and second stages of decomposition, in which there are still differences between coniferous and deciduous wood residues. The situation is similar to other families of xylophagous **Curculionidae** and **Lymexylidae**.

The family **Cleridae**, in our collections, represented by one species *Thanasimus formicarius* (Linnaeus 1758). It is marked by pine wood residues in the first stage of decomposition. Its larvae and adults are the predators. The choice of wood debris depends primarily on the availability of food item to this species. *T. formicarius* is used to assess the dynamics of bark beetle outbreaks because it is a mass of enemies of bark beetles. At the same time representatives of the families **Histeridae**, **Monotomidae**, **Staphylinidae, Tenebrionidae**, and of the part of the family **Elateridae** which are also predators, is rarely indicated in the presence of woody debris in managed forests. They are distributed on the dead wood, depending on the availability of the preys, and therefore occur on conifers and deciduous wood kind.

Representatives of the families **Cucujidae**, **Pyrochroidae**, **Pythidae**, **Silvanidae, Trogositidae** and of the part of the family **Elateridae** according to most authors is closer to the elements saprophages mycetophagy and necrophagy. Accordingly, the distribution of woody debris of various breeds is based on the properties of the substrate of the preferred stage of decomposition, which is largely determined by saproxylic fungus. From this group of species the family **Cucujidae** can be used as indicators because they adult and larvae are enough easily determined to the family. Found of both species of this family are sensitive to disturbances in forest ecosystems.

Table. Distribution of saproxylic insect species in the main tree species in Shchuchyn (Sc.) and Grodno (Gr.) regions (%)

Taxon	Spruce		Pine		Oak		Aspen		Birch		Bl. alder	
	Gr.	Sh.	Gr.	Sh.	Gr.	Sh.	Gr.	Sh.	Gr.	Sh.	Gr.	Sh.
Boridae												
Boros schneideri			100									
Cerambucidae												
Acanthocinus aedilis			100									
Oxymirus cursor						100						
Rhagium inquisitor	10	42	90	55						3		
Rhagium mordax				3	38	54	5		57	43		
Saperda perforata					100			90				10
Saperda scalaris					50		15					35
Semanotus undatus		100										
Cleridae												
Thanasimus formicarius				100								
Cucujidae												
Cucujus cinnaberinus		22				11	83	67			17	
Cucujus haematodes			100	100								
Curculionidae												
Crypturgus cinereus		100										
Crypturgus hispidulus		100										
Dryocoetes autographus		100										
Polygraphus poligraphus		100										
Polygraphus punctifrons		100										
Taphrorychus bicolor								100				
Xylechinus pilosus		100										
Elateridae												
Ampedus balteatus	100	69				8						23
Ampedus erythrogonus		100	100									
Ampedus nigrinus									100			
Ampedus pomonae					9		18		73	100		
Ampedus pomorum										100		
Ampedus sanguineus	30		40	100			20		10			
Ampedus sanguinolentus			10						60	100	30	
Betarmon bisbimaculatus					100							
Denticollis linearis		33		17				50				
Diacanthous undulatus				100								
Ectinus aterrimus					100							
Melanotus villosus	47	21	39	30		11	7	4	7	30		4
Histeridae												
Platysoma deplanatum				100								
Lymexylidae												

Hylecoetus flabellicornis									100			
Hylecoetus dermestoides		100										
Monotomidae												
Rhizophagus puncticollis					100							
Pyrochroidae												
Pyrochroa coccinea						25	100	75				
Schizotus pectinicornis	9	18						36	72	40	9	6
Pythidae												
Pytho depressus			100	100								
Silvanidae												
Dendrophagus crenatus			100	75						25		
Tenebrionidae												
Hypophloeus unicolor					100							
Pseudocistela ceramboides	100	100										
Trogositidae												
Grynocharis oblonga									100			
Staphylinidae												
Nudobius lentus								100				
Quedius scitus								100				

Thus, the study of complex insect inhabitants of dead wood in managed forests provides opportunities to identify sensitive species are indicators of the forest ecosystem. The results of present work can be used of to identify in advance the disturbances in forest ecosystems and take steps early to protect them. On the example of managed forests in Grodno and Shchuchin regions species of the families **Boridae** and **Cucujidae** best for more information about the condition of forests were found.

PSEUDOMONAS BACTERIA WITH NEMATICIDAL EFFECT

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Soil microorganisms representreal deposits of biologically active substances with toxic effects on nematodes. Currently in most countries in combating parasitic nematode species bio-based nematicidal preparations are developed and used, based on predator fungi and parasitic bacteria - *Arthrobotrys*, *Catenaria*, *Verticillium*, *Paecilomyces*, *Pasteuria*, *Pseudomonas* etc. Antibiotic substances are toxic for plants, they penetrate in vegetal tissue through the root, leaves, shoots where they are stored for long time period, being at the same time immunological factors that allow the healing of sick plants (Romanenco, 2004).

In actual conditions of agriculture development in Republic of Moldova the using of biological nonpolluting methods and measures of fighting against economically important phytoparasite nematodes is of great importance especially in cultural plants and in protected areas.

By the contact method under laboratory conditions the effect of some bacteria strains from genus *Pseudomonas* was studied, namely *Pseud. sp.Tg.*, *Pseud. sp. RP*$_{19}$, *Pseud. sp. RP*$_{g}$ and *Pseud. sp. 3RȘB* on endoparasite migratory nematode species *Ditylenchus dipsaci Kuhn*, which was extracted from garlic plants. The *Pseudomonas* strains were detected and isolated from soybean plant rhizosphere.

The results of experiments proved an increased nematocide effect of Ps.sp. strains 3 RȘB, *Ps. sp. Tg* and *Ps. sp. RP*$_{19}$, which in contact with the populations of *Ditylenchus dipsaci* during 21-25 hours at temperature of 20°C provoke the mortality of 80-90% of nematodes. Cultural liquids of Ps. sp. RPg strain in contact with the nematode for 25-48 hours causes the mortality rate of 50-70%.

Testing in laboratory conditions of some strains of genus *Pseudomonas* on processes of seed germination of corn, cucumbers, soybeans, and dry mass accumulation during the development of plants did not show toxicity.

According to data of some researchers (Romanenco, 2000; Romanenco et al., 1998; Taravalli, 2001; Morgovaia et al., 2002), the strains of biologically active microorganisms, among which is *Pseudomonas sp*. have not only fungal and bactericidal action, but also nematocide effect with increased biological and economical efficiency in combating the population complexes of phytoparasite nematodes in cereals, potatoes, fruit trees and shrubs.

EFFECT OF POTATO ROT NEMATODE *DITYLENCHUS DESTRUCTOR* ON THE QUALITY OF TUBERS DURING STORAGE

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Potato rot nematode *Ditylenchus destructor* is of great economic importance and causing losses of potatoes in many parts of Europe, Asia, localized areas of North and South America, and South Africa. Potato rot nematodes are microscopic worms approximately 0.8 - 1.8 mm in length and 23 – 47 µm in diameter, stylet length mostly near 10 – 13 µm (Brzeski, 1991). Their populations usually consist from females, males and juveniles. Morphological characters of females are the posterior vulva position (V = 78 - 83) and postvulval part of uterine sac is near 40 – 98% of vulva–anus distance. Male spicules are 24 - 27 µm long. Tail of both sexes conical usually ventrally curved with a narrow rounded terminus (Photo 1, 2). There are four juvenile stages (the first preceding hatching of the eggs) and final stage is similar to adults, but differing by size and developing reproductive organs. Life cycle lasts about 20 – 26 days at the temperature 20 – 24°C and takes place inside of potato tuber accumulating the multiple generations of this parasite. They eat starch grains reducing the starch content in potato tuber (Pokrovskaia, 1982; Chukantseva, 1980; Paramonov, 1970; Nesterov, 1970; Dementjeva, 1980; Nickle, 1991; Siddiqi, 2000).

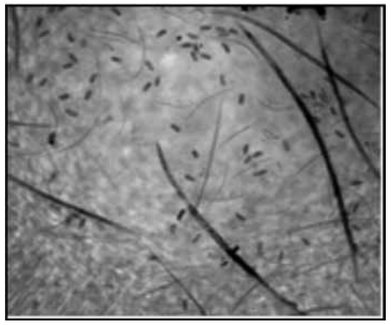

Photo 1. Population of *D. Destructor* (females, juveniles and eggs) (original photo)

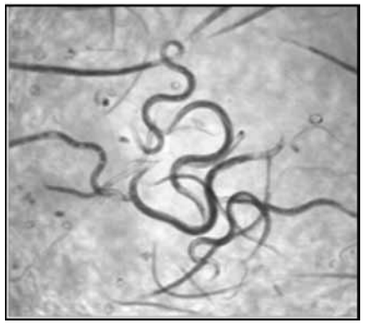

Photo 2. Population of *D. destructor* (females, males and juveniles) (original photo)

D. destructor most frequently infests the underground parts of plants (tubers and stolons of potato), but nematode may also invade above-ground parts and cause thickening and branching of stem and also discoloration of leaves. The potato rot nematode penetrates the tubers from the stem through the stolons or lenticels and eyes of the tubers. Early symptoms are small white spots which later increase, gradually darken through greyish to dark brown or black and the surface of the tuber to become covered with dark patches and dry cracking skin (Photo 3).

During the storage of tubers the potato rot nematodes damage the potato crop as they live inside of tubers and prefer the living tissue where they create the large population rapidly as the fecund females each produce up to 250 eggs. They infect the stolons of planting material reducing the qualitative and quantitative of future harvest (Sturhan, Brzeski, 1991). *D. destructor* is a polyphagous nematode as about 90 plant species of a wide variety of families are known as hosts (Esser, 1985; Sturhan, Brzeski, 1991 and others); according to Gubina (1982) the known host range comprises near 120 species of plants. *D. destructor* for the seed potatoes and flower bulbs is on the list of quarantine organisms of many countries and organizations in the EPPO region (Nickle, 1991).

In Moldova, the potato is mainly grown in northern and north-eastern areas – Briceni, Donduseni, Edinet, Ocnita, Soroca although this culture is very popular and often cultivated in home gardens everywhere. Major crop losses of potatoes are during the cultivation (plant growth) and crop storage (Nesterov, 1970; Dementjeva, 1980).

This paper presents some data of biology and pathogenesis of potato rot nematode *D. destructor* on tubers during the storage period (December – March, 2010 - 2011).

Materials and methods. Potato tubers of different varieties have been collected from some vegetable stores located in the regions Criuleni (potato variety Gypsy), Telenesti (potato variety Alb), Briceni (potato variety Romana). During this study more than 900 potato tubers have been examined to reveal the degree of damage from the potato pot nematodes.

The tubers with specific signs of destruction by potato rot nematodes were selected and the nematodes from these tubers were extracted by the modified method of Bermann during 24 - 48 hours at room temperature.

Infestation of tubers belonging to the different potato varieties by the potato rot nematode *D. destructor* was determined by the standard formula adopted in phytopathology: $P = n/N \times 100\%$ (P – distribution of plant diseases; n – number of diseased tubers; N – total number of tubers in samples).

Results and discussion. The assessment of the stored potato tubers on the affecting of nematode *D. destructor* revealed that all investigated varieties of potato were struck by potato rot nematodes although in varying degrees. The potato varieties were examined accordingly the degree of extended lesion surface of the tuber by nematode *D. destructor* (maximum of lesion tubers, %) by 5-point scale: 1 - resistant varieties (0 - 1%), 2 - slightly affected (1 - 10%), 3 - moderately affected (11 - 25%), 4 - severely affected (26 - 50%) and 5 - very affected (>50%) (by Ivaniuc, Iliashenco, 2010).

In our study the potato variety Gypsy was the most affected by nematode *D. destructor* (35 - 50 % diseased tubers between all exanimated tubers of this variety), following the variety Alb (15 - 20%) and the variety Romana (0,5 -1,5%). Therefore, the potato of the variety Gypsy belongs to severely affected, the variety Alb – moderately affected and the variety Romana – slightly affected accordingly the previous scale.

During the storage period the nematodes *D. destructor* affect tubers and cause the specify disease that occurs gradually. The level of this damage for storage tubers have been examined using the scale proposed by Paramonov A.A. and Brujkova F.I. (1956): 1 – *D. destructor* enters tubers and initially causes the white or light-brown spots about 2 mm below surface that are only visible if the skin is removed; 2 - appearance of the individual lead-gray spots on the surface of the tuber; 3 – external symptoms showing the sunken areas with cracked and wrinkled skin (2-3rd stage shows at harvest); 4 – damage increases, developing dark gray and brown spots, the destruction is the type of dry rot; 5 - development of necrosis, fungal infections, increasing the number of saprobiotic nematodes and microorganisms, which accelerate the decomposition processes. According this scale all studied varieties had the affected tubers with the specific characters of 4 and 5 stages of this disease (Photo 3, 4).

Photo 3. Nematodes *D. destructor* affect tubers Romană and cause the specify disease of 4th stage (original photo)

Photo 4. Nematodes *D. destructor* affect tubers Romană and cause the specify disease of 5th stage (original photo)

The primary diagnostic characters can be detected through the early signs of potato damage caused by the potato rot nematodes. Just to peel and scan the surface of the peeled tubers. Secondary signs of damage are clearly visible in the potatoes in autumn harvest. It is important during the storing time to distinguish the tubers damaged by potato rot nematodes from the fungal diseases such as the dry rot (*Fusarium* sp.) and the late blight (*Phytophthora infestans*). The first symptoms of dry rot are usually the dark decay on the surface of the tuber; the skin becomes wrinkled in concentric rings as the underlying dead tissue

desiccates. The symptoms of late blight infection of tubers is characterized by irregularly shaped areas of brown color of variable size on the skin and dry granular rot is found under the skin in the discolored areas, extending into the tuber.

In the decaying tissues of tubers of 80 - 100 grams was found about 40 - 60 x 10^3 individuals of *D. destructor* with a predominance of adult forms. Such a large number of potato rot nematodes accelerate the pathological processes into the tubers. During feeding the potato rot nematodes secrete the substances that dissolve the cell walls, facilitating the penetration of saprobiotic bacteria and fungi subsequently the saprobiotic nematodes that cause the decomposition process. In the decaying parts of tubers for all studyed potato varieties the bacteriovore nematodes from order *Rhabditida* were numerous. The following species *Pristionchus lheritieri* (Maupas, 1919) (*Diplogasteroidea*, *Neodiplogasteridae*); *Cephalobus persegnis* Bastian, 1865, *Eucephalobus striatus* (Bastian, 1865) (*Cephaloboidea, Cephalobidae*), *Rhabditis* sp., *Mesorhabditis* sp. (*Rhabditoidea*, *Rhabditidae*) and *Panagrolaimus rigidus* (Schneider, 1866) (*Panagrolaimoidea*, *Panagrolaimidae*) have been revealed.

Large populations of *Pristionchus lheritieri* were found not only in the decaying parts of tubers, as well as its healthy parts. They are the active inoculator and distributor of putrefactive infection, accelerating the processes of decay and its dissemination.

Therefore the saprobiotic nematodes are one of the factors to increase the intensity and extensity of invasion, which leads to significant quantitative and qualitative yield losses during prolonged storage (up to 20-40% or more).

The diseased tubers by *D. destructor* apparently do not differ from normal in the initial stages of the disease. During the storage there is the intensive development of mass populations of *D. destructor* and spread to the healthy tubers, thereby reducing the quality parameters of tubers and in general all stored crop. Some infected potato tubers in the early stages of development of *D. destructor* not manifest the specific signs of disease. Using diseased tubers as planting contributes to the defeat and a dangerous disease of potatoes, which can lead to significant yield losses later on (host plants and other cultures). During the planting of potatoes by the affected part the tuber, the nematodes *D. destructor* migrate and penetrate into the newly formed eyes at the meristem and the young roots which formed new tubers. Before placing in storage the potatoes must be dried, careful inspected all tubers on the specific signs of the diseases and keep the temperature (1 – 3^{0}C) and moisture regime (85 – 90%).

THE ZOOPHAGOUS ROVE-BEETLES FROM GENRE *PHILONTHUS* (COLEOPTERA, STAPHYLINIDAE, STAPHYLININAE) FROM THE REPUBLIC OF MOLDOVA

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Staphylininae subfamily registered more numerous numbers of species, also morphological aspects and specific diversity. As for the coloration of the body, it varies with sharp colours and dense pubescent.

The representatives of this subfamily have body sizes up to 40 mm (*Philonthus splendens* F., *Tasgius pedator* Grav., *Staphylinus caesareus* Ced., *Ocypus picipennis* F., *Platydracus chalcocephalus* F.). In addition, there are to mobile, fast moving inside and outside in the substrate.

Food spectrum of the rove-beetles from Staphylininae subfamily is diversified: saprophagous, coprophagous, phytophagous, predators and with combined nutrition. The dominant species in terms of number are predators and they have developed mandibles with triangular, sharp and teeth forms.

The rove-beetles from *Philonthus* genus has a significance role in natural and agricultural ecosystems by eating harmful insects in different biological stages, contributing to reducing their number and appearance in mass.

In the Republic of Moldova from the genus *Philonthus* are known 41 species. From these forty-one species – nine are predators.

***Philonthus carbonarius* Grav** inhabits animal manure, forest litter, heaps of fresh and decomposed plants, some species of fungi from the genera *Piptoporus*, *Polyporus*, *Laetiporus*. These specimens eat the aphids of *Sitobion avenae* and *Rhopalosiphum padi*, also imago and larvae of as house (stable) flies from family Muscidae. Moreover, it devours the small carabid beetles and adults of elaterid beetles [6].

***Philonthus longicornis* Steph.** In addition to aphids, and eggs, larvae and adult of flies, is specialized in

consumption of nematodes ex. *Tylenchulus semipenitrans* [1].

***Philonthus tenuicornis* Muls. et Rey.** This species is included in the list of the most active predators which is able to eat various stages of bugs *Tenebrio molitor* that is pest of flour and other insects considered harmful to agriculture [5].

***Philonthus varians* Payk.** Is an important ecological factor in limiting the decrease of mass zoophyte flies [4].

***Philonthus rectangulus* Sharp**. In laboratory conditions can consume in a day 2-4 larvae of the second age, up to the 32-47 larvae of the first age of the house fly [4].

Philonthus decorus Grav. Eat larvae of synanthropic flies that has body size between 3-5 mm and more than 5 mm, also species of – *Marionina affinis, M. argentea, M. communis, M. riparia* (Annelida, Clitellata), etc. [2].

In some species from this genus were observed that feeding of larvae differ from those of adults. The larvae of *Philonthus politus* are more voracious than adults. Adults of this species eat larvae of synanthropic flies with body size between 3-5 mm and more than 5 mm, also larvae of click beetles (Elateridae) and darkling beetles (Tenebrionidae) lower age [2]. While the larvae of third age can eat in a day 3 - 3.5 larvae of flies while the adult just 2.5 larvae. Such activity of nutrition is highlighted for species from genera *Ocypus*, *Staphylinus*, *Ontholestes* and *Quedius*.

Specimens of *Philonthus splendens* and *Philonthus succicola* can be found everywhere. They have wide cephalic capsule, well developed and long mandibles and can consume other rove-beetles equal to their own size. Like most species from this genus they eat eggs, larvae, pupae of synanthropic flies and other insects. Also, the specimens of *Philonthus splendens* eat the larvae of beetles from *Nicrophorus* and *Trechus* genera, larvae of *Mamestra brassicae* and *Tenebrio molitor*; the *Philonthus succicola* – larvae of click beetles (Elateridae) and darkling beetles (Tenebrionidae) [2, 3].

References:

1. Osman G.Y., Zaki A.M., Salem F.M., Darwisch E.T.E. Biological control study on *Tylenchulus semipenetrans* (*Nematoda*) by certain soil mesofauna. In: Pflanzenschutz Umweltschutz .1998, 61 (6), P. 116-118.

2. Бабенко А. С. Экология стафилинид Кузнецкого Алатау. Томск, 1991. 189 с.

3. Бабенко А.С. Жесткокрылые подсемейства Staphylininae (*Coleoptera, Staphylinidae*) из предгорий Западного Алтая. Фауна Сибири. В: Фауна и экология растительноядных и хищных насекомых Сибири. Новосибирск , 1980. С. 33-41.

4. Корж К. П., Машкей И. А., Тараник К. Т., Мищенко А. А. Стафилиниды -регуляторы численности пастбищных мух. Проблемы почвенной зоологии. В: Тезисы докладов VII всесоюзного совещания. Ашхабад, 1984, книга 1, С. 148-149.

5. Остафичук В. Г., Некулисяну З. З. Биология *Philonthus tenuicornis* Muls. & Rey. (=*carbonarius* Gyll.) (*Coleoptera, Staphylinidae*). В: Фауна и экология энтомофагов. Кишинев, 1982. С. 38-41.

6. Соболева-Докучаева И. И., Солдатова Т. А. Особенности питания полевых стафилинид (*Coleoptera, Staphylinidae*) при лабораторном содержании. В: Научн. высш. школы. биолог. науки. Москва, 1977, нр. 2, С. 53-57.

VERTICAL DISTRIBUTION OF WEEVILS (COLEOPTERA, CURCULIONOIDEA) IN DECIDUOUS FORESTS OF REPUBLIC OF MOLDOVA

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Introduction

Forest canopy research is an increasing field of interest in ecology for several reasons. Forest canopies are one of the last biotic frontiers (Erwin, 1983), host to a large proportion of all terrestrial animals (Erwin, 1982; Basset, 2001) with a high expected number of unique invertebrates, highly structured and very diverse. However, forests and their canopies are considered to be more homogenous and constant systems in comparison with other types of vegetation (Shuttleworth, 1989) and communities of canopy arthropods (Longino, Nadkarni, 1990) or herbivores are assigned to the canopy as a single unit. In deciduous forests, limited knowledge is available about the distribution of arthropods and little evidence exist that near-ground communities differ from those in the canopy (vertical stratification) (Albert, 1976). Among of the numerous amount of arthropods greater part are herbivorous insects, to which weevils belong too.

In this context, the aim of this study was to analyze the vertical distribution of *Curculionoidea* beetles fauna presented in deciduous forests of the Republic of Moldova, which, due to bioclimatic conditions, is extremely diverse.

Materials and Methods

The main material was collected from 29 regions in deciduous forest of the Republic of Moldova during 2008-2010, from early April to mid October of each year. Specimen capture was carried out by indirect collection using sweep net techniques (Fasulati, 1971), and flight interception traps (Basset, 1997). Sampling took place every 10 days, with a few exceptions due to unforeseeable circumstances. For above-ground fauna a standard sweep net, 25 cm in diameter was used at the rate of 50 sweeps per plot. Canopy fauna was defined by flight interception traps in the centre of tree crowns, at heights between 10 m and 20 m above ground. Recovered specimens from each plot were kept into a cloth bag and counted in the laboratory.

The taxonomy of the weevils species dealt with below is based primarily on the works of Caldara (1990), Dieckmann (1977, 1988), Alonso-Zarazaga and Lyal (1999), also entomological museum collections of the Institute of Zoology have been used for taxonomic classification. All samples are deposited in the collection of the Entomological Museum, Institute of Zoology of the Academy of Science of Moldova.

Results and Discussion

During two-year investigations, a total of 319 beetles of the subfamilies *Curculionidae* and *Apionidae* belonging to 22 genera were captured in traps. Altogether, 43 species from the genera *Sitona* (6 species), *Phyllobius* (4), *Lixus* (4), *Larinus* (3), *Otiorhynchus* (3), *Omias* (2), *Tychius* (2), *Tanymecus* (2), *Apion* (2), *Polydrusus* (2), *Liparus* (1), *Cleonis* (1), *Mecaspis* (1), *Sciaphobus* (1), *Dorytomus* (1), *Eusomus* (1), *Stereonychus* (1), *Hypera* (1), *Rhinoncus* (1), *Liophloeus* (1), *Cyphocleonus* (1), *Protapion* (1) and *Hemitrichapion* (1) have been revealed.

The greatest numbers of species and individuals were sampled from the understory, a total of 33 species belong to the following genera: *Sitona* (6 species), *Lixus* (4), *Larinus* (3), *Tanymecus* (2), *Tychius* (2), *Omias* (2), *Apion* (2), *Liparus* (1), *Cleonis* (1), *Mecaspis* (1), *Phyllobius* (1), *Eusomus* (1), *Otiorrhynchus* (1), *Hypera* (1), *Rhinoncus* (1), *Liophloeus* (1), *Cyphocleonus* (1), *Protapion* (1) and *Hemitrichapion* (1), amounting to 76,7% of the total number.

The midstory layer consists of 5 species from 3 genera *Phyllobius* (2 species) *Otiorrhynchus* (2) and *Sciaphobus* (1), amounting to 11,6% from the total number of sampled species. In total, 12 species belonging to 7 genera *Phyllobius* (4 species), *Polydrusus* (2), *Otiorrhynchus* (2), *Sciaphobus* (1), *Dorytomus* (1), *Eusomus* (1) and *Stereonychus* (1), were sampled from the canopy strata, which represent 27,9% of the collected species.

Also, species living on two levels have been noted. Thus, *Phyllobius urticae* DeG. and *Eusomus ovulum* Germ. inhabit both layer, understory and canopy, that correspond to 4,65 % from total number species and *Otiorrhynchus ovatus* L. which lives on understory and midstory levels, amounting 2,32%. Following species *Phyllobius oblongus* L., *P. pyri* L. *Sciaphobus squalidus* Gyll. and *Otiorrhynchus albidus* Stierlin inhabiting midstory and canopy, compound 9,30 % from the total number of the found species. It would be desirable to notice that among phytophagous weevils there is a division into ecological niches, layers. Species inhabiting basically on grass it is seldom possible to find on arboreal forms and contrarily. Such trophic division mainly defines the variety of this group of beetles.

In such studies of arthropods, it is essential not only to focus on the canopy and understory separately, but also to take into account all strata together because the environmental and biological variability from the understory to the canopy may affect the arthropod distribution (Schowalter et al., 1989).

Acknowledgements

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Reference

1. Albert, R. 1976, Zusammensetzung und Vertikalverteilung der Spinnenfauna in Buchenwaldern des Solling, - Faunistisch – okologische Mitteilungen 5 (3 - 4), p 65 – 80.

2. Alonso-Zarazaga, Lyal C.H., 1999, A world catalogue of families and genera *Curculionoidea* (Insecta: *Coleoptera*) (excepting *Scolytidae* and *Platypodidae*). Entomopraxis. Barcelona: 315.

3. Basset, Y., 2001, Invertebrates in the canopy of tropical rain forests, how much do we really know? – Plant Ecology 153, p 87 – 107.

4. Basset, Y., Springate, N.D, Aberlenc, H.P., Delvare, G., 1997, A review of methods for sampling arthropods in tree canopies, - In: Stork, N. E, Adis, J and Didham, R. K, Canopy Arthropods, p 27 – 52.

5. Caldara, R., 1990, Revisione taxssonomica delle specie paleartiche del genre *Tychius* Germar (*Coleoptera, Curculionidae)*. Mem. Soc. Ital. Sci. Natur., 25, No.: 3, p. 53 – 218.

6. Dieckmann, L., 1977, Beitrag uler mitteleuropaisschen Russelkefer (*Coleoptera, Curculionidae*). Ent. Nachrichten., 18, p. 65 – 70.
7. Dieckmann, L., 1988, Beitrage zur Insectenfaune der DDR: *Curculionidae* (*Curculioninae: Ellescini, Acalyptini, Tychiini, Anthonomini, Curculionini*). Beitr. Ent., 38, No.: 2, Berlin, p 365-468.
8. Erwin, T.L., 1982, Tropical forests: their richness in Coleoptera and other arthropod species – Coleopterologists Bulletin 36, p 74 – 75.
9. Erwin, T.L., 1983, Tropical forest canopies: The last biotic frontier – Bulletin of the Entomological Society of America 29, p 74 – 75.
10. Fasulati C., 1971. Polevoe izucenie nazemnyh bespozvonocnyh. Moskva: Vysshaia scola. 424 p.
11. Longino, J.T., Nadkarni, N.M., 1990, A comparison of ground and canopy leaf litter ants (*Hymenoptera: Formicidae*) in a neotropical montane forest, - Psyche 97, p. 81 – 93.
12. Schowalter, T.D., 1989. Canopy arthropod community structure and herbivory in old-growth and regenerating forests in western Oregon. Can. 1 for Res., 19: 318-322.
13. Shuttleworth, W.J., 1989, Micrometeorology of temperature and tropical forests, - Philosophical transactions of the Royal Society of London, Series B 324, p. 299 – 334.

ASPECTS OF FEEDING AND REPRODUCTION OF *CALLIPHORA VICINA* (ROBINEAU-DESVOIDY 1930) SPECIES IN ROMANIA

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Calliphoridae family includes 1100 species described so far, spread worldwide, with a large number of species in Southern Europe. Calliphoridae are large-sized blowflies, commonly shiny with a metallic black-gray, dark blue or green color. Antennae are 3-segmented, aristate. Arista is plumose the entire length. Calypters are very well developed. The rib wing is characteristic. The thorax has the continuous dorsal suture across the middle. The post-scutellum is absent or weakly developed. Females lay about 150-200 eggs per batch, usually yellowish or white in color and approximately 1.5 mm x 0.4 mm long. Hatching from an egg to the first larval stage takes about 8 hours to 24 hours. The larvae are found on carrion and dung. Larvae are headless shell with reinforcing cuticular more developed than Muscidae (Ionescu & Lăcătușu, 1971; Teodorescu & Antonie, 2008).

Calliphora vicina is a common synanthropic species. It is approximately 10-11 mm long, metallic blue-gray colored, yellow orbits, large reddish black bristled eyelashes. The forehead has a median black stripe, the trunk is black with yellow stripes with reddish palpi. Long antennae, with the apex of article two and the basis of article three reddish in color. Arista hairy plumose to top. Black thorax with a gray-blue frost. Clear wings, yellowish basicosta, well developed calypters. Robust legs, black and strong claws. Adults are attracted to decomposing organic matter, emanating a strong odor. To deposit eggs, the females search for vertebrate carcasses or rotting meat. A female can lay up to 200 eggs, on fresh carrion. The average life span of the adult is 27-30 days. It is the most common *Calliphora* species in Romania, found in all areas of vegetation, from sea level to the alpine area. It can be found in urban areas and are most abundant in early spring and fall where the temperatures are around 13-24˚C (Lehrer, 1972; Bei-Bienko, 1988).

In the research made on *Calliphora vicina* species, the aspects of feeding and reproduction, on various nutritional substrates have been highlighted. The experiment was conducted in urban area (Bucharest) at temperatures between 0 ºC - 21 °C and humidity of 29% -100% (figure 1).

The research time span was 62 days, between 03/07/2011 to 05/07/2011.

The vegetation of the perimeter is considered arboreal (mainly specimens of *Aesculus hyppocastanum*, *Tilia sp.*, *Ulmus sp.*, *Fraxinus sp.*), with a rich cover of small plants on the ground. This rich vegetation maintains the humidity of the vegetal land.

As attractive baits for *Calliphora vicina* species 6 specimens of *Metapaneus monoceros*; 4 specimens of *Carassius auratus*; 0.845 kg of *Mytilus galoprovincialis*; 0.868 kg of *Sus scrofa domestica*; a juvenile specimen of *Vulpes vulpes*; one specimen of *Meles meles* were used.

Following the daily monitoring of the experiment it was observed that *Vulpes vulpes* and *Meles meles* were preferred as breeding environments and the rest were just preferred as feeding substrate. Life cycles of *Calliphora vicina* species were also monitored reported to temperature and humidity variations, as well as to the used substrate.

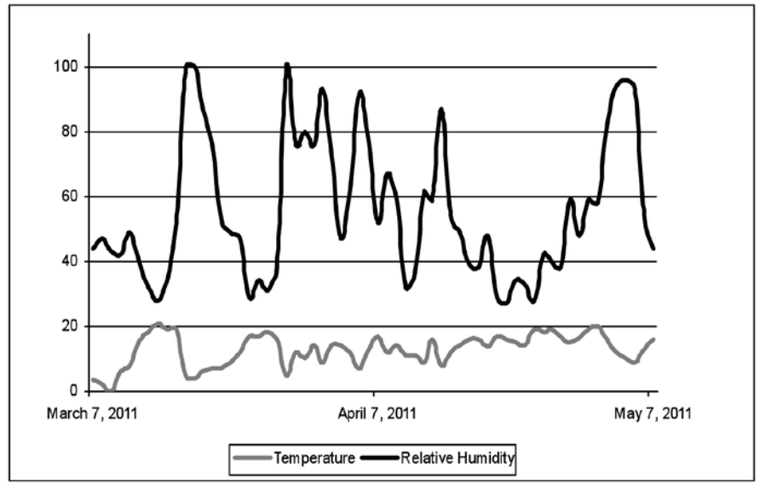

Figure 1. Variation of temperature and humidity values recorded during the experiment

The importance of this research consists in the fact that *Calliphora vicina* is the first insect species that colonizes a cadaver, with a capacity of detecting the pestilential odour from a distance of 16 km. The exploration of the insect community on a corpse can contribute valuable information to the forensic investigation and the field of forensic entomology is relatively unknown in our country and this method is not used by the police investigators.

Due to their ability to colonize corpses quickly after death, blowflies have proved more useful than any other insects in giving an estimate of the post-mortem interval (the time elapsed since death). Knowing the duration of *Calliphora vicina* life cycle, can be useful to determine the post mortem interval in a criminal case. The life cycle for *Calliphora vicina* lasts approximately 18 days.

The variation of temperature and relative humidity can influence the development cycle of this species. *Calliphora vicina* is most abundant in early spring and autumn, when temperatures are around 13 ºC - 24 °C.

Besides the importance that this species may have into a forensic investigation, *Calliphora vicina* has ecological importance taking the carbon and other nutrients in the carrion back down the food-chain. This species is directly involved in the realization of two functions of ecosystems: the movement of matter and the decomposition of organic matter and release of biogenic minerals.

Blowflies can play an important role in food hygiene as they visit excrement and rotting carrion, transferring pathogens as they go, but human myiasis cases involving *Calliphora vicina* are extremely rare.

Through this research we wanted to emphasize the role and importance of this species both in the field of forensic science, biology and ecology sciences.

Bibliography:

G. Ya. Bei-Bienko (Editor-in-Chief) – „Keys to the Insects of the European Part of the USSR, Vol. V - Diptera and Siphonaptera, Part II". Smithsonian Institution Libraries and The National Science Foundation, Washington, D.C. 1988;

Mihail A. Ionescu, Matilda Lăcătușu – „Entomologie". Editura didactică și pedagogică București 1971;

Andy Z. Lehrer: „Fauna Republicii Socialiste România, Insecta, Vol.XI, Fascicula 12 – Diptera, Familia Calliphoridae". Editura Academiei Române, București 1972;

Irina Teodorescu, Iuliana Vlad Antonie – „Entomologie". Editura didactică și pedagogică, București 2008

SPECIFIC DIVERSITY FROM THE LOWER BASIN OF THE RIVER ICHEL

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The current research has been conducted in Ciorescu village, located in central Moldova, 14 km from Chisinau, in the North - East. Ciorescu village has an area of about 0.79 km ^{2}, with a perimeter of 4.06 km and is the place of residence of the commune in villages: Ciorescu Făureşti and Goian.

The village is set on a landscape with valleys and hills, which are part rocky slopes, some arable land. On the slope of the hills that descend towards the river Ichel, a tributary of the Dniester River. The annual water volume is 20.5 million m^3. The medium flow is 0.7 m^3 / c. In the river flows a sewerage system near villages of the district Criuleni. Residual water cleaning installations are either absent or completely worn. The water is heavily polluted. In many places the river is full of household waste, animal waste, garbage, etc. In Făureşti, into the river flows a spring with good quality drinking water. The flora and the fauna have a relatively small diversity and in this area are poorly studied.

In this paper we intend to make an inventory of invertebrate species mentioned so far in the river Ichel. Without claiming to have exhausted all bibliographic material of this area, this work is a first step in knowledge of invertebrate fauna, and may be a database for further research.

The researches on entomofauna from the lower basin of the river Ichel focuses on three directions:

1. Studying the boscage fauna of forested areas;

2. Entomofauna study of open areas covered with grass plant associations;

3. Studying the nocturnal entomofauna.

Samples were collected seasonally during the months from March to June 2011 from two stations:

1. Ciorescu – Făureşti route;

2. Făureşti – Goian route.

The researches were conducted with entomological net, by mowing herbaceous vegetation or by shaking the trees and bushes, and by visual inspection of vegetation, of different manure of mammals and manure under the soil layer, by manual capturing of insects, with aquatic net. As a result of investigations of the river area were collected and identified 103 species of invertebrates belonging to phylum: Plathelminthes, Annelida, Mollusca, and Arthropoda.

Phylum Plathelminthes, class Turbellaria, order Tticladida, species Dendrocoelum lacteum (Müeller,1774).

Phylum Annelida, class Hirudinea, order Gnathobdelida, species Hirudo medicinalis (Linnaeus, 1758).

Phylum Mollusca, class Gastropoda, order Basommatophora, species Stagnicola palustris (Müller,1774), Anisus vortex (Linnaeus,1758), order Stylommatophora, species Vallonia costata (Müller,1774), Oxyloma elegans (Risso,1826), Deroceras reticulatum (Müller,1774), Helicella obvia (Menke,1828,or.1878), Succinea putris (Linnaeus,1758), Chondrula tridens (Müller,1774), Cepae vindobonensis (Pfeiffer,1828), Helix pomatia (Linnaeus,1758).

Phylum Arthropoda, class Crustacea, order Isopoda, species Asellus aquaticus (Linnaeus, 1758), order Amphipoda, g. Gammarus.

Phylum Arthropoda, class Myriapoda, species Glomeris connexa (C.L.Koch, 1847).

Phylum Arthropoda, class Insecta, order Coleoptera with 46 species, that belong to 10 families. Family Carabidae with species Carabus convexus F., Platysma vulgare L., Broscus cephalotes L., Zabrus tenebrioides Goeze, Platysma nigrum Schall, Agonum mulleri Hbst, Platysma cupreum L., Harpalus aeneus F., Amara plebeja Gyllh. Family Cantharididae with 5 species: Lampyris noctiluca L., Cantharis rustica Fall., Cantharis fusca L., Cantharis pellucid L., Rhagonycha fulva Scop.

Family Meloidae with 2 species: Meloė proscarabaeus L., Meloė rugosus L.

Family Coccinellidae with 3 species: Coccinella septempunctata L., Adalia bipunctata L., Psylobora vigintiduopunctata L.

Family Oedemeridae with 2 species: Oedemera mobilis L., Oedemera femorata Scopoli. Family Tenebrionidae with 4 species: Blaps halophila Fisch, Blaps mucronata Fisch, Opatrum sabulosum L., Pedinus femoralis L. Family Cerambycidae with 3 species: Agapanthia villosoviridescens Deg., Dorcadion fulvum Kryn., Dorcadion holosericeum Kryn. Family Chrysomelidae with 8 species: Chrysolina fastuosa Scop., Cryptocephalus sericeus L., Cryptocephalus violaceus Laich., Clytra quadripunctata L., Leptinotarsa decemlineata Say., Cassida nebulosa L., Entomoscelis adonidis Pall., Galeruca tanaceti L. Family Anthribidae with species Anthribus albinus L. Family Scarabaeidae with 11 species: Epicometis hirta Poda, Rhizotrogus aequinoctialis Hbst., Melolontha melolontha L., Amphimallon solstitialis L., Cetonia aurata L., Onthophagus vacca L., Onthophagus ovatus L., Aphodius luridus F., Aphodius bimaculatus Laxm., Aphodius fimetarius l., Aphodius rufipes L.

Order Diptera with 13 species , that belong to 8 families:

Family Tipulidae with species Tipula oleracea Mg. Family Bombyliidae – Bombylius major L. Family Asilidae – Asilus germanicus L., Philonicus albiceps Meigen. Family Sarcophagidae – Sarcophaga carnaria L. Family Tachinidae – Lucilia aesar L. Family Syrphidae – Syrphus pyrastri F., Syrphus ribesii L. Family Muscidae with 4 species: Musca domestica l., Musca corvina F., Mesembrina meridian L., Muscina stabulans Flln. Family Calliphoridae – Calliphora vomitoria Order Hymenoptera with 9 species, that belong to 2 families:

Family Apidae with 7 species; Apis mellifera L., Bombus terrestris L., Bombus lapidarius L., Bombus argillaceus Scopoli, Bombus fragrands Pallas, Bombus paradoxus Dalla Torre, Xylocopa valga G. Family Formicidae with species: Formica rufa L., Lasius flavus L.

Order Lepidoptera with 16 species, belonging to 4 families: Family Pieridae with species – Pieris brassicae L., Pieris rapae l., Pieris napi L., Leptidea sinapis l., Pontia daplidice L., Anthocharis cardamines L., Colias erate Esp., Gonepteryx rhamni L., Colias hyale F., Colias cracea Frcr. Family Papilionidae with species: Iphiclides podalirius L., Zerynthia polyxena Denis et Schif. Family Lycaenidae with species: Polyommatus icarus Rott., Polyommatus daphnis Denis et Schiffer., Lycaena phlaeas L. Family Nymphalidae with species Inachis lo L.

Besides the common species in this area have been reported rare and very rare species in entomofauna of Moldova, included in the Red Book as: Iphiclides podalirius, Zetynthia polyxena, family Popilionidae, order Lepidoptera, Xylocopa valga, family Antophoridae, Bombus argillaceus, Bombus fragrands, Bombus paradoxus, family Apidae, order Hymenoptera.

The final conclusion of this study is that each studied area has its specific characteristics which give preference and adaptability to different groups of invertebrate animals in the territorial fragments. We believe that the number of species mentioned so far do not reflect the real situation in this territory.

These data allowed the possibility of establishing a relative zonality (the researches will be continued) of species of invertebrates from the lower basin of the river Ichel.

EFFECIENCY OF SOME CULTURAL PRACTICES ON THE CYST NEMATODES *(HETERODERA SCHACHITII)* AND THE STRUCTURE OF NEMATODE COMMUNITIES IN THE EXPERIMENTAL SUGAR BEET PLANTATIONS

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Cyst nematode *Heterodera schachtii* Schmidt is considered as one of the most dangerous nematode pests on sugar beet (*Beta vulgaris* L. sp. *saccharifera*) in the sugar-beet growing areas. The typical symptoms are the patchy wilting of the sugar beet foliage, the outer leaves yellow and finally die; the shortened and deformed main root with the increased lateral root formation like „root beard" and the presence of the pinhead-sized white females and brown cysts. The yield losses may be higher than 50% under 300 – 400 eggs and second stage juveniles (J2) in 100 gr of dry soil (Nesterov, 1973; Tacconi, 1978; Greco et al., 1982; Baldwin, Mundo-Ocampo, 1991; Cuarto G., 2008 etc.). In Moldova, the study of nematode communities in the sugar beet plantations with emphasis to the dangerous plant parasite species was investigated by Prof. P. Nesterov in second half of last century. It was revealed that the infestations of *H. schachtii* may reduce especially the weight of sugar beet roots and are strictly related to local climatic conditions. Thus, the soil temperature is above 10^{0}C for a long time thereby increasing the number of pest generations. Cycle of development *H. schachtii* lasts 30 – 45 days and completes at least 3 – 4 generations per year in the climatic conditions of Moldova. The summer high temperatures stress the sugar beet plants reducing the root ability to the resistance against the different invasions (Nesterov, 1970).

Today, farmers may choose among a series of agronomical techniques, which may warrant a success in controlling cyst nematodes, in cause the correctly and punctually applied. Some treatments for preventing of the multiplication of the sugar beet nematodes are the wide crop rotation and long-term application of organic manure and nitrogen fertilizers (Gruzdeva et al., 2007; Linag et al., 2009; Poiras et al., 2010). Every

year the spontaneous hatching of the beet nematode larvae occurs out of cysts. The population would be reduced in the situation when the larvae do not find any host plant for their development. The numerous studies of the crop rotation period for sugar beet propose to include the non-susceptible plants for 3 or 4 years between sugar beet planting to reduce the number of beet nematodes (Curto, 2008).

The objectives of this study were to compare the long-term effects of organic manure (40 ton/ha), nitrogen fertilizer ($N_{60}P_{30}K_{30}$) and 3-years crop rotation (corn, wheat and sugar beet) on the density of juveniles and cysts of *Heterodera schachtii* in the long-term field experiments of Research Institute of Field Crops „Selection" (Balti) and to evaluate the relationship between soil proprieties and nematode communities.

Materials and methods. The experimental plots were: 1- unfertilized permanent culture (P) of sugar beet during 24 years; 2 - permanent culture of sugar beet with application of nitrogen fertilizer (N) $N_{60}P_{30}K_{30}$ and organic manure (M) 40 tone/ha (P+M+N); 3 – unfertilized crop rotation (CR) during three-years including corn, wheat and sugar beet and 4 - crop rotation during three-years including corn, wheat and sugar beet with application of organic manure 40 tone/ha and nitrogen fertilizers $N_{60}P_{30}K_{30}$ (CR+M+N). Soil samples were taken from 0 - 20 cm depth in each plot in autumn (before harvest season) of 2009. Nematodes were extracted from 1 dm^3 of soil and 100 g of sugar beet roots. At least 150 nematodes from each sample were identified. The nematodes were assigned to the following feeding groups (Yeates et al., 1993) characterized by feeding habits: bacteriovores (Ba); fungivores (Fu); omnivore-carnivores (Om-Ca) and plant parasites (PP). To analyze the community structures, the nematode families were allocated to functional guilds (Ferris et al., 2001). The functional guilds are defined as combinations of feeding groups (Yeates et al., 1993) and life strategy using *cp* values from extremely r-strategy to K-strategy (Bongers, 1990).

Results and discussion. Species diversity of nematode communities in permanent culture and crop rotation of 24 years-experimental plots with/without manure and nitrogen fertilizers have been studied. Fourty four species of plant parasite and free-living nematodes with density 550 – 3500 ind./1dm^3 soil and the different number of cysts of *H. schachtii* were revealed. According to the trophic groups (Yeats *et al*., 1991) the plant parasites and bacteriovores were dominated by species diversity and their density especially in permanent culture (Tab. 1, Fig. 1).

Table 1. Number of species and their abundance of nematodes in long-term experimental plots

	Experimental plots of permanent culture and crop rotation with/without organic manure and inorganic fertilizers			
	P	P+M+N	CR	CR+M+N
Number of species in experimental plots	34	31	28	29
Trophic groups: - plant parasites (PP)	10	9	9	9
-bacterivores (Ba)	11	10	9	10
-fungivores (Fu)	5	6	5	5
-omnivore-carnivores (Om-Ca)	8	6	5	5
Number of individuals/ 1dm^3 de sol	1720-3500	950-1680	640-1120	550-1320
Number of cysts/ 1dm^3 de sol	1450-2000	750-1500	0-120	0-68

In the experimental plots of permanent culture (P) the number of cysts *Heterodera schachtii* (cca 1000-2000 and more) were exceeded the threshold of economic damage. The endoparasite species of genus *Pratylenchus* (*P. pratensis, P. subpenetrans*) and ectoparasite *Paratylenchus nanus* were numerous causing the losses of sugar beet crop and its quality. Crop rotations including grains and corn in combination with organic manure and nitrogen fertilizers (CR+M+N) are effectively reduced population *H. schachtii* (till 15 – 20 cysts/1dm^3) to below the damaging threshold density. In this experimental plots the nematode bacteriovores, which are the natural antagonists of the sugar beet cyst nematode, were numerous (Fig. 1).

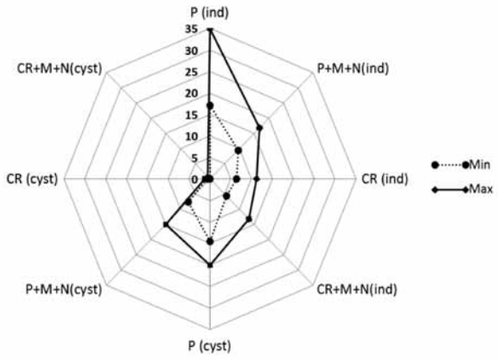

Fig. 1. Number of individuals of nematode communities and cysts of *H. schachtii*

(max. and min.) depends to the experimental plots (ind., cysts x10^3/1dm^3 soil).

Analyzing the structure of nematode communities, the nematode families and genera were located according to the functional guilds (Table 2). The guild designation of nematodes with the similar trophic function and life-history strategy provides a basis for using nematode faunal analyses in an integrative assessment of soil food web condition (Ferris et al., 2001, Okada et al., 2004).

To describe the long-term changes in soil conditions, by excluding opportunistic bacteriovores guild Ba1, that reproduce very rapidly in response to nutrient condition in soil. In our study Ba1 was presented only by genus *Mesorhabditis* and replaced by numerous Ba2 (*Cephalobidae* and *Plectidae*) and Fu2 (*Aphelenchus* and *Aphelenchoides*) that are relatively tolerant in chemical stress or polluted soils (Ferris et al., 2001). So that they may have survived in deeper soil under the fumigation treatment and recovered rapidly (Liang et al., 2009). Nematodes *Cephalobidae* require fewer food bacteria to maintain population growth, and also the family is less affected by food bacterial species for population growth, than *Rhabditidae* (Venette and Ferris, 1998) and this genus tend to be most abundant in soils with less pores, or more clay (Yeats, 2003). The organic manure and nitrogen fertilizers increased the greatly abundance of bacteriovores (guild Ba2) and relatively lower abundance of omnivore-carnivores (guilds Om4, Om5, Ca4), however decreased plant parasites (guilds PP3 and partly PP2). Plant parasite nematodes are potentially more responsive to host plants that to soil amendment (Bulluck et al, 2002, Liang et al., 2009) and crop species may have influenced nematode community structure more than management practices (Neher, 1999).

Table 2. Functional guilds of soil nematodes characterized by feeding habits and life-strategy and families found in the experimental plots[1)]

Guild[2)](feeding group[3)] with c-p value[4)])	Family, genus[3)]
Ba1 (bacterivorous families with *c-p* value 1)	*Rhabditidae* (*Mesorhabditis*)
Ba2 (bacterivorous families with *c-p* value 2)	*Cephalobidae* (*Cephalobus, Chiloplacus, Eucephalobus, Heterocephalobus, Acrobeloides*) *Plectidae* (*Aulolaimus, Anaplectus, Plectus*)
Fu2 (fungivorous families with *c-p* value 2)	*Aphelenchidae* (*Aphelenchus*), *Aphelenchoididae* (*Aphelenchoides*)
Ca4 (carnivorous families with *c-p* value 4)	*Mononchidae* (*Mononchus*), *Mylonchulidae* (*Mylonchulus*)
Om4 (omnivorous families with *c-p* value 4)	*Quidsinematidae* (*Eudorylaimus, Ecumenicus*), *Dorylaimidae* (*Mesodorylaimus, Prodorylaimus*)
Om5 (omnivorous families with *c-p* value 5)	*Aporcelaimidae* (*Aporcelaimellus*)
PP2 (plant parasite families with *c-p* value 2)	*Tylenchidae* (*Tylenchus, Filenchus*), *Anguinidae* (*Ditylenchus, Nothotylenchus*), *Ecphyadophoridae* (*Lelenchus*), *Telotylenchidae* (*Bitylenchus*), *Hoplolaimidae* (*Helicotylenchus*), *Paratylenchidae* (*Paratylenchus*),
PP3 (plant parasite families with *c-p* value 3)	*Heteroderidae* (*Heterodera*), *Pratylenchidae* (*Pratylenchus*)
1) According to Okada et al. (2004); 2) According to Ferris et al. (2001); 3) Allocation of each family, genus to a feeding group followed Yeats et al. (1993); 4) scale c-p from 1 to 5 according to Bongers (1990); 5) Only genus *Filenchus* occurred in the plots, and allocated to Fu2, according to Okada et al. (2002, 2004).	

Therefore the long-term application of fertilizer (manure and nitrogen) in combination with the crop rotation (3 – 4 years) increases the abundance of some nematodes especially bacteriovores, fungivores, omnivores and decreases the plant parasites especially the sugar beet nematode *Heterodera schachtii* in comparison with the permanent culture without fertilizers.

EFFECTS OF SOME PLANT GROWTH PROMOTING RHIZOBACTERIA ON INVASIVE JUVENILES OF ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) OF TOMATO *IN VITRO*

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Plant-parasitic nematodes, especially root-knot nematodes, are important cosmopolitan pathogens affecting the production of field and greenhouse crops. During the last years *Meloidogyne incognita* (southern root-knot nematode) has become an intense problem that occurred worldwide especially on tomato in greenhouse; their larvae infect plant roots and tubers, causing the development of root-knot galls that drain the plant's photosynthesis and nutrients. The overused of the conventional nematicides and other chemicals were detrimental to the environment and human health which have increased the need for new safety methods of managing plant parasitic nematodes (Khan, Kounsar, Hamid, 2002). Consequently, during the recent years, there has been a growing recognition of the role of some natural enemies to combat the plant parasitic nematodes. One interesting and significant aspect involves association of bacteria PGPR (Plant Growth Promoting Rhizobacteria) with certain nematodes. PGPR present a wide variety of soil bacteria which, when grown in association with a host plant, result in stimulation of grown of their host (Abat, 2006; Saharan, Nehra, 2011). It is established that many rhizobacteria are known to produce nematicidal and nematistatic compounds. The effect of bacterial filtrates on nematode juveniles (J2) of *Meloidogyne* spp. and their mortality was studied *in vitro* and *in vivo* (Ashoub, Amara, 2010 etc.). Such bacterial culture filtrates suppressed both galls formation and rate of female reproduction of *Meloidogyne*. PGPR strains (*Azotobacter chroococcum, Pseudomonas fluorescens*, *Ps. putida, Bacillus polymixa*) inhibited the egg hatching and killed the invasive juveniles (J2) by producing wide variety of antibiotics, biological activity substrates, siderophores, organic compounds (Siddiqui, Futai, 2009).

The main objective is to study the suppressive effects of the bacterial culture filtrates of some PGPR (*Azotobacter chroococcum, Bacillus polymixa, Pseudomonas aureofacien, Ps. fluorescens, Ps. putida, Ps. cepacia*) on invasive juveniles (J2) of *Melodogyne incognita in vitro* to reduce nematode larvae population density and their pathogenicity.

Materials and methods. Six bacterial culture filtrates of PGPR were selected. The second age juveniles (J2) of the root-knot nematodes *M. incognita* were extracted by modified Baermann method from the glasshouse soils and roots (Nickle et al., 1991) collected under infected tomato plants (Photo 1, 2, 3). To study the nematicidal and nematistatic effects of non-soluble bacterial culture filtrates of studied PGPR strains (*Azotobacter chroococcum, Bacillus polymixa, Pseudomonas aureofacien, Ps. fluorescens, Ps. putida, Ps. cepacia*), the larval suspension containing 100 freshly hatched juveniles (J2) of root-knot nematode *Meloidogyne incognita* was taken into Petri dishes. Stock solution of bacterial culture filtrates were added to these petridishes, distilled water was taken as control. Each treatment was replicated thrice and kept in room temperatures. Observation on nematode mortality was recorded after 0.05-0.1, 2, 4, 8, 12 and 24 hours.

Experiment of attraction/inhibition of J2 *M. incognita* used the horizontal half-cut plastic tubes (diameter 2 cm and 9 cm in length). The tubes were filled with the fragmented perlite substrate (an aggregate for lightweight concrete) at 15% moisture (the tubes were covered to avoid evaporation). Every tube conventionally was divided into 3 sections (3 cm each): A - near 150 ml suspension of active 1000 juveniles (J2) of *M. incognita* was transferred into section; B – medium part of tube with original condition; C – the root exudates of tomato with/without bacterial culture filtrates of studied strains of PGPR. Root exudates from tomato plant were collected from 14-days old plants grown. The experiments were conducted for 2 weeks.

Results and discussion. The degree of the infection of tomato root system by root-knot nematodes *M. incognita* was carried out on the base of the scale 0-4 points (by Sadykin, 2002) - from individual galls on the tomato roots till more than half or all roots covered by galls. All degree of the infection of tomato root system by root-knot nematodes *M. incognita* were revealed depends of tomato variety and experimental plots in greenhouse IPPEA ASM (Photo 1, 2, 3). It was observed that in control the aboveground part of tomato plants affected by root-knot nematode was underdeveloped with the stunted, withered leaves, small and not numerous fruits.

Photo 1. Galls of tomato roots caused by root-knot nematode *Meloidogyne incognita* from green house (original)

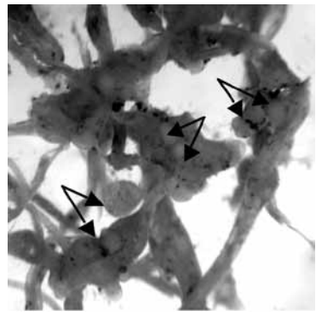

Photo 2. Female of *Meloidogyne incognita* (arrows) inside tomato roots (original)

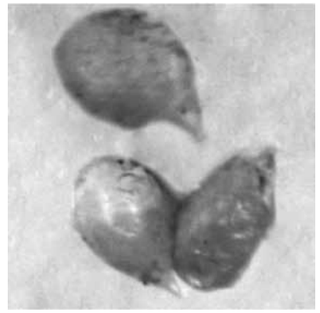

Photo 3. Shape of mature female of *Meloidogyne incognita* (original)

Analysis of experimental results showed that the most effective on the larval (J2) mortality of *M. incognita* was the direct influence of non-soluble bacterial culture filtrate *Azotobacter chroococcum* such as almost total larval mortality was observed during the first minutes of the experiment. The effectiveness of non-soluble culture filtrates of bacteria such as *Bacillus polymixa* on mortality of juveniles (J2) *M. incognita* was for 2 hours, *Ps. aureofacien* and *Ps. putida* - till 5 hours, *Ps. fluorescens, Ps. cepacia* - after 24 hours (Table 1).

Table 1. Impact of culture filtrates of bacterial strains (*Azotobacter, Bacillus, Pseudomonas*) on mobility of infective juveniles (J2) of nematodes genus *Meloidogyne*

	PGPR					
Exposure time (hours)	***Azotobacter***	***B.polymixa***	***Ps.putida***	***P.aureofacien***	***Ps.fluorescens***	***Ps.cepacia***
0.01						
2						
5						
8						
24						

Note: 80-100% J2 active; 40-60% J2 semi-mobile; 10-30% J2 semi-mobile; J2 dead

Effect of tomato root diffusate on migration (chemotactic response) of invasive juveniles (J2) *M. incognita* and also the nematicidal and nematistatic abilities of non-soluble bacterial culture filtrates of studied PGPR strains (*Azotobacter chroococcum, Bacillus polymixa, Pseudomonas aureofacien, Ps. fluorescens, Ps. putida, Ps. cepacia*) presented in Table 2.

Table 2. Effect of root diffusate and treatments (bacterial culture filtrates of *Azotobacter*, *Bacillus, Pseudomonas*) on migration of J2 *M. incognita* (%)

Bacterial culture filtrates added to section "C"	**Sections of experimental tube**		
	A	**B**	**C**
Control (root diffusate without bacterial culture filtrates)	60 ± 5	30±5	10±5
Azotobacter chroococcum	80±10	20±2	0
Bacillus polymixa	70±10	30±5	0

Pseudomonas aureofacein	60±15	35±10	5±2
Ps. putida			
Ps. fluorescens	60±5	30±10	10±5
Ps. cepacia			

Studies of the effect of bacterial culture filtrates on the chemotactic response of invasive juveniles (J2) of *Meloidogyne incognita* to tomato root diffusate showed that *Azotobacter chroococcum* and *Bacillus polymixa* negatively effect on J2 migration, which did not reach the root diffusate (section C) compared with control (Table 2).

In the experiments with non-soluble culture filtrates of *Pseudomonas putida* and *Ps. aureofacien* the mobility of J2 *M. incognita* was partly depressed and near 5% of juveniles were reached section "C". However non-soluble bacterial culture filtrates of Ps. *fluorescens* and *Ps. cepacia* were less nematistatic effect (inhibition) of invasive juveniles (near 10% in section C) compared with other variants of experiments (Table 2).

The results of these experiments to show the negative effects of some cultural filtrates of rhizobacteria strains (*Azotobacter, Bacillus, Pseudomonas*) on the larval (J2) motility, mortality and negative chemotactic response of J2 *M. incognita* to tomato root diffusate. However, these studies should be continued with different substrates (sand, soil *etc.*), exposure time and cultural filtrates of different microorganisms. In the field of microbial antagonists of dangerous plant-parasitic nematodes (especially root-knot nematodes), including bacteria, nematophagous fungi, endophytic fungi and actinomycetes.

Bibliography.

1.Abat B. (2006). Growth of agriculturally important *Pseudomonas* spp. and *Azotobacter chroococcum* on beer waste and observation of their survival in peat. Thesis of the decree of master of science.

2. Ashoub A.H., M.T. Amara. (2010). Biocontrol activity of some bacteria genera against root-knot nematode, *Meloidogyne incognita*. J. American Sci., 6: 321-328.

3. Khan M., K.Kounsar, A.Hamid (2002). Effect of certain rhizobacteria and antagonistic fungi on root-nodulation and root-knot nematode disease of green gram. Nematol. Medit.30: 85-89.

4. Lamberty F., Taylor C.E. (1979). Root-knot nematodes *Meloidogyne* species: systematics, biology and control. Intern. Conf. on *Meloidogyne* spp., 17-28 Oct.1977, Bari, Italy: 477p.

5. Sadikin A.V. (2002). Plant nematodes. Course of lectures. Tiraspol: 153p.

6. Saharan B.S., Nehra V. (2011). Plant growth promoting rhizobacteria: a critical review. Life Sciences and Medical Research, V.21: 1-16.

7. Siddiqui Z.A., K.Futai. (2009). Biocontrol of *Meloidogyne incognita* on tomato using antagonistic fungi, plant-growing-promoting-rhizobacteria and cattle manure. Society of chemical industry Pest Manag. Sci., 65: 943-948.

BIOEFFICACY OF *STREPTOMYCES* CULTURE FILTRATES AGAINST ROOT KNOT NEMATODE *MELOIDOGYNE INCOGNITA IN VITRO*

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Streptomycetes are traditionally considered as soil-dwelling organisms that may influence on the plant growth and protect plant roots against invasion by root pathogens (Krasilinikov, 1970). Antagonistic streptomycetes are considered as ideal biological control agents due to their rapid growth, easy handling and rapid colonization at rhizosphere of plant roots. These bacteria may mediate biocontrol activities by one or more types of mechanisms of diseases suppression (Weller, 1988). However, a primary mechanism of pathogen inhibition is by producing secondary metabolites with the phytostimulating, antimicrobial, antifungal and nematicidal effects (Burteva et al., 2004, 2005; Poiras N., Burteva, 2010; Poiras N., Baltat, Pesca, 2010). Such bacteria are mostly involved in the biological control of phytopathogens (Burteva, 2002; Takka, Hampp, 2008 etc.). Populations *Streptomyces* in agricultural soils form 10^5-10^7 colonies/grams of soil. *Streptomyces* isolates are important for the ecology of soils as they degrade recalcitrant substrates such as chitin and lignin and produce a variety of antibiotics (Smither-Kopperl et al., 2001).

Among phytopathogens the root knot nematodes of genus *Meloidogyne* (*Meloidogynidae*, *Tylenchida*) are obligate endoparasites of a wide range of plant species. The economically most important species is *M. incognita* as destructive pathogen of agricultural crops especially in greenhouses. The infective stage, the second stage juvenile (J2), is attracted to host roots, especially in zone of elongation of growing roots, and migrates by sinusoidal movements towards roots, presumably due to a concentration gradient of substances from the root (Wyss et al., 1992; Wang et al., 2009 etc.). Disrupting host-funding behavior may be an effective way of controlling these plant-parasitic nematodes. Several assays have been used to study chemotaxis in nematodes (Spence et al., 2008, 2010). The morphologic configiration of purported sensory structures located in the cephalic region of head end. It's the primary food-finding mechanisms are governed by chemotactic factors emanating from the host-plant (Zuckerman, Jansson, 1984). Chemotaxis is the primary means by which nematodes locate host plants, how nematodes take a source of a chemoattractant via the shortest possible routes through the labyrinth of air-filled or water-filled channels within a soil through which the attractant diffuses. It was hypothesized that a complex of attractant chemicals influences the interaction between nematodes and their hosts (Reynolds et al., 2011).

Many assays have used agarose plates to reveal the chemotactic responses of J2 *M. incognita* (Ward, 1973; Riddle and Bird, 1985; Wang et al., 2009; Spence et al, 2010 etc.); however, nematodes move along the surface of the agar in a film of water. Nematodes move on their sides on agar surfaces and perceive chemicals through amphids (anterior chemoreceptors). They detect chemical gradients by side-to-side (up and down on agar surfaces) displacement of the amphids due to head movements (Ward, 1973). Other attraction assays have used the sterilized sand-filled tubers in which movement of nematodes cannot be observed directly (Robinson, 1995; Njezic, 2009).

The main objective is to study the negative effect of the culture filtrates of some strains *Streptomyces* sp. isolated from the soils of R. Moldova, as inhibitors of chemotactic responses of second-stage juveniles of *M. incognita in vitro* to reduce nematode larvae population density.

Materials and methods. Seventeen strains of actinomycetes (genus *Streptomyces*) isolated from Moldavian soils, mostly chernoziom with the different humus content (2.4 – 6.8 %), were used in screening procedure. Studied strains were stored in laboratory conditions at about +40 C (refrigerator) on agarized Czapek medium with glucose, starch-ammonia agar, oatmeal agar. Inoculum was obtained on medium Dulone during three days at 27^0 C in flasks 0,25l on agitator. Cultivation of streptomycetes was carried out on complex medium M-I (basic source of carbon was corn flour 20 g/l) in flasks Erlenmeyer on agitator within 5 days at 27^0 C. Biomass has been separated from culture filtrates (CF) on a centrifuge (7000 rev/min. during 20 min.). The received CF contains the complex of the exometabolites (EM) of the studied strains (standard method of Voznjakovsky, 1989). The second age juveniles of the root-knot nematodes were extracted by modified Baermann method from glasshouse soils and roots collected under infected tomato plants (Nickle et al., 1991).

To study the nematicidal effect of *Streptomyces* sp. culture filtrates, the larval suspension containing 100 freshly hatched juveniles of root-knot nematode *Meloidogyne incognita* was taken into Petri dishes with a diameter 3,5 cm and a slight concavity. Measured quantities of stock solution were added to these petridishes, distilled water was taken as control. Each treatment was replicated thrice. The petridishes containing culture filtrates and larval suspension were kept in room temperatures. Observation on nematode mortality was recorded after 2, 4, 8, 12 and 24 hours by counting the live and death larvae under the stereoscopic binocular microscope (Jayakumar, 2009).

For attraction/inhibition assay used the horizontal half-cut plastic tubes (diameter 2 cm and 9 cm in length). The tubes were filled with the fragmented perlite substrate (an aggregate for lightweight concrete) at 15% moisture (the tubes were covered to avoid evaporation). Every tube conventionally was divided into 3 sections (3 cm each): A - near 150 ml suspension of active 1000 juveniles (J2) of *M. incognita* was transferred into section; B – medium part of tube with original condition; C – the root exudates of tomato with/without culture filtrates of studied strains of *Streptomyces* sp. Root exudates from tomato plant were collected from 2-week old plants grown. The experiment was conducted for two weeks.

Results and discussion. Seventeen strains of streptomycetes isolated from Moldavian soils were screened for their potentialities to reduce the root-knot nematode larvae population density *in vitro*. Based on the preliminary screening, six strains *Streptomyces* sp. 11, *Streptomyces* sp. 22, *Streptomyces* sp. 47, *Streptomyces* sp. 49, *Streptomyces* sp. 76 and *Streptomyces* sp. 154 possessed a pronounced nematicidal activity were selected for further study (Table 1). The cultural filtrates of the selected strains of streptomycetes exhibited nematicidal properties to a varying degree against the root-knot nematode larvae. At present study we use the native solutions to select the best cultural filtrates of different streptomycetes strains induced *M. incognita* larval mortality for the further experiments. The expression of nematicidal activity varied with time of exposure of nematode juveniles to the culture filtrates.

Table 1. Effect of *Streptomyces* culture filtrates on juveniles of root knot nematodes

Exposure time (hours)	*STREPTOMYCES SP.* STRAINS					
	S.sp.11	S.sp.22	S.sp.47	S.sp.49	S.sp.76	S.sp.154
2	+ +	++	++	+++	++	+++
4	++	++	+	++	+	++
8	+	+	+	+	+	+
12	+0	+0	0	+	+0	+
24				0		0

Note: Value of nematicidal activity of culture filtrates was determined by the number of motile nematodes (or viability): +++ (80 – 100% actively motile nematodes), ++ (40 – 60% active and poorly motile nematodes), + (10 – 30% poorly motile nematodes), 0 (mortal nematodes)

The experiment shows the ability of the culture filtrates paralyzes the mobility of infective larvae (J2) of root-knot nematodes and reduces their viability during the different time period. The test reported that all studied strains of *Streptomyces* induced *M.incognita* larval mortality however it took the different time period. The high nematicidal activities were shown by the cultural filtrates of four strains *Streptomyces* sp. 47, *Streptomyces* sp. 11, *Streptomyces* sp. 22 and *Streptomyces* sp. 76 and *Streptomyces* sp. 154 during the twelve experimental hours (Tab.1).

Assays of the next survey is a negative potential of the cultural filtrates of studied strains of streptomycetes as a treatment for chemotaxis-response of J2 *M.incognita* to tomato root exudates. Nematodes move in soil primarily on gradients chemicals realized by the host's root system. Since nematodes are essentially aquatic organisms, chemicals eliciting nematodes responses in soil are likely to be water soluble (Njezic, 2011).

Effect of tomato root exudates on migration J2 *M.incognita* and the nematicidal abilites of cultural filtrates of six streptomycetes strains on J2 chemotaxis-response presented in Fig. 1. At least near 60% of J2 *M.incognita* remains in section A (for all treatments), 20 - 29% of J2 movemed to section B and from 9% J2 (control, root exudates) till 0 – 7% J2 (experiment, root exudates and cultural filtrates of streptomycetes) moved to section C depends from treatments.

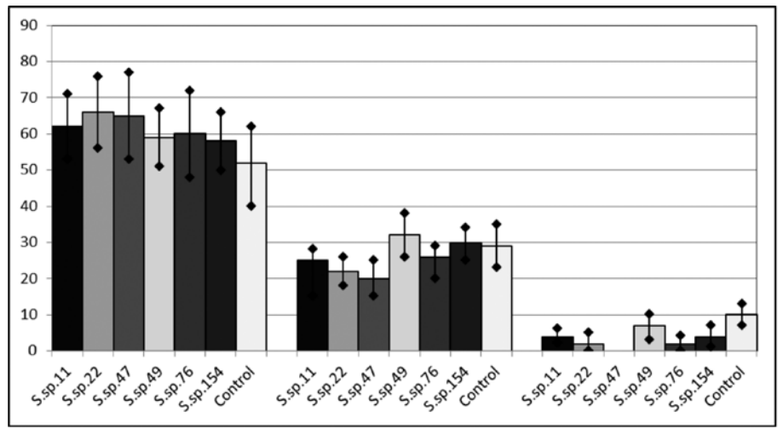

Fig. 1. Cumulative percentages of J2 of *M.incognita* that was found in different sections of the experimental tubes (A, B, C) after two weeks exposure to root exudates of tomato with culture filtrates of studied strains of *Streptomyces* sp. and root exudates of tomato (control).

The results of this experiment to show some negative effects of cultural filtrates of some selected strains of streptomycetes on chemotaxis-response of J2 *M.incognita* to tomato root exudates. However, these studies should be continued with different substrates (sand, soil *etc.*), exposure time and cultural filtrates of different microorganisms.

Therefore, most nematicidal activities were shown by the cultural filtrates of four strains *Streptomyces* sp. 11, *Streptomyces* sp. 22, *Streptomyces* sp. 47 and *Streptomyces* sp. 76. In previous study it was revealed that these strains of streptomycetes possess also the phytostimulating abilities and positively influence on germination of tomato seeds and root formation (Poiras N., Burteva, 2010; Poiras N, Postolaki, Baltat, Poiras L., Burteva, 2010).

BUMBLEBEES ON A GRADIENT OF ANTHROPOGENIC TRANSFORMATION IN NORTHERN TAIGA LANDSCAPES

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The studies were performed during 2006 – 2011 in different geographical locations on the delta of the Northern Dvina River. The fauna includes 25 species of bumblebees belonging to 9 subgenera. The greatest number of species represented subgenera *Psithyrus* (8) and *Thoracobombus* (5). The most abundant: *B.(Ml.) sichelii, B.(Bo.) lucorum, B. (Ps.) bohemicus, B. (Ps.) rupestris*.

Surveyed habitats divided into five types of areas standing on the nature and characteristics provided by the vegetation and anthropogenic transformation of landscapes. Topical complexes of bumblebees comprise from 11 species to the maximum of their number (25), which marked on the delta of the Northern Dvina River.

The results show that the effect of moderate anthropogenic transformation of landscapes is not always clearly a negative factor for topical complexes of bumblebees, even though the vulnerability of this taxonomic group to anthropogenic stress. Thus, the highest species richness of bumblebees observed on habitats, exposed to long-term human economic activity. On the other, intact landscapes in the Northern European Part of Russia characterized by a low number of species.

This fact is explained that anthropogenic transformed landscapes within northern taiga are more favorable for most species of bumblebees. These areas is accompanied by greatest complexity and diversity of habitats and greater richness of flowers that an important regulator for bumblebees populations in biotopes.

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THE DINAMICS OF POLYPARASITIC CONTAMINATION OF GRAZINGS RELATED TO THE ACTION OF METEOROLOGICAL FACTORS

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The infestqation of sheep influents negatively the situation with grazing lands that are infested with parazitologic elements. This phenomenon is also considerably influenced by meteorological factors. The grazing lands represents a reservation that conservate fro the long period of time the infesting forms of parasites. The process of spreading out of the parasitic elements is one of the factors for biological spoiling, contaminating the gyegienical status of the environment, with severe consequences for the health of humans and animals. Some of the stages of the biological circles of parasites – exogen parasitic forms (eggs, larvae) evolutionate on the surfaces of grazing lands and in intermediatory hosts till the infesting stage (Olteanu et al., 2001; Erhan et al., 2007).

Taking into accountant the mentioned above, the proposed research aims covered the analysis of influence of the environmental factors on the development and survival of the exogen parasitic elements on the surface of the grazing for sheep and goats, and establishing the correlation between the number of exogen parasitic elements and environment factors (temperature, rains, humidity).

The study have been conducted during one year and included realisation of investigations on corelation between quantity of larvae (L3) on the grazing land and influence of meteorological factors. Each month during the grasing season, the samples of grass (forage) from different places with cultivated graminee plants have been collected -*Familia Gramineae* -80% and oleracious plants -*Familia Leguminosae -20%*.

The obtained results of the parasitological study of the forage have been analised and compared with values of environmental factors (temperature, precipitations, humidity), in order to establish the influence of these on the development of the exogen parasitic elements.

The parasitological examination of the grazing spaces for pasturing of sheep situated in the surroundings of Călăraşi city during period March-Octombrie reveals the existance of infesting larvae of strongiloid type observed on the third stage of development *(L3),* that are characteristic for ***gastro-intestinal nemathods*** (genus *Trichostrongylus, Nematodirus, Strongyloides)*, as well as larvae of ***pulmonary nemahtodes*** (genus *Protostrongylus* – in second stage of development, and genus *Dictyocaulus* – third stage*)*. The number of parasitic elements collected from the grazing lands (medium per month) and variations of environmental factors (temperature, precipitations, humidity) are presented in Table 1.

Table 1. The quantitative characteristics of the presence of the gastro-intestinal and pulmonary nemathods in sheeps on the grazing lands during pasturing season in 2009

	Number of larvae /100g of grass							
Specification	**March**	**April**	**May**	**June**	**July**	**August**	**Sept.**	**Oct.**
Grazing land 1	40	55	65	25	5	4	52	45
Grazing land 2	45	65	70	38	8	6	60	55
Medium/month	42,5	60,0	67,5	31,5	6,5	5,0	56,0	50,0
Temperature(°C)	9,9	9,9	19,2	23,3	25,1	23,5	18,2	9,9
Precipitations (l/m2)	1,0	27,0	10,6	11,6	0	9,6	32,2	54,2
Humidity (%)	60,6	58,2	60,7	57,2	45,2	66,35	72,2	75,6

While analysing the data presented in Table 1 one can observe that in March the number of larvae per 100g of grass obtained from those 2 grazing lands have been in increase since in winter months the central zone of republic have registered the medium positive temperatures that allowed survival of the larvae on the ground. The infestation indices on these lands represent the highest values in May (67,5 larvae/100g of grass) and September (56 larvae/100g of grass), while the medium temperatures were 19,2 °C in May and 18,2 °C in September, but the precipitations and humidity registered the favorable indices. The minimum number of larvae/100g of grass obtained from both researched grazing lands have been identified for July and Augist, when the average monthly temperature reached the maximum level of 23,5-25,1 °C, but the level of precipitations and humidity reached the minimum level.

In this way, the variation in number of larvae was directly depending on the environmental factors (temperature, precipitatations, humidity) that are fluctuating each month. The maximum level of parasitic spoiling of grazing lands for sheep and goats, during the pasturing season can be characterized by a bifazic aspect, the curve of infestation representing two maximum values (peaks) in May and September (Fig.1)**.**

The correlation between the parasitic elements observed on the grazing lands as well as the values of the meteorologic factors (temperature, precipitations and humidity) were calculated (Fig.2).

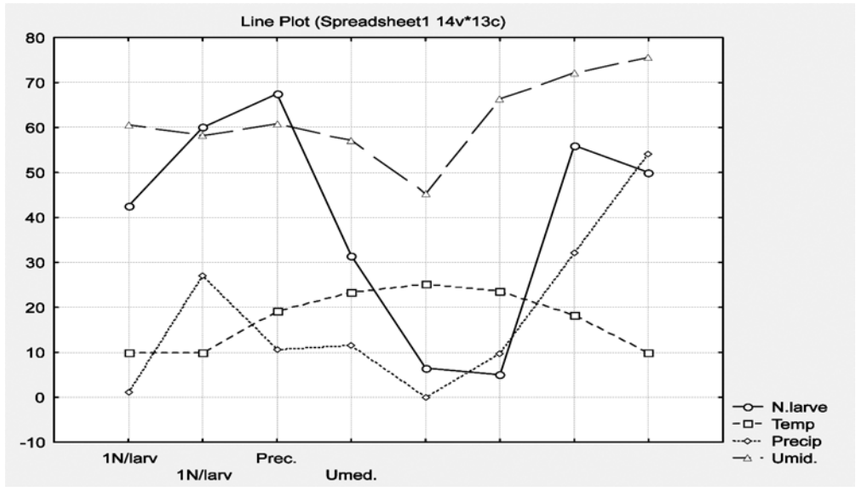

Fig.1 *The dinamics of the parasitic elements on the grazing lands and the meteorologic factors i*

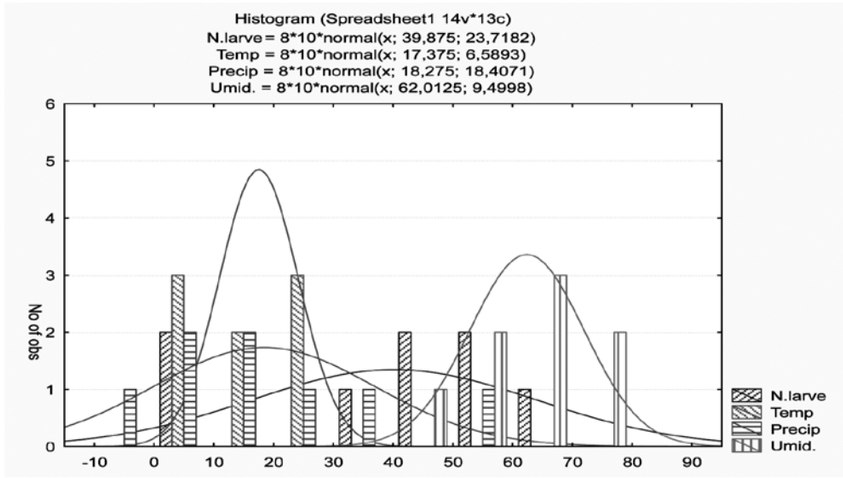

Fig.2 *The corelation between the parasitic elements on the grazing lands and the values of the meteorologic factors*

There were established that the indices of correlation (r) calculated in relation to the number of larvae and depending on the temperature was 0,67 (+), of precipitations - 0,44 (±) and that depending on the humidity - 0,03 (-).

Therefore, the positive correlation exists between the quantity of parasitic elements on the grazing lands and meteorologic parameters' values, that demonstrates their direct influence on the development of the biologic cycle of parasites and the dinamics of parasites population in general.

HETEROPTERA FAUNA (INSECTA: HETEROPTERA) FROM PROTECTED NATURAL AREA "BREANA-ROŞCANI" (GALATI COUNTY)

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Protected natural area "Breana-Roşcani" covers an area of 78.3 ha and is situated on the territory of the Băneasa commune, near the village Roşcani, in north-central area of the Galati County.

The studied area is characterized by hilly ridges, extended, monoclinic, with parallel arrangement and separated by consistent valleys with fairly developed slope processes that offers a subsided view with heights ranging from 5 to 10 m. Due to its location, protected natural area "Breana-Roşcani" vegetate under a plain continental climate characterized by hot summers and very cold winters. The average annual relative air humidity is 72%.

The soils contain a lithological substrate consisting of loess deposits.

Inside protected area, the Ponto-Sarmatian forest vegetation is dominated by the downy oak with disseminated presence of the peduncle oak, sessile oak, linden, manna ash and field maple. Trees naturally regenerate by vegetative propagation, for the most part, but also by seed germination. The average age is 48. Naturally, the trees allow glades to form which creates conditions for romanian peony (*Paeonia peregrina* var. *romanica*), a declared natural monument, to grow. Herbaceous associations are mostly constituted by the gramineous plants.

Data on diversity of heteropters fauna for this area is lacking. This study was conducted during 2009-2010. Collections were made using the following methods: entomological net, by hand (directly from the plants or by shaking the crown of the trees and shrubs over the entomological umbrella).

The material was collected separately on samples, killed with ethyl ether, preserved dried on needle-sticks and stored in entomological boxes. Material determinations were made in laboratory using a stereomicroscope and various bibliographic sources (KIS 1984, 2001; DERJANSCHI & PERICART 2005, PERICART 1983, MOULET 1994, WAGNER 1966).

Determined material has been ordered on infraorders, suprafamilies, families and species according to current taxonomic system (AUKEMA 1995, 1996, 1998, 2006).

In this study, 61 species were collected belonging to Suborder Heteroptera (2 infraorders, 7 suprafamilies and 14 families). Note the presence of the following species in this area: *Psacasta neglecta*, *Sciocoris sulcatus* and *Sciocoris macrocephalus* (Pentatomidae family) that has a sporadic presence in the southern regions of Romania, and also the presence of *Coriomeris affinis* (Coreidae family), a holomediteranean species, rare in Romania, cited for Moldova only in Hanu Conachi, Galați County (ȘERBAN 2010).

Catoplatus nigriceps (Tingidae family), a common species in central Europe, southern Russia, Caucasus, Transcaucasus and Anatolia, is first prompted for Romania in the natural reservation "Breana-Roşcani".

Ord. Hemiptera
Subord. Heteroptera
Infraord Cimicomorpha
Superfam. Miroidea
Fam. Miridae
Adelphocoris lineolatus (Goeze, 1778)
Capsodes goticus (Linnaeus, 1758)
Deraeocoris rubber (Linnaeus, 1758)
Harpocera thoracica (Fallén, 1807)
Leptoptema dolobrata (Linnaeus, 1758)
Stenodema holsata (Fabricius, 1787)
Stenodema laevigata (Linnaeus, 1758)
Stenotus binotatus (Fabricius, 1794)
Superfam. Reduvioidea
Fam. Reduviidae
Rhynocoris iracundus (Poda, 1761)
Superfam. Cimicoidae
Fam. Nabidae
Nabis ferus (Linnaeus, 1758)
Superfam. Tingoidea
Fam. Tingidae
Catoplatus nigriceps Horváth, 1905
Dictyla rotundata (Herrich-Schaeffer, 1835)
Infraord. Pentatomomorpha
Superfam. Lygaeoidea
Fam. Lygaeidae
Geocoris erytrocephalus (Lepeletier & Serville, 1825)
Beosus maritimus (Scopoli, 1763)
Nysius graminicola (Kolenati, 1845)
Oxycarenus pallens (Herrich-Schaeffer, 1850)
Megalonotus praetextatus (Herrich-Schaeffer, 1835)
Peritrechus gracilicornis Puton, 1877
Rhyparochromus vulgaris (Schilling, 1829)
Xanthochilus quadratus (Fabricius, 1798)
Fam. Berytidae
Neides tipularius (Linnaeus, 1758)
Superfam. Pentatomoidea
Fam. Cydnidae
Tritomegas bicolor (Linnaeus, 1758)
Tritomegas sexmaculatus (Rambur, 1839)
Fam. Thyreocoridae
Thyreocoris scarabaeoides (Linnaeus, 1758)
Fam. Scutelleridae
Eurygaster integriceps Puton 1881
Psacasta neglecta (Herrich-Schaeffer 1837)
Fam. Plataspidae
Coptosoma scutellatum (Geoffroy, 1785)
Fam. Pentatomidae
Aelia acuminata (Linnaeus, 1758)
Aelia rostrata Boheman, 1852
Carpocoris pudicus (Poda, 1761)
Codophila varia (Poda, 1761)
Dolycoris baccarum (Linnaeus, 1758)
Eurydema oleracea (Linnaeus, 1758)
Eurydema ornata (Linnaeus, 1758)
Eysarcoris ventralis (Westwood 1837)
Graphosoma lineatum (Linnaeus, 1758)
Holcostethus sphacelatus (Fabricius, 1794)
Neottiglossa pusilla (Gmelin, 1790)
Neottiglossa leporina (Herrich-Schaeffer, 1830)
Sciocoris sulcatus Fieber, 1851
Sciocoris macrocephalus Fieber, 1851
Staria lunata (Hahn, 1835)
Suprafam. Coreoidea
Fam. Coreidae
Coreus marginatus (Linnaeus, 1758)
Syromastus rhombeus (Linnaeus, 1767)
Coriomeris affinis (Herrich-Schaeffer 1839)
Ceraleptus lividus Stein, 1858
Ceraleptus gracilicornis (Herrich-Schaeffer, 1835)
Fam. Alydidae
Camptopus lateralis (Germar, 1817)
Fam. Rhopalidae
Brachycarenus tigrinus (Schilling, 1829)
Chorosoma schillingii (Schilling 1829)
Corizus hyoscyami (Linnaeus, 1758)
Maccevethus caucasicus (Kolenati 1845)
Myrmus miriformis (Fallén, 1807)
Rhopalus subrufus (Gmelin, 1790)
Rhopalus conspersus (Fieber, 1837)
Rhopalus (Rhopalus) distinctus (Signoret 1859)
Rhopalus parumpunctatus Schilling, 1829
Rhopalus rufus Schilling, 1829
Stictopleurus abutilon (Rossi, 1790)
Stictopleurus pictus (Fieber, 1861)
Stictopleurus subtomentosus (Rey 1888)

REFERENCES

1. Aukema, B., Rieger, C., 1995 - Catalogue of the Heteroptera of the Palearctic Region 1, Published by the Netherlands Entomological Society, 222pp.
2. Aukema, B., Rieger, C., 1996 - Catalogue of the Heteroptera of the Palearctic Region 2, Published by the Netherlands Entomological Society, 361pp.
3. Aukema, B., Rieger, C., 1998 - Catalogue of the Heteroptera of the Palearctic Region 3, Published by the Netherlands Entomological Society, 350pp.
4. Aukema, B., Rieger, C., 2006 – Catalogue of the Heteroptera of the Palearctic Region, Pentatomomorpha II, volume 5, Published by the Netherlands Entomological Society, 550pp.
5. Derjanschi, V., Péricart, J., 2005 – Hémiptères Pentatomoidea euro-méditerranéens, vol 1, Généralités , Systématiques: première partie, Faune de France 90, France et régions limitrophes, Fédération Française des Société de Sciences Naturelles, 489pp.
6. Kis, B., 1984 – Heteropterea, partea generală şi suprafamilia Pentatomoidea, Fauna R.S. România, Insecta, vol VIII, Fascicula 8:1-214, Editura Academiei Republicii Socialiste România,Bucureşti, 215 pp.
7. Kis, B., 2001 – Heteroptera, Suprafamiliile Coreoidea şi Pyrrhocorioidea, Fauna României, Insecta, vol VIII, Fascicula 9:1-93, Editura Academiei Române, Bucureşti, 93pp.
8. Moulet, P., 1995 – Hemiptères Coreoidea (Coreidae, Rhopalidae, Alydidae) Pyrrhochoridae, Stenocephalidae Euro-Méditerranéens, Faune de France 81, France et régions limitrophes, Fédération Française des Société de Sciences Naturelles, 336pp.
9. Pericart, J., 1983 - Hémiptères Tingidae euro-méditerranéens, Faune de France 69, France et régions limitrophes, Fédération Française des Société de Sciences Naturelles, 618pp.
10. Cecilia Şerban, 2010 - Contributions to the study of coreoids fauna in the lower basin of the Siret river, Oltenia Journal for Studies in Natural Sciences, tom XXXVI fasc. 2 pg. 101-107, ISSN: 1454-6914.
11. Wagner, E., 1966 – Wanzen oder Heteropteren I. Pentatomorpha, Die Tierwelt Deutschlands, Jena, 55, 179pp.

THE INFLUENCE OF HUMIDITY ON DISTRIBUTION IN BIOTOPES OF INSECTS FROM ORTHOPTERA ORDER IN THE REPUBLIC OF MOLDOVA

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From the literature it is known that humidity causes the formation of nucleus fauna of insects of order Orthoptera and not only [Iorgu 2008]. Based on this concept in the study period 2005-2009 were investigated a lot of biotopes to determine their common Orthoptera complexes. Have thus been about one hundred sectors investigated with hygrophilous, hygro-mesophilous, mesophilous, meso-xerophilous and xerophilous vegetation.

During of five yars were investigated 25 sectors hygrophilous: Gashpar, Pascauți, Goleni, Corestautsi, Sarata Noua, Balatina, Edinets, Tatarauca Noua, Trebujeni, Zabriceni, Otaci, Oclanda, Arioneshti, Cremenciug, Slobozia Mare, Holoshnitsa, Lozova, Tsaul, Cobani, Radenii-Vechi, Slobozia-Dushca, Nicolaevca, etc. So, on vegetation the vegetation near the lakes, rivers, ponds, wetlands and floodplains the Orthoptera species are represented by *Conocephalus fuscus*, *C. dorsalis*, *Ruspolia nitidula*, *Metrioptera roeselii* (Tettigonioidea); *Gryllomorpha dalmatina*, *Gryllotalpa gryllotalpa* (Grylloidea); *Xya variegata*, *Pteronemobius heydenii* (Tridactyloidea); *Tetrix subulata, T. Bipunctata* (Tetrigoidea); *Locusta migratoria*, *Paracinema tricolor bisignata*, *Mecostethus alliaceus*, *Stethophyma grossum*, *Chrysochraon dispar*, *Euthystira brachyptera*, *Omocestus viridulus*, *Chorthippus parallelus* (Acridoidea), are common.

The fauna of Orthoptera order from hygro-mesophilous ecosystems like meadows, selvedge and neighbouring territories were investigated the next points: Feteshti, Buzdujeni, Boldureshti, Poruceni, Radenii Vechi, Tigheci, Capriana, Durleshti, Troița Noua, Girbovats, Cimishlia, Comrat, Singera, Strasheni, Cobusca Noua, Anenii Noi, Brinzeni, Congaz, Singerei, Mihalasheni, Trestieni, Calarashauca, Holoshniţa, Cremenciug, Valcineț, Codreni, Peresecina, etc. In a such habitat the Orthoptera species are represented by *Ephippiger ephippiger*, *Ruspolia nitidula*, *Meconema thalassinum*, *Leptophyes albovittata*, *L. boscii, L.*

punctatissima, *Phaneroptera falcata*, *Metrioptera bicolor*, *M. brachyptera*, *M. roeselii*, *Decticus verrucivorus*, *Pachytrachis gracilis*, *Pholidoptera fallax*, *Ph. griseoaptera*, *Pterolepis germanica*, *Tettigonia viridisima*, *T. caudata*, *Yersinella raymondi* (Tettigonioidea); *Gryllus campestris*, *Melanogryllus desertus*, *Nemobius sylvestris*, *Oecanthus pellucens*, *Gryllotalpa gryllotalpa* (Grylloidea); *Tetrix bipuncatata*, *T. tenuicornis*, *T. subulata* (Tetrigoidea); *Pezotettix giornae*, *Calliptamus italicus*, *Chrysochraon dispar*, *Euthystira brachyptera*, *Chorthippus albomarginatus*, *Ch. apicarius*, *Ch. biguttulus*, *Ch. brunneus*, *Ch. dichorus*, *Ch. dorsatus*, *Ch. parallelus*, *Ch. pullus*, *Ch. vagans*, *Myrmeleotettix maculatus*, *Gomphocerippus rufus*, *Omocestus viridulus*, *Stauroderus scalaris*, *Stenobothrus lineatus*, *S. stigmaticus*, *Mecostethus alliaceus*, (Acridoidea) are general.

In halophytic and less abundant vegetation ecosystems the number of grasshoppers and locusts are limited: *Melanogryllus desertus* (Grylloidea) and *Epacromius tergestinus*, *E. coerulipes*, *Aiolopus thallasinum*, *Mecostethus alliaceus* (Acridoidea). On the salty meadows were observed only two species – *Acrida ungarica* and *Paracinema tricolor bisignata*.

During the years 2005-2009 was studied over 40 points with steppe vegetation like: Giurgiuleshti, Valea Perjei, Bugeac, Slobozia Mare, Cobani, Cimishlia, Ciumai, Bugeac, Congaz, Vadul-lui-Isac, Troitsa, Cucoara, Trebujeni, Vraneshti, Arioneshti, Cotiujeni, Peresecina, Hirtop, Ordashei, Trifeshti, etc. In xerophilous ecosystems, where humidity is lower, we have meet locusts and grasshoppers with specific features, which enable them to withstand fluid deficit. It was noted that most drought-resistant Orthoptera species are: *Ephippiger ephippiger*, *Phaneroptera nana*, *Saga pedo*, *Decticus albifrons*, *Gampsocleis glabra*, *Onconotus servillei*, *Pachytrachis gracilis*, *Platycleis affinis*, *P. abopunctata grisea*, *P. intermedia*, *P. veyseli*, *Pterolepis germanica* (Tettigonioidea); *Oecanthus pellucens* (Grylloidea); *Acrida ungarica*, *Calliptamus barbarus*, *C. italicus*, *Arcyptera microptera*, *Dociostaurus brevicollis*, *D. maroccanus*, *Chorthippus biguttulus*, *Ch. brunneus*, *Ch. dichorus*, *Ch. dorsatus*, *Ch. loratus*, *Ch. mollis*, *Ch. macrocerus*, *Euhorthippus declivius*, *E. pulvinatus*, *Omocestus haemorrhoidalis*, *O. rufipes*, *O. minutus*, *Stenobothrus nigromaculatus*, *Celes variabilis*, *Oedaleus decorus*, *Oedipoda germanica* and *O. Coerulescens* (Acridoidea).

In rocky biotopes (Brinzeni, Goian, Moleshti, Trebujeni, Naslavcea, etc.) fauna of Orthoptera insects also is very poorly and were collected only a few species: *Chorthippus biguttulus*, *Ch. brunneus*, *Chorthippus pullus*, *Euhorthippus pulvinatus*, *Oedipoda caerulescens* (Acridoidea).

References:

Iorgu I., Iorgu E. Bush-crickets, crickets and grasshoppers from Moldavia (Romania). Pim, Iaşi, 2008. 294 p.

Stahi N. PhD thesis "Orthoptera insects (Insecta, Orthoptera) from the Republic of Moldova: fauna, ecology and their importance". Chisinau, 2011. 178 p.

BIOLOGY, ECOLOGY AND INSECTICIDE CONTROL WITH VIRIN-ABB-3 OF THE SPECIES *HYPHANTRIA CUNEA* IN THE AGRICULTURAL, ORNAMENTAL AND FOREST PLANTATIONS

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In Moldova, as well as in Europe, there are many invasive species that have acclimated here and rapidly spread aggressively occupying even larger areas, and their activity often influences negatively the ecosystems in which they grow.

H. cunea from the family Arctiidae is a dangerous pest insect, whose origin is North America (Canada, USA), where it is spread everywhere between Atlantic Ocean and the Pacific[11]. *H. cunea* is native to North America and spread to the EPPO region after the Second World War.

Table1. Geographical distribution of H. cunea in EPPO region and Asia

Country	Year	References
Hungary	1940	Waren & Tadic 1970; Ripka G, 2005
Austria	1951	Boehm, H. 1976; Jermini et al., 1995; CABI Bioscience 2006
Bulgaria	1961	Smith *et al*. 1992; Encheva, L.1977;Tschorsnig, Herting, 1994;
France	1975	Jermini *et al.*,1995; Chauvel, 2000
Germany	1953	Braasch,1976
Italy	1980	Marcuzzi, 1989; Zangheri & Donadini, 1980; Smith *et al*. 1992; Mazzon e Martini,2000
Croaţia	1949	Zúbrik *et al*. 2006
Slovénia	1990	Zezlina & Girolami, 1999
Moldova	1952	Ciuraev, 1962; Stareţ 1968; CABI Bioscience 2005; FAO 2007c
Romania	1949	Smith *et al*. 1992; Oltean, 2002
Ukraine	1952	Ciuraev, 1962; Stareţ 1968; CABI Bioscience 2005
Russia	1978	EPPO 1996a; Ижевский С.С.2002
Poland	1962	Buszko, Nowacki, 2000; CABI Bioscience 2005; IOP 2002
Lythuania	1986	Ivinsic et al.1988
Slovakia	1947	Jasic J 1962; Hrubik P 2007
Suisse	1991	Jermini, 1995
Turkey	1977	Sullivan G.T, Karaca I., Ozman-Sullivan S.K. & Kolarov J. 2010
Korea Republic	1979	Chung et al. 1995; Smith *et al*. 1992
New Zealand	2003–2005	Kean, 2003
China	1979	Qu 1987; Yang *et al*. 2008.
Japon	1945	Gomi & Takeda 1996; 2004
Georgia	1955	Loladze, 2003
Greece	1979	Mouloudis, S.; Vassilaina-Alexopoulou, P.; Papadogeorgopoulos, F.; Mourikis, P. A.1980

At present, it is recommended to use against the *H. cunea*, the ecologic clean virus preparation Virin –ABB-3, which is not connected with the laboratory rising of insects. For achieving these aims natural populations of insects shall be used. It is profitable from economic point of view, because the natural food is used. The obtaining of the virus preparation directly on the insects hosts creates the conditions for the obtaining of the native virus. On the basis of our experiments and those of the other specialists, we ascertained that raising insects' hosts creates the conditions for obtaining of native virus.

The experiments with the preparation Virin-ABB-3 on the contaminated caterpillars (larvae) of Hyphantria cunea Drury on different plants became an acute necessity for the determination of the percentage of the mortality of specimens with the same concentration and the same number as well as the biological effectiveness. According to the fig.1, on the 5th day, the death rate of caterpillars of Hyphantria cunea Drury on different plants are modified on the average of 2%, on the 10th days on the average of 7%, on the 15th day on the average of 3,5%.

The highest mortality rate of the caterpillars has the mulberry – 97,5%, the lowest mortality rate has acacia – 75,0 %. The biological effectiveness according to Abbott on the 15th day represented 73,8%. The mortality rate in the control on the 10th – 15th day was 5%.

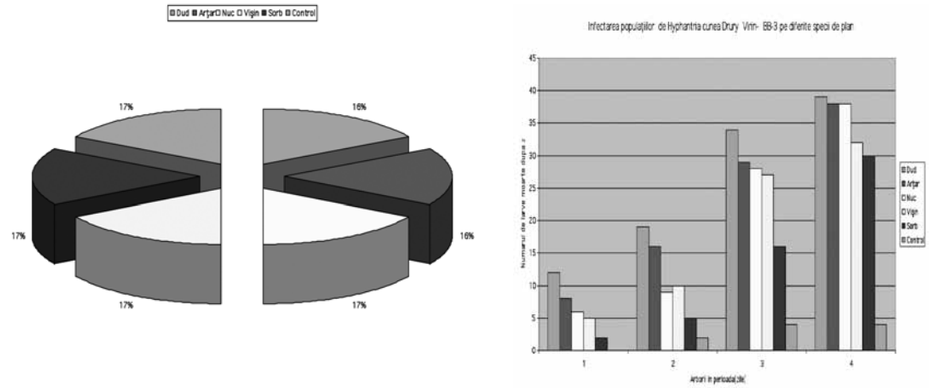

Figure 1. The infection population of Hyphantria cunea Drury Virin-ABB-3 of different plants

CONCLUSIONS

The comparison of viral pathogens with conventional chemical pesticides is usually solely from the perspective of their efficacy and cost. In additional to efficacy, the advantages of use of microbial control agents are numerous. These include safety for humans and other non-target organisms, reduction of pesticide residues in food, preservation of other natural enemies, and increased biodiversity in managed ecosystems.

Even if the baculovirus preparations are proposed to be used as biological methods against harmful insects, they are not widely applied today because of the long incubation period. According to the presented experiments, the control of the preparation Virin-ABB-3 of different plants field conditions, demonstrated that the most efficient form is the mortality rate of the caterpillars has the mulberry – 97,5%.

1. Boehm H. [25 years of *Hyphantria cunea* and *Ceratitis capitata* in Austria]. In: *Land- und Forstwirtschaftliche Forschung in Oesterreich*, Band VII (Ed. by Faber, W.), Österreichischer Agrarverlag, Vienna, Austria. -1976. -P. 81-88.
2. Braasch, D. 1976. On the overwintering possibilities for the fall webworm (Hyphantria cunea Drury, Arctiidae, Lepidoptera) in the German Democratic Republic. Nachrichtenblatt fur den Pflanzenschutz in der DDR, 30(11), 223-225.
3. Buszko J., Nowacki J. The *Lepidoptera* of Poland. A distributional checklist. // Polish Entomological Monographs.-2000.-Vol.1.- P.1-178.
4. CAB International (CAB). Quarantine Pest of Europe. Data sheets on carantine pests for the European Union and the European and Mediterranean Plant.- 2005.-P.186
5. Chauvel G. Lepidoptera damaging green spaces, nurseries and urban forest.// PHM Reviu Horticule.- 2000.- N.416.- P.18-2
6. Chung Y. J., B. Y. Lee, and B. H. Byun. A list of insect pests of trees and shrubs in Korea // Forestry Research Institute, Seoul, Republic of Korea. - 1995.
7. OEPP/EPPO. EPPO Summaries of Phytosanitary Regulations // Paris: OEPP/EPPO (Organisation Europeenne et Mediterraneenne Pour La Protection Des Plantes / European and Mediterranean Plant Protection Organisation). - 1999. - No. 04, P
8. Encheva L. Possibilities for biological control of Hyphantria cunea. // Rastitelna Zashchita.-Bulgaria; Plant Protection.-1977.- V. 25(12).- P. 30-32. Krištín A. Invasive Animals. // Život. Prostr.- Vol. 35.-No. 2, 68-72, 2001
9. Gomi T. Geographic variation in critical photoperiod for diapause induction and its temperature dependence in Hyphantria cunea Drury (Lepidoptera: Arctiidae). //Oecologia.-1997.- V. 111(2).- P. 160–165.
10. Gomi T. Effects of timing of diapause induction on winter survival andreproductive success in Hyphantria cunea in a transition area of voltinism. // Entomological Science. - 2000. -V. 3(3). - P.433–438.
11. Gomi T, Muraji M, Takeda M. Mitochondrial DNA analysis of the introduced fall webworm, showing its shift in life cycle in Japan. *Entomol Sci.* 2004;7:183-188
12. Hrubik P. Alian insect pests on introduced woody plants in Slovakia. Acta entomologica Serbica 2007, vol. 12, iss. 1, p. 81-85

APIDS (HYMENOPTERA: APOIDEA) – POLLINATORS OF SPONTANEOUS MEDICINAL PLANTS FROM REPUBLIC OF MOLDOVA

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The treatment of various diseases with medicinal plants was in used since the beginning of civilization. In the wide variety of existent tutorials, in works dedicated to the history of medicinal plant use in treatment of many diseases is stated that the man became aware of their curative properties since ancient times. The use of curative properties of medicinal plants is recorded in the most ancient written documents of human civilization. The first tractates on medicinal plants belong to Sumerians – inhabitants of Asia, actually Iraq territory, and have been written 6000 years BC.

Definitely, the medicinal plants were used with the purpose of disease treatment also before the appearance of writing and the data about the curative properties of plants gathered during many years have been transmitted from generation to generation verbally.

Almost all medicinal plants that can be industrialized have been and still are used in pharmaceutical industry. A large variety of medicinal teas was created for the treatment of many diseases. They have as compounds indigenous vegetal products. The industrialization of medicinal plants has the following consequences: a) ensuring the necessities of drug stores and the chemical-pharmaceutical industry with high quality vegetal products; b) satisfaction of increasing population needs; c) export of medicinal plants; d) intensification of studies in aromatherapy (use of volatile essential oils in treatment of respiratory diseases).

The quantitative composition of substances present in raw materials obtained from spontaneous medicinal plants is varied and depends on the influence of many factors:

1. Soil composition of the ecosystem where spontaneous medicinal plants grow and develop.
2. The necessity of profound studies of spontaneous medicinal plants biology, of their spreading area, the way of introduction of some plants in culture and acclimatization of new plants.
3. Pollination of medicinal plant flowers by apoids (wild bees) contribute to quantitative and qualitative increasing of active principles and to growing of seed harvest.

During several years our researches had the aim to study the complexes of pollinators (representatives of suprafamily Apoidea) of some species of spontaneous medicinal plants from Moldova. As result of our researches were emphasized and registered the trophic connections of apoids with spontaneous medicinal plants and pointed out the species diversity of these pollinators from R. Moldova.

Further on we present the list of some medicinal plants from spontaneous flora, comprising 45 species, for each species is presented the complex of apoids pollinators registered during the studies.

According to above presented data, during the study of complex of apoids pollinators of some spontaneous medicinal plants from R. Moldova, it was established that five plant families containing medicinal plans species, have the greatest number of apoids pollinators. The families: Asteraceae with 11 medicinal plants species has an entomocomplex of 82 apoids pollinators; Lamiaceae – 11 plants species and 69 apoid species; Papilionaceaea – 7 planta species and 69 apoid species; Boraginaceae – 4 plant species and 21 apoid species; Apiaceae – 15 apoid species. Other 9 families contain an insignificant number of spontaneous medicinal plant species, only 1-2 and, respectively, 1-2 wild bee species.

In literature there are no data about pollinators of spontaneous medicinal plants, therefore the data presented in this paper are new for science.

Apoid species recorded and identified by the author are preserved in the Museum of Entomology of Institute of Zoology of Academy of Sciences of Moldova.

SEASONAL ACTIVITY PATTERNS OF HUMAN-BITING MOSQUITOES (DIPTERA: *CULICIDAE*) IN THE REPUBLIC OF MOLDOVA

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INTRODUCTION

Seasonal activity of mosquito populations, as well as other ecological and behavioral features, is strongly influenced by climatic factors such as temperature, rainfall, humidity, wind, and duration of daylight (Reiter, 2001). Seasonal abundance patterns of mosquito vectors are required as baseline knowledge to understand the transmission dynamics of vector-borne pathogens (Reiter, 2001; Lord, 2004). Human bait catches have been used for many years and remain the most useful single method to collect anthropophagic species (Silver, 2008).

Seasonal abundance and activity of blood meal mosquito species were not previously reported in the Republic of Moldova. However, only a few studies assessed faunal distribution of mosquitoes (Prendel 1950, 1956, 1965; Tihon 1981). To our knowledge, there is no current information on the seasonal biting activity of mosquitoes attracted to humans in the Republic of Moldova. With the aim of contributing to the knowledge of human-biting mosquitoes, we evaluated the seasonal activity patterns of mosquitoes captured by using human volunteers.

MATERIALS AND METHODS

The mosquito specimens were sampled from the different biocenoses of the northern, central and southern parts of the Republic of Moldova during a three-year period from April 2008 till October 2010.

Mature mosquito habitats such as open pastures, forests and floodplains were surveyed. Adult mosquito surveys were conducted with human volunteers as baits and collectors. The material was collected by oral aspirators or glass tubes from humans during the 5-30 min. The biting activity of each mosquito species was estimated as the number of specimens captured per hour in each collecting period. The temperature was recorded during each collection. The specimens were identified to species according to standard taxonomic keys (Stackelberg 1937, Cranston 1987, Becker 2003).

Data analysis

In order to characterize the mosquito community that was attracted to humans, we calculated richness (S) (number of species) and Shannon diversity index (H) (Price 1984):

$$H = -\sum p_i \ln p_i,$$

where p_i = the proportion of i^{th} mosquito species in the total sample collection for each month and season. The dominant species index (*d*) was estimated using the Berger-Parker equation (Magurran1988):

$$d = N_i / N_{tot},$$

where N_i = the number of adult mosquitoes of i^{th} species and N_{tot} = the total number of adult mosquitoes for all species collected.

A single-factor analysis of variance (ANOVA) was carried out to establish the difference between seasonal diversity indexes.

RESULTS AND DISCUSSIONS

During the three-year study 745 female mosquitoes belonging to 19 species and 5 genera (*Anopheles* Meig., 1818; *Aedes* Meig., 1818; *Ochlerotatus* Arrib., 1891; *Culex* L., 1758; *Coquillettidia* Dyar, 1905) were captured in human landing collections (Table 1).

Table 1. Mosquito (Diptera: *Culicidae*) species collected by using human volunteers in the Republic of Moldova from April 2008 to October 2010.

№	Species	No. of mosquitoes collected	Dominant index (%)	(*)Biting activity of species (mean±SE)		
				Forests	Open area	Floodplains
1	*Aedes vexans*	350	47.7	15.2±2.2	5.6±1.9	7.3±2.6
2	*Ochlerotatus sticticus*	74	9.9	14.6±3.9	-	-
3	*Ochlerotatus excrucians*	57	7.5	5.7±1.6	-	-
4	*Culex pipiens*	49	6.6	4.6±1.5	12.6±7.4	5.5±3.3
5	*Culex modestus*	47	6.3	2.3±0.5	10.0±4.7	4.4±2.1
6	*Ochlerotatus cataphylla*	33	4.4	12.9±6.9	-	-
7	*Ochlerotatus geniculatus*	32	4.3	4.5±1.2	-	-
8	*Coquellettidia richiardii*	25	3.4	1.0±0.5	6.5±1.3	-
9	*Ochlerotatus caspius*	19	2.6	1.2±0.6	9.5±3.6	3.5±0.9
10	*Anopheles hyrcanus ps.*	15	2.0	-	-	9.8±3.3
11	*Anopheles plumbeus*	8	1.1	1.8±0.5	-	-
12	*Ochlerotatus behningi*	6	0.8	2.1±0.6	-	-
13	*Ochlerotatus riparius*	6	0.8	2.8±1.1	-	-
14	*Ochlerotatus cantans*	5	0.7	1.3±0.1	-	-
15	*Ochlerotatus diantaeus*	5	0.7	1.1±0.3	-	-
16	*Ochlerotatus communis*	5	0.7	1.7±0.5	-	-
17	*Ochlerotatus annulipes*	4	0.5	1.1±0.4	-	-
18	*Aedes cinereus*	3	0.4	0.8±0.3	-	-
19	*Ochlerotatus pulcritarsis*	2	0.3	0.3±0.1	-	-
	Total	**745**	**100**			

(*)The numbers represent the estimated mosquito biting activity per hour of collection.

The highest species richness and diversity were observed in June and July and the lowest in April and October. Seasonal richness was as follows: Spring S = 9, Summer S = 18, Autumn S = 7. The diversity in Spring (H = 1.68) and Summer (H = 1.95) did not differ significantly ($p > 0.05$), and the values of both seasons were significantly higher ($p < 0.01$) than those of Autumn (H = 0.67). Monthly mosquito richness was strongly related to temperature ($R^2 = 0.8$, $F_{1/10} = 18.6$, $P<0.05$) (Figure 1.). *Ae. vexans* (47.7%) was the most frequently collected species while *Oc. pulcritarsis* (0.3%) was the least frequently collected (Table 1).

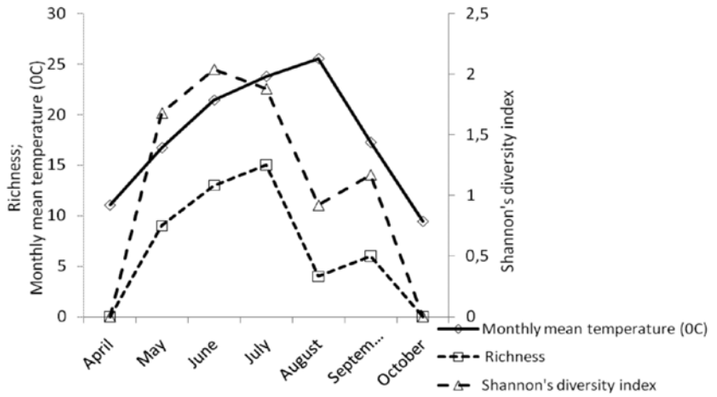

Figure 1. Monthly mean temperature, richness and diversities (Shannon Index) of mosquito fauna collected in the Republic of Moldova.

All mosquito populations showed a clear seasonal activity pattern, with greater numbers in Summer than in Spring and Autumn. The biting activity of the mosquito species most frequently captured (*Ae. vexans*, *Oc. sticticus*, *Oc. excrucians*, *C. pipiens* and *C. modestus*) also differed significantly among seasons, but with different patterns (Table 2).

Table 2. Comparisons of biting activity of mosquito species most frequently captured among months.

Species	May	June	July	August	September
Ae. vexans	1.0	9.7	16.6	11.0	16.0
Oc. sticticus	0	13.0	28.3	3.5	1.0
Oc. excrucians	6.8	7.5	5.6	0	0
C. pipiens	1.5	4.5	17.5	4.0	0.9
C. modestus	3.0	2.8	9.8	0	2.5

The numbers represent the estimated mosquito biting activity per hour of collection.

Ae. vexans and *C. pipiens* were captured during the five months and both showed the highest values in July - 16.6 and 17.5 respectively. *Oc. excrucians* was not present in August and September and the highest values were recorded in June (7.5). *Oc. sticticus* was not present in May but showed the highest human biting activity in July (28.3).

As a result among the 31 mosquito species from 7 genera (*Anopheles*, *Aedes*, *Ochlerotatus*, *Culex*, *Culiseta* Felt, 1904, *Coquillettidia*, *Uranotaenia* Lynch Arribalzaga, 1891) registered in the Republic of Moldova (Prendel, 1965; Tihon, 1981, Oboroc, 2009) 19 species have been found as human-biting mosquitoes, some of which are recognized vectors of arboviruses (Becker, 2003).

REFERENCES

Becker, N., et. al. Mosquitoes and their control. New York, 2003, 505 p.

Cranston P. et al. Key to the adults, male hypopygia, fourth-instar larvae and pupae of the British mosquitoes (*Culicidae*). Ambleside, 1987, 149 p.

Lord, C. 2004. Seasonal population dynamics and behavior of insects in models of vector-borne pathogens. Physiol. Entomol. Vol. 29, p. 214–222.

Magurran, A. E. 1988. Ecological diversity and its measurement. Princeton University Press, Princeton, NJ.

Oboroc T.M. Diversity of blood meal mosquitoes (DIPTERA: *CULICIDAE*) in the Republic of Moldova. // International Conference of Young Researches, VII edition, Chișinău, 2009, p. 21.

Price, P. W. Insect ecology. Wiley, New York. 1984, 595 p.

Reiter, P. Climate change and mosquito-borne disease. Environmental Health Perspectives. Vol. 109, 2001, p. 141-161.

Silver, J. Mosquito ecology. New York, 2008, p. 1469.

Прендель А. Подвиды *Anopheles maculipennis* Молдавской ССР. Мед. паразитол. и паразитарные болезни, 1950, Т. 18, вып. 5. с. 12-15.

Прендель А. Сравнительно-фаунистический очерк кровососущих комаров Молдавии и смежных областей. Проблемы паразитологии, 1956, Тр. 2-ой научн. конф. паразитологов УССР, с. 252-254.

Прендель А., Корнечевская, Г., Моторный, И. Материалы по фауне кровососущих комаров Молдавской ССР и пограничных районов Украины. Работы по паразитофауне юго-запада СССР. Кишинев, 1965, с. 111-113.

Тихон Е. О фауне кровососущих комаров Молдавии. Известия АНМ ССР, No. 4. 1981, с. 73-75.

Штакельберг А. Кровососущие комары Палеарктики. М.,1937, 253 с.

PARASITOFAUNA IN SYNANTHROPIC FELINES *(FELIS CATUS)* FROM URBAN ECOSYSTEMS OF CHIŞINĂU

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The close association of man with animals in large areas often in unsatisfactory conditions, in urban and peri-urban aggregations of stray dogs, almost feral, the presence of cat colonies, maintained around the waste storage containers and in the basement of apartment blocks, favor the emergence of zoonotic invasions [1, 2, 3, 4].

According to OMS and FAO data over 150 pathogen agents are known with involvement in appearing of zoonoses, which constitute a major problem of public health. A significant part of parasito-zoonoses have as reservoir the synanthropic animals, the number of which increased a lot in the rural, as well as in urban environment.

Felis catus is one of the main sources of parasitic pollution of the environment in urban ecosystems of Chisinau city, which constitute a real danger for human population infestation. For this reason it is necessary to impose a broader knowledge of the totality of invasions sources to estimate the risk of spreading and contamination.

Evaluation of parasitological state in synanthropic felines was performed on a sample of 279 cats, investigated by macroscopic and microscopic examination in laboratory of parasitology of DSV of Chițînău city, in the period 2006-2010. The aim of the study was the determining of parasitism structure after the localization on/in organism, establishment of invasion incidence and emphasizing of major parasitoses with zoonotic status.

The obtained results showed that *Felis catus* from urban ecosystems of Chişinău are infected with 12 species of zooparasites: *Eimeria felina*, *Toxoplasma gondii*, *Dipylidium caninum*, *Diphyllobothrium latum*, *Toxocara cati*, *Toxascaris leonina*, *Ancylostoma canium*, *Demodex cati*, *Notoedres cati*, *Otodectes cynotis var cati*, *Felicola subrostrata*, *Ctenocephalides felis*. The structure of cat parasitism includes 5 (42%) ectoparasite species and 7 (58%) endoparasite species, including 5 species with cavity localization and 2 species with intracellular localization. The dominant position is occupied by the species from class *Nematoda* with 25% and class *Arahnida* with 25%, followed by the species from class *Sporozooa* – 16,7%, *Cestoda* – 16.7% and *Insecta* – 16.7%. From the above mentioned species 9 (75.0%) can cause human invasions, thus representing the danger of increased incidence of parasitozoonoses.

After the frequency of registered cases, the dominant positions in the parasitism structure in synanthropic felines from urban ecosystems of Chişinău is occupied by the endoparasites with intestinal localisation *Toxocara cati* and *Dipylidium caninum*. The evaluation of major parasitoses (toxocarosis/dipilidiosis) in *Felis catus* in seasonal dynamics shows and extensity of 30.0% in spring; 41.2% in summer; 41.3% in autumn and 31.3% in winter. The distribution of toxocarosis/dipilidiosis cases in juvenile cats (<12 months) constitute 37.6%. In adult category (>12 months) the incidence of major parasitozoonoses is of 33.9%. Per total in felines the repartition of toxocarosis/dipilidiosis cases is varying: 39.4% in 2001, 36.1% in 2006, 33.3% in 2007, 45.8% in 2008, 28.4% in 2009, 39.4% in 2010, the mean being 35.3%.

Seasonal evaluation toxocarosis and dipilidiosis incidence in synanthropic cats from urban ecosystems of Chişinău in the period 2006-2010 proved a concrete reality: in summer (41.2%) and autumn (41.3%) the incidence is increased, while in spring (30.0%) and in winter (31.3%) the spreading of parasitozoonoses in felines decreased. The instability of this phenomenon is due to parasitogenic, xenogenic and environmental factors, which ensure the structural integrity and functional stability of parasitic biosystems.

Therefore, the synanthropic felines represent an important invasion source of toxocarosis/dipilidiosis for human population and fro the environment and this phenomenon is out of control in urban ecosystems of Chişinău. The ways of invasions transmissions in *Felis catus* is by food and by lactation. The cat population is sensible to infestation at any age, starting with postnatal period and represents a constant danger by polluting the environment with free parasitic forms.

Bibliography

1. Ionescu, V. Zoonoze parazitare–o problemă de actualitate. Rev. Rom. Parazitol., Bucureşti, 2005, Vol. XV, Nr. 1, p. 19-29.

2. Olteanu, Gh. şi a. Parazitozoonoze. Probleme la sfârşit de mileniu în România. Bucureşti, 1999, Editura: Viaţa medicală. 592 p.
3. Şuteu, I. Zooparaziţii şi mediul înconjurător. Bucureşti, Editura: Ceres, 1996. 238 p.
4. Şuteu, I. Actualităţi privind epidemiologia, patogenia şi controlul zoonozelor protozoariene. Rev. Scentia parazitol., Cluj-Napoca, 2002, Vol. III, Nr. 1, p. 57-63.

THE DEFOLIATION TORTRICIDAE OF FRUIT SPECIES FROM REPUBLIC OF MOLDOVA

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In recent years (2008–2011), in orchards from Republic of Moldova is developing intensively defoliation species of Tortricidae. Favorable climatic conditions for their development (evolution) and technological indiscipline to maintain the species below economic threshold of harmfulness, require continuous and repeated chemical treatments.

For practical convenience Tortricidae defoliation according to hibernation stage (egg and larva) are divided into two groups: 1) *Archips rosana* (rose tortrix moth), A. xylosteana (variegated golden tortrix) and *A. crataegana* (brown oak tortrix), 2) *Adoxophyes orana* (summer fruit tortrix), *Pandemis ribeana* (fruit tree tortrix), *Acleris variegana* (green moth trees).

Tortricidae defoliation hibernation the of autumn (2010) until spring (2011) for first group (egg hibernation) was recorded stage embryo viability from 35% (*A. xylosteana* and *A. crataegana*) to 72% (*Archips rosana*); for second group (larva hibernating) – 72.3% (all species). Estimation of biological reserve of the first generation in 2009 (about 3% of infestation orchards and over 51% infestation of rosettes) and 2010 (over 3% of infestation orchards and over 65% rosettes), explains the favorable development of Tortricidae in 2011. In autumn 2010, the second generation of species (*A. xylosteana, Pandemis ribeana*), already infected more than 60% of orchards and fruit attack over 9% (late varieties). In 2011, the Tortricidae defoliations continues to evolve over economic threshold of harmfulness, chemical treatments are applied especially in central and southern republic.

The main factor in the evolution the Tortricidae defoliations of fruit trees is: 1) technological indiscipline to keep them under economic threshold of harmfulness; 2) failure the optimal terms of reduction of embryonic and larval stage (during gemmation apple); 3) ignoring plant hygiene of fruit trees and orchards in general; 4) application of the chemicals during the growing inadequate season (recommended for other species of harmful insects) and aggressive (causes momentary mortality, but also leads to the formation of species resistance) ; 5) no respected the indicate economic threshold of harmfulness (5 larvae/100 buds or rosettes) at the time of chemical treatment; 6) make delayed treatment, after which the chemical preparations do not manifest the expected effeciency.

The study and detailed knowledge of the Tortricidae defoliation biology and integrated combat system is an successful in producing quality and quantity of fruit in Moldova.

SUGAR BEET ENTOMOFAUNA IN REPUBLIC OF MOLDOVA

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In 2008 in Republic of Moldova was harvested sugar beet in record quantities: over 965 200 tons with productivity of 42.1 t / ha. Of crops that were produced 132 500 t of sugar or two times the annual need of the republic. These successes were achieved thanks to the responsible attitude towards this crop from the large companies: the Moldovan-German „Südzucker Moldova" (2001) and Moldovan-Russian „Marr Sugar" (2002). In particular „Sudzucker Moldova" is committed for advanced cultivation sugar beet in Republic of Moldova.

By following technologies growing sugar beet are achieved great success. Climatic conditions and biological factors, however, influences and persist in agricultural landscapes, including this culture. In 2011, do experiments for testing of insecticides, according to research methodology was necessary to study entomofauna Chenopodiacea.

After investigations were recorded following families with species: 1) Curculionidae – *Tanymecus dilaticollis*, *T. palliatus*, *Bothynoderes punctiventris*, *Psalidium maxillosum*; 2) Chrysomelidae – *Chaetocnema concina*, *Cassida nebulosa*; 3) Cryptophagidae – *Atomaria linearis*; 4) Tenebrionidae – *Optarum sabulosum*, 5) Aphidae – *Aphis fabae*; 6) Gelechioidea – *Gnorimoschema ocellatella*.

Curculionidae were spread everywhere, but their density did not exceed the economic threshold of harmfulness (PED), recording only 0.3 - 0.7 ex/m^2. In Fălești, including Glinjeni village where they do experiments, PED to *T. palliatus* was exceeded, it is estimated over 2 ex/m^2. Factors that influenced the development of species: adjacent landscape with orache and other plants with rhizomes; low temperatures during beet growth up to two true leaf (retain plant growth and decreases the action of preparations), creation of low-quality fields for sugar beet (45–50% the gaps between plants) because of soil preparation and use inadequate technology.

Ch. concina species (beet flea) – in 2010 was strongly influenced by adverse weather conditions in spring, significantly reducing their populations. However hotbeds have been the basic source and then individuals spread again. In 2011 PED was exceeded (over 14 individuals/m^2), especially on field edges and damage caused to plant were more than 20%.

Species which have been significantly exceeded in 2011 PED was *Aphis fabae*. Hibernating egg viability was 74.5% and 90% of them were destroyed during the winter. However in the second half of May were recorded flying forms of females. Entomophagous aphids and frequent heavy rains didn't keep populations under PED. Thus, in June were recorded large populations of aphids on plants of orache and beet, this led to covering, twisting, no purifying and absence of the physiological processes in 80% of plants and 9% of the beet. Orache was a decisive factor in the development and spread of aphid chenopodiaceae .

Among entomophagous were recorded: Coccinellidae (3–4 ex/plant) in colonies of aphids, specimens of solitary chrysopidae, carabid (1–1,5 ex/m^2) and Syrphidae (solitary specimens). Other harmful species that were previously mentioned, in 2011 were recorded as sporadic faunal species.

In conclusion, we should note that the system of integrated cultivation of sugar beet, not ensure completely avoidance the development of harmful species in fodder beets and sugar beets. Climatic conditions (t^{o}C and UR% favorable for insect and unfavorable for plantlet until the formation of two true leaf), biological factors (limited entomofauna) and anthropological (partial destruction of weeds, the elements of cultivation technological fulfil superficial etc.) are the reasons that cause lower yields of sugar beet. During plants growth, chemical seed treatments, are not enough to keep pests under the PED. Additional chemical treatments often are necessary, especially in hotbeds formed in previous years.

WESTERN CORN ROOTWORM (DIABROTICAVIRGIFERA VIRGIFERA LE CONTE) POPULATION MONITORING WITH HELP OF SEX PHEROMONE

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Western corn rootworm (Diabrotica virgifera virgifera Le Conte) is the most spread pest of corn crop in the north of the USA, being for the first time described in 1909. At present time the pest is spread in 24 states of the USA, being found itself in Europe in 1992 nearly the airport of Belgrade Surchin, the pest has adapted itself and was spread at a speed of 40 – 80 km/year (Baca, Camprag, Keresi,1995) and further it settled in other European countries, having reacted in 2001 Transcarpatian regions of the Ucraine (Babidorich et al, 1997; Babidorich, 2002; Babidorich et al, 2005). Presently it occupied all the corn crops on 16 thousand hectares in western regions of the Ucraine. So western corn rootworm was marching triumphantly during 9 years over the corn crops of the Ucraine and Moldova and can penetrate into southern regions of the Rumania and Ucraine.

In consequence, a very important way of western corn rootworm depistation is utilization of synthetic sex pheromone of the pest. That is why at the Institute for Plant Protection and Ecological Agriculture an investigation was carried out to synthesize the sex pheromone of the western corn rootworm, to estimate it in the field for monitoring the pest development and to elaborate means of its control.

The sex pheromone of the western corn rootworm is known as 8-methyl-2-decanylpropionate (Guss et al, 1982; Sonnet et al, 1985). The laboratory synthesis of the pheromone was carried out through an analogous to Sonnet et al (1985) scheme proceeding from the 2-methylbutanol:

$CH_3CH_2CH(CH_3)CH_2OH$ ----- $CH_3CH_2CH(CH_3)CH_2Br$ (1) -----
$CH_3CH_2CH(CH_3)CH_2CH_2CH=CH_2$ (2) ----- $CH_3CH_2CH(CH_3)(CH_2)_4Br$ (3)
$CH_3CH_2CH(CH_3)(CH_2)_5C(=O)CH_3$ (4) -----
$CH_3CH_2CH(CH_3)(CH_2)_5C(OH)CH_3$ (5) -----
$CH_3CH_2CH(CH_3)(CH_2)_5C(CH_3)OCOC_2H_5$ (6)

As a result of interaction between 2-methylbutanol and phosphorus tribromide during 24 hours at a temperature of 50-55^{o}C 1-brom-2-methylbutane (1) is obtained. Further the latter is transformed in ether into suitable Grigniar reagent, which reacts with the 2-methylbutanylbromide (1) in ether during 4 hours at boiling and the 5-methylpentene-1 (2) is obtained. The compound 2 reacts in hexane with gaseous hydrogen bromide in the presence of benzoyl peroxide (for 3,5-4 h), which proceeds into 1-brom-5-methylheptene (3). The latter reacts further with the acetoacetic ether in ethanol in the presence of sodium alcoholate at 70-75^{o}C during 12 hours. The reaction product is boiled for 1 hour in 10% alcohol solution and cetone 8-methyl-2-decanon (4) is obtained. The reaction of cetone 4 with the lithium alumohydride in ether during 12 hours gives the alcohol 8-methyl-2-decanol (5). Interaction between the alcohol 5 with the propionyl cloride in benzene at 20^{o}C during 5 hours brings to the final compound 8-methyl-2-decanylpropionate (6) – the sex pheromone of the western corn rootworm (Diabrotica virgifera virgifera Le Conte).

Investigations during 2005-2010 on western corn rootworm appearence monitoring were accomplished on corn crops in v. Velikaia Bacta and v. Velikie Beregui of Beregovsk region near the border with Hungary and v. Onokovtsy of the Uzhgorod region of Transcarpatia near the border with Slovakia on stationary fields. Male capture registration in pheromone traps and depistation of western corn rootworm larvae on corn roots were carried out weekly. Different types of traps were run and were suitable happened to be the open one of 44 x 29 cm dimensions. The doses tested were of 1,2 and 3 mg of active substance per dispenser.

A high size of western corn rootworm population was registered begining with 2005 in v. Velikaya Bacta, and in v. Velikie Beregui as well, where 5400 and 1788 imago males were trapped in three traps with 1 mg/dispenser, respectively, that constituted in average 15,3-77,4 male per trap/week. In 2007 were captured respectively 1417 and 1364, that constituted 5-36 males in average per trap/week. In 2008 1087 and 976 individuals were traped, respectively, constituting in average 9-74,7 inmgo males per trap/week.

In 2008 in v. Velikaya Bacta by pheromone of 2006 synthesis in dozes of 1, 2 and 3 mg of active substance per dispenser on open traps only 1087, 697 and 533 imago males of western corn rootworm were captured, that constituted 46,9; 30,1 and 23 %, respectively. In control 0,5 % of imago males of western corn rootworm were captured. In an usual triangle trap in dozes of 1, 2 and 3 mg of substance 431, 187 and 97 of imago males of western corn rootworm were captured, that constituted 60,2; 26,2 and 13,5 %, respectively. By pheromone of 2008 synthesis in dozes of 1 mg per dispenser in an open trap 1076 imago males were captured, and in an usual triangle trap - 498 of imago males, constituting respectively 68,4 and 31,6 %. It should be noted that the open pheromone traps captured in total 70 % of the western corn rootworm, and usual trianglet raps – only 23-30 % of the pest.

In 2009 4021 males in v. Velikaya Bacta and 4485 males in v. Onokovtsy, respectively, that constituted in average 11,3-178,7 and 12,7-207,7 imago males in average per trap/week. In 2010 on open sex pheromone traps were captured in v. Velikaya Bacta 6882 individuals, and in v, Onokovtsy – 6650 individuals of beetle, that in average 52,3-448 and 17,3-535,7 imago males per trap/week. Population number of the western corn rootworm on corn crops with a new year was in growth. The data of males captured in sex pheromone traps testifies about high population number of the pest in corn crops and in comparison with 2009 the pest population density exceeds by 1,5 times. During second part of 2010 summer on experimental plots liing down of the corn plante on 10-30 % of whole area.

Runs on capture of imagoes of the western corn rootworm in sex pheromones traps with the doze of 1 mg of substance per dispencer near the border of Transcarpatia and Rumania (v. Deakovo), and Hungary (v. Velikayi Bacta), and Slovakia (v. Onokovtsy), and Poland (v. Zhornava) were also accomplished. For five weeks of evidence since 19 of July till 22nd of September 2009 1712 individuals near the border with Rumania, 1545 with Hungary, 1140 with Slovakia, and 642 with Poland were captured. So the main raid and migration of the pest on corn plantations in Transcarpatia takes place from Rumania and Hungary through basin of Tisa river.

In consequence the monitoring of western corn rootworm spreading continues. The pheromone monitoring is used in two directions: continuous monitoring on territories poppulated by pest with the purpose of investigation seasonal and dayly dinamics of flight, population density determination, and areal of pest hearth on corn, and on other crops; spreading monitoring – new hearth depistation on non populated area.

THE ROLE OF ECOLOGICAL AGRICULTURE IN PROTECTING ARTHROPODS DIVERSITY

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Ecological agriculture as a science or art of keeping control over agricultural living organisms and their environment that brings benefit for the nature and mankind being targeted at the land cultivation and obtaining agricultural products without use of synthesized chemical substances and genetically modified organisms in order to get and commercialize high quality agricultural products thus ensuring preservation and development of dynamic and durable agricultural ecological systems. As a field of science and way of management it provides positive effect on different indicators of agricultural ecological systems' performance. Preservation of biological diversity in agricultural ecological systems is manifested through increasing the range of agricultural crops used in production technologies as well as through promoting development of organisms that are beneficial for excluding the use of synthetic fertilizers and plant protection substances (European Environment Agency, 2006).

It is very important to preserve species habitation in order to maintain biological diversity of natural agricultural ecological systems as well as those modified due to anthropic activity and agrocenoses. This fact is first of all related to preservation of zone landscapes and existence of «biocenotic oases» i.e. forest sectors and polifunctional forest shelter belts (with the respective component of trees plantations and grass vegetation). Thus, the «green shell» contributes to preservation of local flora and fauna gene pool and creates shelters and migration routes for various components of biological diversity (Vadineanu A., 2007).

Ecological agriculture enriches and does not reduce biological diversity preserving the initial gene pool of treated crops. Maintenance of biological diversity activates «regulatory forces of nature» that contribute to development of durable agriculture. The latter is achieved due to developing highly productive and stable agricultural ecological systems, elaborating ecological technologies based on peculiarities of natural landscapes, use of various and highly qualitative plant hybrids resistant to unfavourable environmental conditions, application of modern technologies amicable with the environment and economically efficient, i.e. respective crops rotation, «green fertilizers», etc., except use of mineral fertilizers and phytosanitary control techniques (Voloşciuc L.T., 2009).

Ecological agriculture allows settling both, issues of biological diversity and diversity in general. It means that both, agriculture and industry shall become safe and non-destructive for the environment. Constructive premises of an efficient and beautiful ecological «design» of natural components – both, agricultural and industrial, serve as the base. The above-said shall be taken into consideration while choosing optimal types of landscape arrangements highly promising for self – regulation in agrocenoses when making decisions regarding plant types and varieties, their placement, crops rotation and ecologised plant protection techniques.

The attitude of people to the nature under conditions of ecological agriculture shall manifest collaboration with nature, need to learn from it while not subordinate. It will result in harmony between agriculture development and state of biological diversity with clear future expectations manifested through abundance and non – limitation of forms and varieties diversity (Voloşciuc L.T., 2009, 2009a).

In addition to diversifying the range of cultivated agricultural crops, ecological agriculture benefits to preserving varieties of spontaneous flora and fauna. In ecological farms the number of plant varieties of spontaneous flora exceeds by 2 to 3 times those in farms with conventional agriculture, the number of bird types exceed by 57 percent those in classic farms and by 44 percent more invertebrates.

References

1. European Environment Agency, Urban sprawl in Europe. The ignored challenge, Office for Official Publications of the European Communities, Luxemburg, 2006, 210p.
2. Vadineanu A., Conservarea bio si ecodiversitatii si dezvoltarea socioeconomic in Romania, Conferinta Nationala de Ecologie, Mamaia, 2007, 186p.
3. Voloşciuc L.T. Probleme ecologice în agricultură. Chişinău: Bons Offices, 2009, 264p.
4. Voloşciuc L.T Ecological agriculture as a reliable way for stable development of agriculture in Moldova. Karantin i zahist roslin, Kiev, 2009. cerven, No. 6. P. 15-17.
5. Voloşciuc L.T. Ecological agriculture as a reliable way for stable development of agriculture in Moldova. Information Bulletin WPRS/IOBC, No.39, 2009a. P. 66-72.

THE IMPACT OF ECTOPARASITIC POLIINVASIONS ON PROTEIC INDICES IN CHICKENS (*Gallus gallus domestica*)

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The parasites provoke the pathogenic processes in hosting organism by involving specific mechanisms varying on the type of species, parasite associations etc. In some situations the spoiling effect is pronounced, in other situations the toxic or inflammatory effect is predominating, this often being observed. The way of influence of such is different and depends on the stage of evolution, even related to the same genus. The pathological changes caused by parasites contributes to changing of the activity of ferments, content of microelements, proteins, distress of the acid-basic balance and inhibit oxygenizing processes. As a consequence, the natural resistance of hosting organism is diminished (2). The pathogenic effect of poliinvasions on hosting organism represents a permanent stress generating factor that affects its existence including due to the immunologic, morphologic and physiopathologic reconstructions **(7).**

The changes that take place in the organism infested by poliparasites differs from those infested by monoinvasion. In all cases, on the level of each parasite-host system, the pathologic influence of parasites is quite complex one: mechanic, toxic, chemic, allergic, spoiling, inoculating, immunomodulating etc. (1). The adaption of the host to the parasite causes an evolution of protection mechanisms. Yet this process is directed to the confrontation of such mechanisms. In this "stage" of evolution the parasite proved to be more „mobile" that is able to withstand the immune system of the host (4). The monitoring of the indices of the total proteins as well as of the protein heads allow to determine the evolution of parasitic factor and severity of infestation, through known correlations between ratios of these indices and parasitic spectrum in infested birds. In all pathological conditions associated with metabolism intensification, the need in proteins became high; this also takes place in situations with mix invasions with ectoparasites when the organism is confronting infections (5)**.**

The aim of the research was to establish consequences of mix invasions for protein indices (total proteins, albumines, α-globulines, β-globulines, and γ-globulins) in chicks poliparasited with biting lices, fleas and gamasid mites.

MATERIALS AND METHODS

The research have been organized involving 20 chicks as of 4 months, Silver Adler race, that have been devided into two groups: group 1 – control sample, non-infested (n = 10); group II – infested with biting lices (*Cuclotogaster heterographus*, *Eomenacanthus stramineus*, *Goniocotes gallinae*, *Goniocotes maculatus*, *Goniodes dissimilis*, *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus pallidulus*), fleas (*Ceratophylus gallinae, C. hirundinis*) and gamasid mites (*Dermanyssus gallinae, D. hirundinis* (n=10).

The birds have been examined clinically and on parasitologic aspects (scatoscopy, external examination) in order to identify the eventual evolution of some diseases that may influence the results of the experiment. During the experiment, the condition of feeding and maintenance have been identical for both groups. The sanguine probes have been obtained using EDTA anticoagulant, just before the feeding process. Thre were established the following biochimic parameters: total proteins, albumines, α-globulines, β-globulines and γ-globulines.

The content of the protein ratios from sanguine serum have been determined with use of electrophoresis method (6,8). The obtained data have analyzed statistically with calculation of variation indices of arithmetic average (M) and average error mean (m). The statistic revelance (P) of the medium ranges of the studied parameters in different groups have been calculated using Student criteria (3).

RESULTS AND DISCUSSIONS

While determining the biochemical parameters in the group of chick infested and included into experiment, the obtained results allowed to identify some indices of protein metabolism status of birds poliinfested with biting lices, fleas and gamasid mites reflecting the changes taking place at the level of organs, apparatus and systems. The results are presented in Fig.1.

The biochemical analysis reveals an increased level of serum proteins in chicks of Group 2 II (infested) with 11,2% ($p>0,05$), followed by a diminished level of albumins up to 12,9% ($p<0,05$) compared to Group 1 (control sample). There were established some changes in protein rates, manifested by increased level of

γ-globulines in infested group by 26,8% (p>0,05), a diminished level of α–globulines - by 17,1% (p<0,05) and β –globulines by 13,2% (p<0,05) compared to the control sample group.

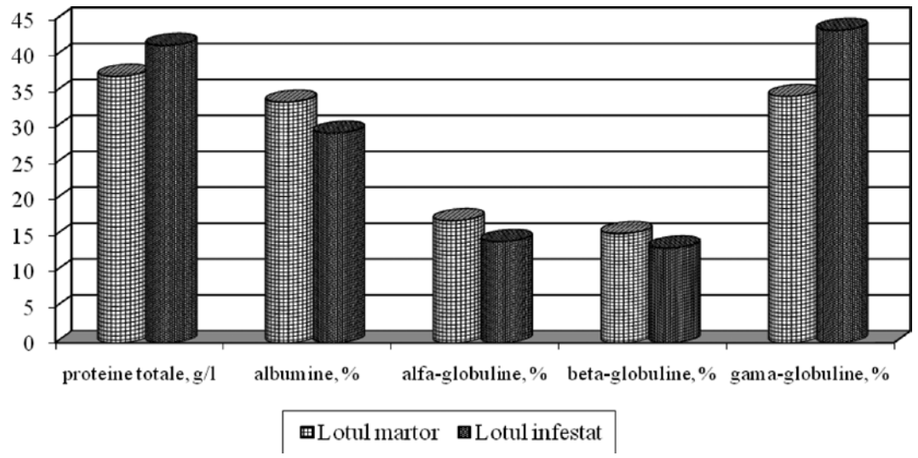

Fig.1 The changes registered in the protein indices.

In this way, the changes of protein indices indicates on different pathological stages in organism. The increase of the γ-globulines level in infested chicks indicates on the intensified activity of immune status and involvement of this in the processes of anti-parasite response but at the same time reveals the dependency of immune activity of organism reflected influences by the level of invasion.

CONCLUSIONS

The mixtinvasions with ectoparasites such as biting lices, fleas and gamaside mites provoke distress of protein metabolism in infested birds, expressed by the increased level of serum proteins, γ-globulines, and diminished quantity of total albumines, α- and β-globulines.

BIBLIOGRAPHY

1. Iacob O., Ţarcă F. Studiul parametrilor hematologici şi biochimici la miei trasori. Revista Română de Parazitologie. 1998, vol. 8, nr 1, p. 95-96.

2. Olteanu Gh., Panaitescu D., Gherman I. Poliparazitismul la om, animale, plante şi mediu. Bucureşti: Ceres, 2001, 593 p.

3. Лакин Г. Биометрия. Москва: Высшая школа, 1990. 352 с.

4. Омаров Бекет С. Динамика гематологических и биохимических показателей при экспериментальном боррелиозе птиц. Автореф. Дисс. ученой степени кандидата биологических наук. Алма-Ата, 1987. 25 с.

5. Prelesov Petyo Nedelchev, Groseva Nelly Ivanova, Goundasheva Dimitrina Ivanova. Pathomorphological changes in the tissues of chickens, experimentally infected with biting lice (Insecta: Phthiraptera). Vet. arh. 2006, vol. 76, nr 3, p. 207-215.

6. Назаренко Т., Кишкун А. Клиническая оценка результатов лабораторных исследований. Москва: Медицина, 2000. с. 243-271.

7. Фурдуй Ф., Штирбу Е., Струтинский Ф. Стресс и адаптация с/х животных в условиях индустриальных технологий. Кишинэу: Штиинца, 1992. 196 с.

8. Чиркин А. Клинический анализ лабораторных данных. Москва, 2004. с. 99.

WATER ECOLOGY

SEDUM TELEPHIUM EXTRACT MODULATES CLASTOGENIC EFFECTS OF AQUATIC POLLUTANTS ON *CARASSIUS AURATUS*

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Sedum telephium L. is a succulent medicinal plant widely used in traditional medicine in Europe . Investigating the opportunity of revigorating its intensive use in modern medicine, we gathered data about the modulatory effects of this plant's extracts on the clastogenic effects induced by chemical pollutant agents upon a common and widely spread fish *Carassius auratus*, using a modern molecular technique PFGE-CHEF.

PFGE-CHEF allows evaluating the extent of double-break DNA lesions and the pattern of molecular weight distribution in the migrated DNA, and is a very useful and robust tool in the assessment of molecular effects of pollutants upon DNA of aquatic animals.

Our findings show that the extracts modulate the clastogenic effect of aquatic pollutants in a concentration- dependent manner.

STUDY ON MOLLUSKS FROM DUBASARI RESERVOIR

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The zoobenthos is a mandatory chain in the hydrobiological system of monitoring and control of surface waters. The mollusks, alongside the oligochaeta, form one of the most stable groups of hydrobionts, which belong to the zoobenthos, due to their longevity sometimes exceeding 6-7 years [1]. The main objective of this study consisted in the investigation of species diversity of mollusks – part of zoobenthos – and of some of their quantitative parameters upstream the Dubasari Reservoir dam. The works were carried out in summer 2007.

Hydrobionts were picked up manually, the method of squares being applied, by using a metal frame that covered an area of 0,0625 m^2. This harvesting procedure was chosen taking in account the nature of the Dubasari Reservoir bottom in this region- it is covered by big stones, which dimensions exceed the capture surface of Petersen grab (0,025 m^2) - classical apparatus for quantitative benthic investigations. The sampling was carried out on the both banks of reservoir, at a depth of 0,7-1,5 m and a distance of 5-15 m from the shore (till the starting line of the muddy area, where zebra mussel *(Dreissena polymorpha)* practically is not detected). Four collection stations were chosen on each bank (at a distance of 200, 600, 1200 and 2000 m upstream the dam); at each station a mollusks sample were collected (in four repetitions). As result, the total surface the mollusks sample was harvested from was equal to 0,25 m^2; later the necessary recalculations for one square meter were made.

Six species of mollusks were registered in the samples collected from the right bank: *Theodoxus fluviatilis, Viviparus viviparus, Lithoglyphus naticoides, Bithynia tentaculata, Lymnaea auricularia (Gastropoda)* and *Dreissena polymorpha (Bivalvia)*. On the left bank, alongside the above mentioned species, the *Physa fontinalis (Gastropoda)* was found out.

It was revealed that both from density and biomass points of view two species dominated upstream the Dubasari Reservoir dam – *D. polymorpha* and *T. fluviatilis.* On the right bank the *D. polymorpha* density ranged from 236 to 2064 individuals/ m^2 (in average - 1134 individuals/m^2), on the left bank – from 164 to 1692 (in average – 305) individuals/m^2. *T.fluviatilis* registered on the right bank a number of 230-1604 (in average – 824) individuals/m^2, but much less on the left one, respectively, 32-124 (in average - 77) individuals/m^2. According to the biomass values, *D. polymorpha* hold the first place: its mean biomass on the right bank was 391 g/m^2, on the left one- 136 g/m^2. In the case of *T.fluviatilis* these values were of 51,8 g/m^2 and respectively, 4,77 g/m^2.

The remaining species encountered a much smaller density – 3-8 individuals/m^2. Among them *V.viviparus* revealed a higher biomass - 19 g/m^2 on the right bank and 11,72 g/m^2 – on the left one, which is explained by larger sizes, characteristic for this species.

Calculations showed that the mean value of mollusks density in this area of reservoir was of 1190 individuals/m^2, the mean value of their biomass - 311 g/m^2. Unification of samples collected on both banks allowed the determination of the share of each species in the total mollusks density and biomass (Tab.1).

Table 1. Contribution of different species in formation of mollusks density and biomass upstream the Dubasari dam

nr.	Species	Share in total density, %	Share in total biomass, %
1.	*Dreissena polymorpha*	60,42	84,58
2.	*Theodoxus fluviatilis*	37,82	9,00
3.	*Viviparus viviparus*	0,42	4,82
4.	*Lithoglyphus naticoides*	0,25	0,64
5.	*Bithynia tentaculata*	0,34	0,32
6.	*Physa fontinalis*	0,17	0,32
7.	*Lymnaea auricularia*	0,58	0,32

It is worth to stress that such kind of study was carried out for the first time in the Dubasari Reservoir. In the 1980s the collaborators of the Institute of Zoology conducted comprehensive researches on the species structure (diversity) and quantitative aspects of zoobenthos in the Lower Dniester, including Dubasari station (downstream the Dubasari dam) [2]. Obviously, to make conclusions about the dynamics of mollusks quantity in lower part of the Dubasari Reservoir, similar researches are needed to be performed during the several vegetation seasons, but the obtained results may serve as a strong benchmark for next investigations.

Bibliography

1. ABACUMOV V.A., CACIALOVA O.L. Zoobenthos in the system of water quality control. Scientific bases of the water quality control according to hydrobiological indicators. Proceedings of Unional Conference, Moscow, November 1-3, 1978. L:Hydrometeoizdat, 1981, p.167-174. (in Russian)
2. The ecosystem of Lower Dniester under intensive anthropogenic impact (resp.editor Ganea I.M.). Chisinau: Stiinta, 1990, 260 pp. (in Russian)

THE DYNAMICS OF NITROGEN AND PHOSPHORUS CONCENTRATIONS IN AQUATIC SEDIMENTS OF THE DUBASARI RESERVOIR

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Nowadays the human impact on aquatic ecosystems of the Republic of Moldova contributes to the radical changes of biodiversity and quantitative structure of the hydrobiont communities, water quality, living conditions and functioning of hydrobiocenoses in Dubasari reservoir.

The building of the Dubasari Reservoir, with a length of 125 km, on the Dniester River affected its hydrological, hydrochemical and hydrobiological conditions. The river ecosystem suffers intense assaults due to anthropogenic activities among these activities are the building of hydropower stations, overuse of agricultural, chemicals and wastewater discharge.

Unfortunately, during the last decades Dubasari Reservoir is characterized by a large amount of bottom sediments, and currently the silt layer consists of 9 – 13 m. As a consequence, the decrease of self-purification processes was observed.

Biogenic elements are the basis of the formation of necessary life conditions for the development of hydrobionts and running of self-purification processes in the water body. These are the elements that determined the process of eutrophication: the development of aquatic plants depends on their quantity and, respectively, the primary production of the water body.

This paper proposes a systematization of the results obtained during 1986-1990 by the researchers of

the Laboratory of Hydrobiology and Ecotoxicology of the Institute of Zoology and their comparison with the results of investigations carried out recently, in spring 2011.

Sample collection was made systematically in three sectors of the reservoir: superior, medial, lower. The mud was collected by Petersen device that allowed taking the first 10 - 15 cm of sediment layer. Samples were placed in polyethylene bags and transported to the laboratory, where they were analyzed. The mud was subjected to centrifugation (2000 rpm/min) for 30 min.

The concentration of biogenic elements was determined in the obtained centrifuged solution according to accepted hydrochemical methods for surface water (Alekin, 1973, Semenov, 1977).

Ammonium ions were analyzed fotocolimetric with Nessler reagent, nitrite ions - with Griss reagent, sodium salicylate - with nitrate ions, phosphate ions with ammonium molybdate, total nitrogen according to Kjeldahl method.

The analysis of the results was performed using Excel program.

Mud, one of the most informative research objects, due to the accumulation of information about the processes occurring in the ecosystem, is used as indicator in assessment of the ecological status of aquatic ecosystems. Serving as a living environment for various forms of benthic organisms, it is directly influenced by their vital activities. The autotrophic and heterotrophic bacteria and benthic flora and fauna- important steps of the food chains within an ecosystem- have an important role in the transformation of biogenic elements. Being in a permanent connection with the layer of water, the mud directly affects the ecological status of the entire water body.

Intensity training, gravimetric and chemical composition of the mud depends on the physical-geographical conditions of the water body and the combination of processes that occur in the ecosystem. The economic developments, characteristic for the 1980s, in particular and human activity, in general, were the dominant factors in the mud forming (wastewater discharge, runoff from agricultural land, etc.). As result, the growth of biogenic elements flow occurred, ecosystem productivity increased and organic matter entered into aquatic deposits. Total nitrogen and phosphorus in the mud tank, mainly depends on the accumulation of organic substances in sediments, which can have both autochthonous and allochthonous origins. The intensity of transformation processes and ratio between mineral forms of nitrogen and phosphorus in the mud are determined by the intensity of biological processes- the role that belongs to microbial communities.

Over the years, deposits of high mud have been accumulated in the Dubasari Reservoir with a significant stock of organic matter and their mineralization products.

Yearly observations indicate that nitrogen and phosphorus concentrations in sediments are quite variable, having maximum amplitude in accordance with the most industrially developed years.

The analyzed mud solutions contained large amounts of organic matter and mineral products - orthophosphates, ammonia nitrogen, nitrate nitrogen and nitric nitrogen, of which concentration is ten times higher compared to the layer of water. This is mainly determined by the decomposition of macrophytes.

Especially the macrophytes and phytoplankton have the major role in the production-destruction processes. The content of mineral nitrogen is an indicator of oxidation and reduction processes of organic matter in sediments and it prevails permanently over organic nitrogen content in the mud solutions, with a value of more than 60 percent of the total nitrogen content. The sediments from the Dubasari Reservoir are characterized by a high content of ammonium ions, their concentrations ranging on average from 4.85 mg/l up to 5.19 mg/l in the period 1986-1990. Investigation carried out in the spring 2011 revealed a visible lower ammonium concentration - 1.73 g/l.

Nitrite nitrogen was registered in all samples, independent of sector or season, in such way confirming the presence of the nitrification process, or oxidation of ammonia nitrogen. Nitrites ions content has had a slight variation during the 1986-1988: from 0.02 mg/l to 0.018 mg/l, excepting 1990, when their average value was 0.086 mg/l. In spring 2011 nitrite ion concentration was 0.024 mg/l. Situation is similar for mean nitrate concentrations: the value for the period 1986-1990 ranged from 0.173 mg/l to 0.408 mg/l and in the spring of 2011 it was 0.148 mg/l.

The same situation is observed for phosphorus, and especially the prevalence of organic forms of phosphorus on the mineral shows minimize self-cleaning the entire reservoir. According to the concentrations of nitrogen and phosphorus, the Dubasari Reservoir has a high level of eutrophication.

Bibliography

1. Byzgu S.E., Dymchishina-Kriventsova T.E., Naberezhnii A.I., Tomnatic E.N., Salaru V.M., Yaroshenko M.F. Dubossary Reservoir, Moscow: Nauka, 1964. – 220 pp. (in Russian).
2. Byzgu S.E., Cojocaru I.F., Zubcov E.I. The dynamics of the chemical composition of sediments of the mud solution Dubossary Reservoirs // Biological resources of reservoirs Moldova, Chisinau: 1975. - P.14-25. (in Russian).
3. Martynova M.V. Nitrogen and phosphorus in the sediments of lakes and reservoirs. Moscow: Nauka, 1984. – 143 pp. (in Russian).
4. Semeonov A.D Guide to the chemical analysis of the continental surface waters //. – Leningrad: Gidrometeoizdat, 1977 – 542 p. (in Russian).
5. Pollution and self-cleaning Dubossary reservoir / Edited by Academician of the Academy of Sciences of the MSSR Yaroshenko M.F. Chisinau: Stiinta, 1977. (in Russian).

THE ROLE OF WET AREAS IN THE CONTEXT OF EXTREME CLIMATIC CHANGES – CASE STUDY THE DANUBE FLOODPLAIN

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Wet areas may be defined as complex aquatic and terrestrial ecosystem structures that play a major role in regulating and balancing climatic (temperature variation, humidity, hydrological regime), ecological (through the location of a great biodiversity), and economic processes – production of natural resources. The main features of extreme climatic changes are prolonged drought periods alternating with heavy rainfalls that trigger disastrous effects upon the terrestrial environment (Busuioc 2003; Bălteanu & Şerban 2005).

The role of wet areas in the context of extreme climatic manifestations resides in their capacity of attenuating the negative effects of extreme climatic values upon the environment both regionally and locally. Under these circumstances, the protection and development of wet areas becomes a 'must'.

The Danube Floodplain, with a total surface of 417,617 ha, represented the largest wet area in Europe and one of the largest in the world (Figure 1).

40% of this surface was covered by permanent lakes, channels, streams, swamps, reed thickets, 40% were periodically flooded terrains, and 20% rarely flooded terrains. Due to its natural resources, the floodplain was considered the richest in Romania. Fish production was on the first place. In permanent and temporary lakes, referring only to the natural production, there were fished more than 14 million Kg/year. In the rarely flooded fields, cereal production was similar to the production obtained in plain areas (4,000-5,000 Kg/ha wheat). The floodplain had four main functions among many others (Antipa 1910, 1921).

The first function – the hydrological one. It acted as a regulator for the hydrological regime of the Danube. Through its vast surface, this area was a real *safety valve* that limited the destructive effect of floods occurring at large discharges of the Danube (maximum discharges of 13,000 m^3/s). At the same time, it was a large water reservoir that ensured the necessary supply during dry periods, when the level of the river was extremely low (minimum discharge of 2,500 m^3/s) and affected many activities (navigation, water supply of the settlements). Thus, it played the role of hydrological balance.

The second function – the climatologic one. The flooding area, through the vast surface covered by the aquatic ecosystems rich in paludous and terrestrial vegetation ensured the moderation of an excessively continental climate characterized by extremely hot and dry summers specific in the South of Romania and especially within the Danube Plain.

The third function – the ecological one, was extremely important due to the diversity of ecosystems and the richness of plants and animals' populations; thousands of species enriched the flora and fauna of Romania and Europe.

The fourth function, the economic one, a resultant of the three previously mentioned functions, is also important because of the great fish production, agricultural products, wood, hayfields and animal breeding.

Present structural functional state of the Danube Floodplain. Starting with the years 1962-1965 and, then, after 1970, the floodplain was subject to great hydrotechnical works. Through the construction of the 1,157 km long dyke, the Danube was separated by its floodplain. Under these circumstances, the ecosystem structures characteristic to the floodplain – lakes, marshes, channels, willow forests, specific flora and fauna, disappeared (Brezeanu & Marinescu 1965; Brezeanu & Cioboiu 2004, 2008; Şerban & Jula 2002).

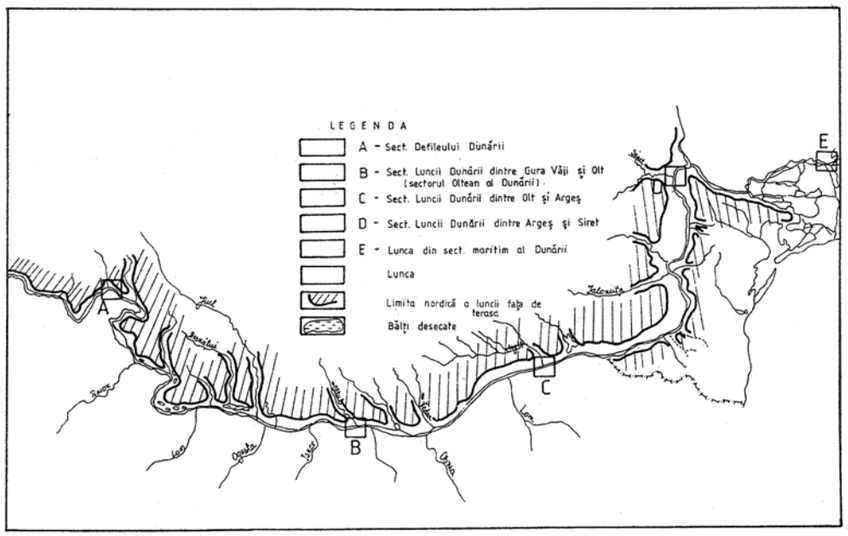

Figure 1. The Danube Floodplain (Km 900 – 28)

These structures were replaced by 360,000 ha agricultural fields and 10,000-15,000 ha fish ponds. Of the 360,000 ha only 70,000-80,000 ha may be considered agriculturally productive under adequate maintenance and exploitation conditions; the rest of 280,000 ha are poorly productive fields due to certain factors – water excess, salinization, deterioration of the soil structure, oxidation etc.

In the context of climatic changes and due to the inefficiency of the damming works, periodically, there occurs severe flooding periodic with negative economic consequences.

The reconstruction of the floodplain and the rehabilitation of its natural structures and functions (Cioboiu, 2003) is an objective necessity in the context of climate changes and global warming – a national program proposed and sustained by the European Union.

REFERENCES

Antipa, Gr., 1910. *Regiunea inundabilă a Dunării. Starea ei actuală şi mijloacele de a o pune în valoare.* Inst. Arte Grafice, Bucureşti. 320 pp.

Antipa, Gr., 1921. *Dunărea şi problemele ei ştiinţifice, economice şi politice*. Librăriile „Cartea Românească" şi Pavel Suru, Bucureşti. 191 pp.

Bălteanu, D., Şerban, Mihaela, 2005. *Modificările globale ale mediului*. Ed. C.N.I. Coresi S.A. Bucureşti: 1 – 225.

Brezeanu, Gh., Marinescu-Popescu Virgina, 1965. *Cercetări hidrobiologice comparative asupra Dunării (km 697) şi bălţii Nedeea*. Hidrobiologia VI. Ed. Acad. Rom. Buc.: 169 – 195.

Brezeanu, Gh., Cioboiu, Olivia, 2004. *The Danube River as controlling factor of the ecology of the Danube Delta and the Black Sea; Die Donau als Steuerungsfaktor der Okologie des Donau Deltas und des Schwarzen Meeres.* I.A.D. Danube News; Donau Aktuell, No. 9: 4 - 7.

Brezeanu, Gh., Cioboiu, Olivia, 2008. *Reconstrucţia zonei inundabile a Dunării – condiţie fundamentală pentru dezvoltarea durabilă a funcţiilor sale ecologice şi economice.* A 48 – a Sesiune anuală de comunicări ştiinţifice a Inst. de Biol. Bucureşti, Ed. Ars Docendi: 47.

Busuioc, Aristiţa, 2003. *Schimbări climatice – perspective globale şi regionale*. Sesiunea Ştiinţifică Anuală a INMH Bucureşti: 12 – 23.

Cioboiu, Olivia, 2003. *Zona inundabilă din sectorul Cetate – Dăbuleni (km Dunării 811 – 661), model pentru reconstrucţia ecologică a regiunii inundabile a Dunării*. Analele Universităţii Craiova, Seria Geografie, Ed. Universitaria Craiova: 28 – 38.

Şerban, P., Jula, Graziella, 2002. *Some Issues an the Evolution of Water Quality and Water management in the Danube River Basin*. Limnol. Rep. 34. Ed. Acad. Rom. Buc.: 867 – 885.

INVASIVE FISH SPECIES IN SMALL RIVERS OF REPUBLIC OF MOLDOVA

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Small rivers ecosystems from Republic of Moldova at actual stage are intense affected by anthropic factor. Instability of structural-functional state of this biocenosis conditioned penetration of some allogenic fish species which, in new settled conditions, intense proliferate and submit autochthon population. Also, active eutrophisation, clogging and fragmentation of ecosystems facilitate numerical development of some limnophilous native species, which becomes multidominant and dangerous for icthyocenosis functionality.

In present paper we intend to make a short characteristic about spread particularities of invasive fish species in small rivers limited by R. of Moldova (Bac, Raut, Cubolta, Racovaţ, Cainari, Ciuhur, Cogalnic, Ciulucul de Mijloc, Vilia, Larga, Lopatnic, Copacianca, Draghiste).

The most abounding allogenic invasive fish species and the biggest value of meeting frequency are: prussian carp - *Carassius gibelio* (Bloch, 1782) and stone moroko - *Pseudorasbora parva* (Temmink & Schlegel, 1846). Penetration period of *prussian carp* in aquatic ecosystems of Republic of Moldova it is unknown with preciseness, but certainly is the first invasive species discovered, while *stone moroko* for the first time have been discovered in 1972, in inferior Nistru (Козлов В.И., 1974).

These species, because of large effective, reproduction advanced strategies, euryphagous and accented ecological polymorphism, undermine nutritive base of native species, some of them becoming very rare or even disappeared from mentioned ecosystems (crucian carp - *Carassius carassius* (Linnaeus, 1758), tench - *Tinca tinca* (Linnaeus, 1758), mudminnow - *Umbra krameri* Walbaum, 1792 , weatherfish - *Misgurnus fossilis* (Linnaeus,1758)).

Chinese sleeper- *Perccottus glenii* Dybowski, 1877 and pumpkinseed - *Lepomis gibbosus* (Linnaeus, 1758) are species in permanent ascension in new territories, but chinese sleeper active advance, from north to south direction of our country, while pumpkinseed - slowly and constant in contrary direction. Chinese sleeper as new species for ichtyocenosis of our country have been discovered recently (Moşu A., 2005) but high capacity of spread and active nutrition with larvas and saplings of other fish species, makes it a dangerous species for situation of local ichtyocenosis. From potential invasive and interfered species that because of abiotic and anthropogenic condition changing proliferated more in the last period of time we mention: black-striped pipefish - *Syngnathus abaster* Risso, 1827, southern ninespine stickleback - *Pungitius platygaster* (Kessler,1859), monkey goby - *Neogobius fluviatilis* (Pallas, 1814), racer goby - *Neogobius gymnotrachelus* (Kessler, 1857) and western tubenose goby - *Proterorhinus semilunaris* (Heckel, 1837). These species are distinct by conditional assignment to allogenic species group (most of them being of ponto-caspic and mediteranean origin), proliferating and rapid expanding of spreading area due to: euryhaline potential, successful reproductive strategies, high trophy activity and, not as the last, because of negative anthropic modifications of affected hydrobiotops (construction of accumulation basins, modification of termed and chemical regime, active choking and eutrophisation).

Accentuate eutrophisation in small rivers from Republic of Moldova and pressing absence of ichtyophagus fish species create perfect conditions for development of limnophilous native species with short life cycle, but their large ecological valence, conditioned excess expanding of effective, disturbing local ichtyocenosis stability, no less as under the action of allogenic species. From this group we mention: spined loach – *Cobitis taenia* Linnaeus, 1758, bitterling – *Rhodeus amarus* (Bloch, 1782), *european perch - Perca fluviatilis* Linnaeus,1758 and roach - *Rutilus rutilus* (Linnaeus, 1758).

To find out a logical compromise between "invasive species" and "domestic invasion" and to demonstrate invasive potential not only of non-native but, also of aborigine, we use index of competitive ability (Skolka, Gomoiu, 2004), adjusted to aquatic ecosystems ichtyocenosis from Republic of Moldova (at the moment ichtyocenosis of Bac river). Have been demonstrated that big values of this index could be obtained for non-native species *(stone moroko (9,3), prussian carp (8,9),)* and for aborigine *(spined loach (9,1), bitterling (8,0))*.

According to our estimations, in waters of Republic of Moldova, in different years, have been taken measures for rising of fish productivity by introduction of 15 fish species of asiatic and American origin belonging to 10 genus and 6 families. In small rivers ecosystems in present are spread only three species silver carp- *Hypophthalmichthys molitrix* (Valenciennes, 1844), bighead carp – *Hypophthalmichthys nobilis*

(Richardson, 1845) and grass carp - *Ctenopharyngodon idella* (Valenciennes, 1844), abundance of that is in direct dependence by population share in lakes bed and intensity of annual flash flood. In small rivers bed these species do not spend long time (uncharacteristic hydrobiotop) being captured by lake falls down the river or arriving in big rivers.

Thinking about accumulated world experience in this domain, would be welcome elaboration and realization of national program of concrete actions about supervision and prevention of biological pollution allogenic fish species according international bonds of Republic of Moldova respecting biological diversity Convention Nairobi, 1992, Art. 8, point "h".

ICTYOFAUNISTIC INVASION IN BAC RIVER ECOSYSTEM

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Ichthyofaunistic studies indicate that in the last years, under action of negative anthropogenous factors, had reduced not only specific diversity and quantitative characteristics of aquatic ecosystem ichthyocenosis from Republic of Moldova, but had appeared new "guests" which more affected the situation of local population.

It is known that once with stabilization of a species in new habit it is dificult or imposible situation rectification. That is why, in settled conditions of Republic of Moldova, the problem remains unsolved and it is more addressed by criteria if an alogenic species induce pozitive or negative economical effects.

The propose of paper is to settle down qualitative and quantitative component of Bac river ichtyofauna, allochtone fish species presure exerted on native species and hightlighting of the most esential factors which contributed to major modifications in functional state and structure of this ichtyocenosis.

Ichtyological material have been colected between 2010-2011 years from Bac river ecosystem.

As a result of investigation have been identified 26 fish species belonging to 5 ordins and 7 families, the most numerous beeing *Cyprinidae* family (13 species), succeeded by *Gobiidae* family (5 species), *Percidae, Cobitidae* and *Gasterosteidae* families (with 2 species each), *Esocidae, Signatidae* families with one species each.

The largest share is hold by *Cyprinidae* family reprezentatives, most species captured, being ubicvist and tolerant to fluctuations of different habit gradients.

Analising the value of ecological index of fish species colected in this year we can conclude that the most numerous species is *bleak* (152 ex.), beeing very abundant in most of sectors, folowed by *spined loach* (47 ex.), *stone moroko* (37 ex.), *prussian carp* (35 ex.) and *bitterling* (31 ex.). Other are classified as relatively rare and very rare.

According to value of domination index is point out an eudominante species (D5) - *bleak* (30,33%), going in a bigger shares to stability of ichtyocenotic system in superior flow of river and at confluence with Nistru river; 4 dominante species (D4): *spined loach* (9,54%), *stone moroko* (7,38%), *prussian carp* (6,98%), *bitterling* (6,18%), all these species constitute the base in ichtyocenosis formation and maintenace and 8 subdominante species (D3) including economically valuable species as *silver carp, grass carp, common carp*; others beeing recedents (D1, D2) with value between 0,19% and 1,99%.

Constantly and frequently are pointed out *spined loach* (100%), *bleak, stone moroko* and *prussian carp* (78,57%) being euconstat (C4) encountered on hole main flow of the river, as constant (C3) species is *roach* (57,14%). In accesories species calsses (C2) we can find *grass carp* (28,57%), other species being casual and very rare.

The biggest value of ecological significance index checked in to *bleak* (23,83%), W5 class; *spined loach* (9,54%), *stone moroko* (5,80%) and *prussian carp* (5,48%) from W4 class – being characteristic for river ichtyocenosis. To W3 class square 4 species with values from 1,19% to 2,65% respectively and to W2 class corresponds 10 species with values between 0,145 and 0,96%. As accessories species for this ichtyocenosis have been identified *bitterling*, *grass carp* and *common carp*, other species belonging to accidental W1.

Some of species as *northern pike*, *belika* and *weatherfish* registered an effective decline, values of quantitative index being in continuous deduction. *Gudgeon,* a sensible species to pollution, is more frequently met in superior flow of the river.

Economically valuable fish species (*common carp, bitterling, bighead carp, grass carp*), are introduced in fish farms, from where they come into the river, but their presence in the river is temporary because of indistinctive habit to their ecological exigencies.

Have been calculated Shannon Winner diversity index (Hs) which allow ichtyocenosis diversity appreciation by his value which is a good indicator of affection state of aquatic ecosystems. It's informational value being 3,751±0,335. According to equitability (e), its small value of 0,144±0,012 demonstrates a well emphasized patchy of different species. According to Simpson index (Is) = 0,124±0,011, we remark ichtyocenosis domination by only some eurybionte species only.

By import of allogenic fish species economically valuable and fish material changing from aquatic ecosystems get in such species as *prussian carp - Carassius gibelio* (Bloch, 1782) and *stone moroko – Pseudorasbora parva* (Schlegel, 1842). Penetration of *prussian carp* and *stone moroko* in aquatic ecosystems of Republic of Moldova is an eloquent example of fish invasion with allogenic organisms, which have been had negative consequences to different levels of biotical organization.

Prussian carp is a euribionte species with a big adaptive potential, holding a dominant position, euconstant and characteristic in ichtyocenosis of Bac river. Frequency it is met in hole river flew even in strong polluted sectors near Chisinau city. As other interpreter of tertiary plain ichtyofaunisic complex support large fluctuations of concentration of water solved oxygen. Owing to ginogenetics form of reproduction it can assure a much share of species fertilization. Certainly is an invasive species which contribute direct or indirect to autochthon fish disappearance *crucian carp* (*Carassius carassius* (L., 1758)), which, not so long time ago, was tipical for small rivers ichtyocenosis of Republic of Moldova.

Stone moroko, species with short life cycle which is one of the most pondered in Bac river being characterized with some adaptive particularities (reproductive, trophics, etological e.t.). it succed to make very numerous populations which values of ichtyomass is significant in some sectors. (Bicovat chanels, Anenii-Noi). It is a dominant, euconstant, and characteristic species of Bac river ichtyocenosis belonging to Chinese plain ichtyofaunistic complex. Because of *stone moroko* is a species in continuous expansion and occupied an area increasingly larger we conclude that it is a phylogenetic young species, with large share in speciation process (Gavriloaie and Falca 2006). Quiet changing of autochthones species from position of dominante species via competition have created structural and functional modifications of ichtyocenosis. High capacity of development of strategy and flexibility in application of r and K strategies is a success factor which made it present in all types of aquatic ecosystems. In some fish farms from Bac river flew *stone moroko* developed in huge quantities and sublimated nutritional base of economically valuable fish species.

A quick and aggressive expansion in aquatic ecosystems of Bac river basin has *blask-striped pipefish,* from *Syngnathidae* family belonging to mediteranean ichtyofaunistic complex, perfect adjusted to salt habit change, becoming an important trophic concurrent with economically valuable species. In Ghidighici basin is considered as dominant species having a high meeting frequency.

For quick integration in new habit, an allochtone species have to have some characteristics to be in advantage unlike other species (reproductive characters, characters about population structure, e.t.). According to adaptive characteristics have been calculated "competitive ability index", so it was possible to estimate the impact of native and invasive polydominant species from Bac river in quantification form: *stone moroko (9,3), spined loach (9,1), prussian carp (8,9)and bitterling (8,0).*

A reason for why small rivers become very sensible to invasive species penetration is that ecosystems have been strong disturbed by eutrophication phenomenon. In this conditions limnophilous, invasive and allogenic species are in advantage.

URBAN HABITATS OF MALACOFAUNA IN CHIŞINĂU

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Studies in the past half century have shown that in cities can live a considerable number of gastropods, as representatives of synanthropic fauna indigenous and invasive species.

Anthropogenic habitat modification in combination with anthropochore with a high degree of urbanization can lead to the creation of molluscan fauna that not have analogies in natural ecosystems and certainly deserves to be studied. According to these studies revealed about the processes and patterns of urbanization: anthropogenic migration of living organisms, features of invasion in urban biotopes, methods and results of human impact on various vital processes of living organisms.

Special investigations of urban malacofauna began relatively recently.

Materials and methods

Basic material for this work served observations, research carried out during 2005-2010. Different habitats were studied in Chisinau city. Special attention was paid to industrial areas, parks, cemeteries, artificial water basins.

Collection and preservation were performed according to specific methods. Species determination was made after the literature: Grossu [1], Grossu [2], and Старобогатов [4].

Results and discussion

Vegetation in Chisinau

In this paper, urban habitats studied are taken into industrial areas, parks, cemeteries, artificial water basins. The study of malacofauna identifies a complex of terrestrial species we encountered in most studied landscapes, they forming the core of urban malacofauna.

It includes 10 species:

1) Vallonia costata (Muller, 1774);
2) V. pulchella (Muller, 1774);
3) Chondrula tridens (Muller, 1774);
4) Deroceras reticulatum (Muller, 1774)
5) Arion (Mesarion) subfuscus (Draparnaud, 1805;)
6) Xeropicta. derbentina (Krynicki, 1833);
7) Helicella obvia (Menke, 1828)
8) M. carthusiana (Muller, 1774);
9) Cepaea vindobonensis (Ferussac, 1821);
10) Helix pomatia (Linnaeus, 1758).

The described complex is commonly for parks, cemeteries. Some urban landscape is characterized by a number of species mixorare of this complex. Thus, for industrial zones are special features: Xeropicta derbentina (Krynicka, 1833), Helicella obvia (Menke, 1828), Cepaea vindobonensis (Ferussac, 1821), Helix pomatia (Linnaeus, 1758).

In the formation of urban malacofauna we observe two processes related to urbanization. The formation process of the city as an inter-regional transport knot has conditioned, the conditions of presence for the urban fauna of invasive species. The formation of the city as a geographical complex, with special climatic conditions determines the formation of a group of organisms not because of common origin but the similarity of ecological niches.

The malacofauna of artificial basins had been formed mainly by anthropochora or zoochora. For water basins in the studied area are characteristic the following species: Lymnaea stagnalis (Linnaeus, 1758), Radix labia (Rossmässler, 1835), Viviparus viviparus (Linnaeus, 1758), Anodonta cygne (Linne, 1758). In the aquatic tanks subjected to less human activity are the present species: *Bithynia tentaculata* (Linnæus, 1758), *Esperiana (Fagotia) esperi* (Férussac, 1823), *Physa acuta* (Draparnaud, 1805), *Anisus vortex* (Linnaeus, 1758), *Stagnicola palustris* (O.F.Muller, 1774).

The study of molluscan fauna in different types of water bodies shows that there is a correlation between natural and artificial landscapes. For some water bodies there is an accidental malacofauna training.

References:

1. Grossu A., *Fauna Republicii Populare Române*. Mollusca vol.3, fas.3 Bivalvia. Acad. RPR, Bucureşti, 1962, pag.42.

2. Grossu A., *Gastropoda Romaniae*, vol.1. Caractere generale, istoricul şi biologia gastropodelor; clas Prosobranchia şi Opisthobranchia, Ed. Litera, Bucureşti, 1986.

3. Гонтя Т, *Малакофауна водоемов басеина Днестра*, Автореферат, Кишинев,1985.

4. Старобогатов Я, *Класс Брюхоногие и двухстворчатые молюски*. Определитель пресноводных беспозночных Европеиской части СССР, 1987, 177с.

THE POSSIBILITIES OF ADAPTATION THE FISH POPULATIONS OF THE MIDDLE AND LOWER SECTORS OF DNIESTER RIVER CURRENT ECOLOGICAL CONDITIONS

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Aim of our research was the revelation of the complex action reflect external factors on structural-functional changes in existing fish populations in the middle and lower sectors of Dniester River. Analysis of the data obtained have enabled the distribution of fish populations in the medial and inferior sectors of Dniester River into four groups distinguished between them.

Group I - Normal state of populations - Pike, Roach, Dace, Perch (medial sector of Dniester River); Gibel Carp, Rudd, Roach, Perch, Pike (lower sector of Dniester River).

Populations of Pike (medial sector), of Rudd, Pike and Perch (lower sector) were shown six age groups (0 + 5 +). After the numeric value, according to the rules, they are prominent in young age groups (for a summer 33.8 – 35.5% and two years 25 – 28,0%). A significant share constituent and reproductive age groups of the population (36-38.1%). In terms of ecological current has a heightened pace Pike growth grave-dimensional, the highest in the ihtiocenzis and reaching sexual maturity, early (1-3 years) compared to other species. The population of Pike priorities ensures enhanced interspecifical competition. A similar population structure have been reported to the Perch and Rudd, but unlike Pike, reach sexual maturity at the age of 4 years with a reduced pace of growth grave-dimensional. The numeric value of the relative populations of juvenile Gibel Carp, Dace and Roach, unlike Perch and Rudd, is less than the best.

Group II - Small disturbances in the structure of populations - Gibel Carp, Rudd, Asp, Carp (medial sector of Dniester River); Bream, Carp (lower sector of Dniester River).

It has been reported a decrease in the intensity of the trivial representation of younger age groups. For example, in the medial sector, the numerical value of a relative of juvenile summer of the Gibel Carp was only 7.5% of the entire population, at the Rudd – 8%, at Asp -12,5% and at Carp - 14%. It should be mentioned that the populations of Gibel Carp, Rudd and Asp are present with five age groups compared with the Carp produced a reduction in the number of groups, which demonstrates decreasing reproductive potential of the population.

In the lower sector, population of Bream is present with eight age groups, but the numeric value of juvenile relative a summer was only 5.1% and two years – 7.7% of the entire population, which demonstrates decreasing the potential for reproduction of this species. A similar population structure may be flagged to Carp, but unlike the Bream - the numeric value of the relative population of juvenile Carp is smaller and the numerical value of this species is reduced.

Group III - Disorder in the structure of the populations - Bream, Vimba, White-eye bream, European chub (medial sector of Dniester River); White-eye bream, Zander, Nose carp, Asp (lower sector of Dniester River).

In this group has been reported a considerable reduction of the intensity of the younger age groups. For example, the population of European chub (medial sector) the numerical value of a relative of juvenile summer and two years accounted for 0% and 15%, to the Vimba - 0% and 11%, and to the White-eye bream – 0% and 3%.

In the population of White-eye bream (lower sector) have been noted only the unit exemplars of juvenile a summer (0.3%) and two years (3.2%). The Zander have not been identified for a summer stock and in populations of Nose carp and Asp was not their present one summer and two years. It was revealed 5 age

groups (0 + up to 4 +) for White-eye bream and 4 age groups (1 + up to 4 +) for Zander. The Asp and Nose carp were reported as 4 age groups but with a range (from 2 + to 5 +).

Sexual maturity is reached at this group at the age of four to five years at a lower rate of gravidimensional growth.

Group IY - Structural degradation of populations - Nose carp, Barbel, Zingel, Zander (medial sector of Dniester River); Dace, European chub, Vimba (lower sector of Dniester River).

Populations of the species mentioned are distinguished by the lack of young age groups and a small number of groups with their reproductive age. For example, the population of the Zander (medial sector) have been demarcated by the 4 age groups (2 + up to 5 +) and in those of Nose carp, Barbel and Zingel – only three major age groups from 4- to 6 years.

Small populations of Dace, European chub and Vimba in the lower sector of Dniester River were highlighted only 3 age groups: from Dace - 3 +, 4 +, 5 +; to European chub – 4 +, 5 +, 6 + and Vimba - 2 +, 3 +, 4 +.

Conclusions.

1. Analysis of the data obtained have enabled the distribution of fish populations in the medial and lower sectors of Dniester River into four groups distinguished from each other: **Group I (**Normal state of populations) - Pike, Roach, Dace, Perch (medial sector of Dniester River), Gibel carp, Rudd, Roach, Perch, Pike (lower sector of Dniester River); **Group II (**Small disturbances in the structure of populations) - Gibel carp, Rudd, Asp, Carp (medial sector of Dniester River), Bream, Carp (lower sector of Dniester River); **Group III** (Disorder in the structure of the populations) - Bream, Vimba, White-eye bream, European chub (medial sector of Dniester River), White-eye bream, Zander, Nose carp, Asp (lower sector of Dniester River); **Group IY** (Structural degradation of populations) - Nose carp, Barbel, Zingel, Zander (medial sector of Dniester River), Dace, European chub, Vimba (lower sector of Dniester River).
2. The investigations carried out in Dniester River (medial and lower sectors) have shown that the present conditions of reproduction, growth and nutrition are extremely unfavorable for lyto- and psammofile fish species (the invasion with algaes and macrophytes, the low level of water, siltation of breeding grounds, washing sand, sudden fluctuations in the water level, etc.). While intensified competition with phytofile fish species that currently occupies breeding grounds and places of fattening.
3. In general, for all the valuable species of fish have been reported a number of unfavorable factors such as changes in thermal regime, the fall in water level and considerable variations of it, reducing the nutritional base (phyto-, zooplankton, bentos), overgrowth of impaired of fish that is devouring the eggs and youngs of valuable fish populations and species that have become active concurents with these competitors in nutrition.

ASSESSMENT OF POLUATION OF RIVER BÎC

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There is no country currently that doesn't face problems with drinkable water resources . Moreover, about 20 percent of the world's population has no access to quality drinkable water, and around 50% are deprived of proper sanitary conditions related to water use.

The main sources of pollution of surface water and groundwater in the Republic of Moldova are dumps near water basins, near wells, the liquid fraction of diverse origin, economic sources of pollution, seepage, pollutants entering the groundwater directive, that contain harmful and toxic substances such as harmful and nitrites, ammonium salts, pathogenic bacteria, which then enters the aquatic ecosystems and human body.

Currently, intense human activity brings a negative impact on water quality and aquatic ecosystems.

Every year there is a growing amount of physical and chemical agents, who possess a harmful action and influences directly or indirectly the genetic apparatus of all organisms.

Given the high degree of environmental pollution in Moldova, the problem of river pollution assessment Bic is one of the major research objectives, becouse r. Bac crossess the capital of Moldova.

Being right tributary of the Dniester River, the river Bac flows in south-western village Temeleuți direction of flow to the southeast. Rivers length is 155 km, water catchment area 2040 km2, 181m spring rate, mouth spring - 6.0 m, fall river - 175 m, average slope - 1.13%, maximum, on the first 6 km - 6, 6%.

Following investigations staff and use of data courteous provided by the State Hydrometeorological Service of Moldova for the period 2008-2010 and the Ministry of Environment we can demonstrate that

the river Bac pollution is a process that runs for several years, steady process, with gradual increasing of pollution content. Water river at the entrance in Chisinau is already polluted, and it pollutes more intensive in the city. The main indices of pollution - COD, BOD5, NH4 + both at the point of discharge from lake Ghidighici, and in the last sampling point, the bridge "Singer-Floreni" annual average concentrations exceed the permissible norm. But if the entry in the Chisinau overruns are the order of the units (CCO - 2.0 times, BOD5 - 2 - 3.9 times, NH4 + - 1.4 times), leaving the city they are in the tens (CCO - 7.0 - 8.2 times, BOD5 - 19.9 to 21.2 times, NH4 + - 47.8 to 55.4 times).

In 2008 the following data of solvit oxygen in water were recorded 7.4, 0.10 oil products, phenols 0.001; ions amomiu - 2.37, phosphorus - 0.47; nitrite - 0.158; upstream of Chisinau. Chisinau and downstream of oxygen in water 1.7, 0.27 oil, phenols 0.001; ions amomiu - 23.4, phosphorus - 2.12; nitrite - 0.062.

In 2009 an improvement of the data were recorded the oxygen in water being of 8.20, upstream and downstream of the Chisinau - 2.38; oil - 0.07 upstream and downstream of Chisinau 0.19; ions ammonia - 1.17 22.70 upstream and downstream, phosphorus - 0.36 in upstream and downstream 0.30.

In 2010 there was an improvement of water quality in r. Bac oxygen in water 9.49, oil 0,05- 0.45 ammonium ion, nitrite 0.048, nitrate 2.70, phosphorus 0.36.

The content of nutrients in the river Bic in recent years tend to increase towards the source to the confluence with fl. River, especially in downstream city. Practically permanent r. Bîc waters are found oil content which increases the downstream section. Their concentration exceeds 25-35 times the CMA, and the periods of average annual index is 0,14 to 0,21 upstream of town and 0.20 to 0.35 mg/dm3 downstream of town, which is in excess of 3-6 CMA.

In most cases r. Bac waters contain amounts of nitrite concentrations higher than permissible limit set for waters intended for fishing.

Seasonal dynamics of mineral phosphorus is not so obvious and varies from 0.005 mg / L to 0.002 mg / l, on the contrary, in recent years the highest concentrations were recorded in summer (2.5 mg / l), the flow water was lowest, and the processes of photosynthesis is increased. This phenomenon is caused by wastewater discharges and especially of unauthorized leaks from car washes located directly on the river, which are key players in the river pollution with phosphorus mineral and organic range at Chisinau. Mineral phosphorus concentrations in water vary within Bic r. 0.09 to 0.36 mg / l and depend largely on river pollution with sewage and runoff from urban lands.

Sources of pollution of groundwater are related, in fact, to the household activity of population. Factors that pollute wells and springs can be agricultural land, farms, households, places of storage of chemicals and fertilizers, small, dumps.

Following the survey we think it would be better to identify sources of serious pollution with sodium, phosphorus, phenols, petroleum, copper, zinc, ammonium ions. To exclude the negative impact of polluted water on human health and ecosystems in general it is not enough just its thorough treatment, but the most effective way remains to protect water resources and sources of pollution exclusion.

ИСТОРИЯ ИЗУЧЕНИЯ ДОННОЙ ФАУНЫ КУЧУРГАНСКОГО ВОДОХРАНИЛИЩА

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Специальных работ по изучению донной фауны Кучурганского водохранилища (в прошлом - лимана) до ввода в эксплуатацию Молдавской ГРЭС не было. Отдельные сведения об этой экологической группе беспозвоночных лимана встречаются в работах М.Ф. Ярошенко (1950, 1957), Ю.М. Марковского (1953) и Ф.Д. Мордухай-Болтовского (I960).

С момента основания Института зоологии АН Молдовы в 1961 г. роль института, а именно его гидробиологической школы, основанной академиком М.Ф. Ярошенко, в комплексном исследовании гидрофауны Кучурганского водохранилища является основополагающей. Фундаментальные основы исследований, заложенные академиком М.Ф. Ярошенко, нашли свое дальнейшее развитие под руководством таких далеко известных за пределами Молдовы гидробиологов, как д.б.н. Ф.П. Чорика в 1991-1992 гг., а с 1992 г. и по настоящее время - академика И.К. Тодераша, который продолжил развитие молдавской гидробиологической школы, подготовив более 20 кандидатов и 5 докторов биологических наук.

Изучение донной фауны Кучурганского водохранилища до ввода в эксплуатацию Молдавской ГРЭС.

И.И. Дедю и В.Х. Чокырлан (1965) было установлено, что до ввода в эксплуатацию Молдавской ГРЭС донная фауна Кучурганского лимана была довольно богата и разнообразна и была представлена 110 бентосными и нектобентосными формами, в том числе: *Nematoda* - 1, *Polychaeta* - 2, *Oligochaeta* - 55, *Hirudinea* - 4, *Mollusca* - 25, *Mysidacea* - 3, *Cumacea* –3, *Amphipoda* - 14, *Decapoda* - 1, *Odonata* - 5, *Ephemeroptera* - 1, *Plecoptera* - 1, *Coleoptera* - 2, *Diptera* – 17 (*Chironomidae* – 16). Фактическое число таксонов донной фауны на тот период было несколько больше. М.З. Владимиров и И.К. Тодераш (1988) отмечали, что фауна зообентоса Кучурганского водохранилища насчитывала 167 видов.

Наиболее массовые виды придонных беспозвоночных лимана принимали участие в образовании отдельных экологических комплексов (ценозов). По данным Ю.М. Марковского (1953), И.И. Дедю и В.Х. Чокырлан (1965) до ввода в эксплуатацию Молдавской ГРЭС в лимане преобладали 3 ценоза мизид; бентосное население лимана, также принимало участие в образовании 3 ценозов: 1) *D. polymorpha* + *Hypanis pontica*, 2) *Micromelania lincta* + *D. polymorpha* и 3) *Oligochaeta* + *Chironomidae*.

В работах этого периода исследований помимо видового состава приводятся также сведения о количественном развитии зообентоса водоема.

Изучение донной фауны Кучурганского водохранилища после ввода в эксплуатацию Молдавской ГРЭС.

После ввода в эксплуатацию в 1964 г. Молдавской ГРЭС учеными гидробиологами Института зоологии АНМ начаты комплексные исследования гидрофауны Кучурганского водохранилища, в том числе и зообентоса, которые продолжаются и по сей день. К началу 80-х гг. XX столетия исследования донной фауны проводились под руководством академика М.Ф. Ярошенко. В результате проведенных исследований к этому времени в водохранилище-охладителе было обнаружено 190 таксонов гидробионтов, объединенных 24 систематическими группами, среди которых преобладали виды олигохет, хирономид, моллюсков и понто-каспийских ракообразных реликтов (Ярошенко, 1973). Малакофауну водохранилища исследовали М.Ф. Ярошенко и Ф.А. Гонтя (1970; Гонтя, 1985), которые отмечали 16 видов легочных моллюсков, а также таких литореофилов, как *Theodoxus fluviatilis*, *Th. danubialis*, *Viviparus viviparus*, *Fagotia acicularis*.

Специфической особенностью донной и придонной фауны Кучурганского водохранилища является наличие в ней значительного количества понто-каспийских видов. Особенности развития каспийской фауны лимана до превращения его в водохранилище-охладитель нашли свое отражение в работах И.И. Дедю и В.Х. Чокырлан (1965), М.Ф. Ярошенко и И.И. Дедю (1962), М.Ф. Ярошенко (1973), которые отмечали, что видовое разнообразие понто-каспийцев составляло 26 % от всего видового разнообразия донной фауны. В разные периоды становления водоема в Кучурганском водохранилище И.И. Дедю (1984) отмечал обитание 15 понто-каспийских видов амфипод.

Впоследствии особенности развития каспийских видов зообентоса Кучурганского водохранилища были отражены в работе М.З. Владимирова (1986), где он, в частности, отметил, что из около 158 видов донных гидробионтов 24 вида (или 15,2 %) представляли каспийскую фауну. Особое внимание уделялось такому важному компоненту зообентоса, как дрейссене. М.З. Владимиров и И.К. Тодераш (1985) установили ее продукцию в Кучурганском водохранилище и эффективность ее утилизации рыбами.

Функциональную роль понто-каспийцев в биогенной миграции микроэлементов исследовали И.К. Тодераш и Е.И. Зубкова (1986). Вопросы накопления и миграции микроэлементов в биоте Кучурганского водохранилища Е.И. Зубкова продолжает изучать и в настоящее время, активно привлекая к этому молодых ученых и формируя свою научную школу.

В период максимальной тепловой нагрузки на водохранилище (1981-1984 гг.) комплексные исследования зообентоса осуществляли М.З. Владимиров и И.К. Тодераш, которые легли в основу фундаментальной монографии «Биопродукционные процессы в водохранилищах-охладителях ТЭС» (1988). Ими было установлено, что в результате термофикации произошло изменение структуры сообществ зообентоса, видовое разнообразие донных сообществ Кучурганского водохранилища сократилось почти на 70 видов.

В тоже время учеными лаборатории гидробиологии Института зоологии АН М на данном этапе развития гидробиологического режима и биоты водохранилища было зарегистрировано 25 ранее не отмеченных видов, в основном из хирономид и моллюсков. В итоге к этому времени фауна зообентоса насчитывала около 168 таксонов.

В 1984 г. вышла в свет монография И.К. Тодераша «Функциональное значение хирономид в экосистемах водоемов Молдавии», в которой значительное внимание уделяется фауне хирономид Кучурганского водохранилища, их биологии и продукции, а также их месту в биотическом балансе зообентоса.

Начиная с 1997 г. исследование донной фауны Кучурганского водохранилища и реакций зообентоса на изменение условий среды обитания под руководством академика И.К. Тодераша начал С.И. Филипенко, опубликовавший по зообентосу водохранилища более 25 статей, в том числе 1 монографию («Зообентос Кучурганского водохранилища: динамические процессы и использование в биологическом мониторинге», 2005).

Перспективы исследований зообентоса Кучурганского водохранилища видятся в дальнейшем изучении влияния электростанции на биоту водоема-охладителя и ее адаптационный потенциал при различных уровнях антропогенного воздействия, а также функциональной роли донной фауны, в том числе и в биогенной миграции веществ.

Отдельно поднятая проблема видов-вселенцев в водоемах Молдовы, в том числе актуальна и для Кучурганского водохранилища (Филипенко, Лейдерман, Филипенко Е.Н., 2009; Мунжиу, 2010).

Одним из приоритетных направлений гидробиологических исследований остаются биоиндикационные исследования и оценка экологического состояния Кучурганского водохранилища по зообентосу.

Литература

1. Владимиров М.З. Влияние термофикации водоемов-охладителей ТЭС на количественное развитие теплолюбивых каспийских видов зообентоса // Современное состояние экосистем рек и водохранилищ бассейна Днестра. – Кишинев: Штиинца, 1986. – С. 60-67.
2. Владимиров М.З., Тодераш И.К. Продукция дрейссены Кучурганского водохранилища-охладителя Молдавской ГРЭС и эффективность ее утилизации рыбами // Рыбохозяйственные исследования прудов и естественных водоемов Молдавии. – Кишинев, 1985. – С. 74-82.
3. Владимиров М.З., Тодераш И.К. Качественный состав и количественное развитие макрозообентоса // Биопродукционные процессы в водохранилищах-охладителях ТЭС. - Кишинев: Штиинца, 1988. – С. 130 – 138.
4. Гонтя Ф.А. Малакофауна водоемов бассейна Днестра.: Автореф. дис. … канд. биол. наук. – Кишинев, 1985. – 22 с.
5. Дедю И.И., Чокырлан В.Х. Донная фауна Кучурганского лимана до вступления в эксплуатацию Молдавской ГРЭС // Материалы зоологического совещания по проблеме "Биологические основы реконструкции, рационального использования и охраны фауны южной зоны европейской части СССР".- Кишинев, 1965. - С. 447 – 480.
6. Дедю И.И. Отряд Разноногие ракообразные, или бокоплавы // Мшанки, моллюски, членистоногие (Из серии «Животный мир Молдавии»).- Кишинев: Штиинца, 1984.- С. 161 – 184.
7. Марковский Ю.М. Фауна беспозвоночных низовьев рек Украины. Условия ее существования и пути использования // Водоемы дельты Днестра и Днестровский лиман. – Киев, 1953. – Ч. I. – С. 25.
8. Мордухай-Болтовской Ф.Д. Каспийская фауна в Азово-Черноморском бассейне. - М.-Л., 1960.- 286 с.
9. Мунжиу О.В. Биологические инвазии в бассейне Днестра и других водоемах Молдовы // Бассейн реки Днестр: экологические проблемы и управление трансграничными природными ресурсами. Материалы Междун. научно-практ. конф. - Тирасполь: Издательство ПГУ, 2010. – С. 145-148.
10. Тодераш И.К. Функциональное значение хирономид в экосистемах водоемов Молдавии. - Кишинев: Штиинца, 1984.- 172 с.
11. Тодераш И.К., Зубкова Е.И. Роль популяций Dreissena polymorpha pallas в биогенной миграции микроэлементов в экосистемах Нижнего Днестра и Кучурганского водохранилища // Современное состояние экосистем рек и водохранилищ бассейна Днестра. – Кишинев: Штиинца, 1986. – С. 138-144.
12. Филипенко С.И. Зообентос Кучурганского водохранилища: динамические процессы и использование в биологическом мониторинге. – Тирасполь: Изд-во Приднестр. ун-та, 2005. – 160 с.
13. Филипенко С.И., Лейдерман А.И., Филипенко Е.Н. Проблема антропогенного вселения чужеродных организмов в водные экосистемы бассейна Днестра // Вестник Приднестровского университета. - № 2 (34), 2009. - С. 137-142.
14. Ярошенко М.Ф. Рыбохозяйственное значение пойменных водоемов Днестра и мероприятия по их улучшению // Научные записки. – т. III.- Кишинев, 1950.- С. 93 – 110.
15. Ярошенко М.Ф. Гидрофауна Днестра. - М.: Наука, 1957.- 169 с.
16. Ярошенко М.Ф. Донная фауна лимана-охладителя // Кучурганский лиман-охладитель Молдавской ГРЭС. - Кишинев: Штиинца, 1973.- С. 101 – 115.
17. Ярошенко М.Ф., Дедю И.И. Роль Понто-Каспия в формировании донной фауны бассейна реки Днестр // Биологические ресурсы водоемов Молдавии. – Кишинев: Штиинца, 1962. – С. 3-20.
18. Ярошенко М.Ф., Набережный А.И. К биологии Dreissena polymorpha Pallas в Кучурганском лимане-охладителе МГРЭС // Биологические ресурсы водоемов Молдавии. – Кишинев: Штиинца, 1971. – Вып. 8. – С. 31-41.
19. Ярошенко М.Ф., Гонтя Ф.А. Моллюски водоемов низовья Днестра // Биологические ресурсы водоемов Молдавии. - Кишинев, 1970.- Вып. 7.- С. 65 – 73.

CHARACERISTICS OF REPRODUCTIVE SYSTEM OF *ABRAMIS BRAMA* SEXUALLY MATURE FEMALES IN VARIOUS TYPES OF COSTESTI-STANCA RESERVOIR

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KEYWORDS: oogenesis, oocyte, gonads, resorption, *Abramis brama,* vitellogenesis, vacuolization.

INTRODUCTION

Bream is a widespread species in the rivers, aquatic reservoirs and ponds of Moldova. In Dniester River, before the regulation of its flow, the bream population was divided into resident and semi-anadromous forms. Currently, as a result of hydraulic engineering, several local intrapopulation groups, fairly isolated from each other were formed, which differ after their growth rate, linear sizes, number of age groups, terms of spawning and character of gametogenesis phases occurrence (Chepurnova, 1991). In the reconstructed water reservoirs of Moldova the bream showed high ecological plasticity and a wide range of structural and functional adaptation toward changing environmental conditions (Bodareu et al, 1986; Shatunovskii, 2009).

Research features of development of the reproductive system in representatives of cyprinid fishes in Ichthyologic literature were always in scientists' attention. However, the analysis of the development of sexual cells in the bream in the changed conditions of their habitats is relatively poor studied (Koshelev, 1984; Statova, 1985; Chepurnova, 1991).

The peculiarities of oocyte development in bream from different water bodies is reflected in changes in the duration of the maturity stages during pre-vitellogenesis that affect the age of sexual maturity of fish, and during the reproductive cycle the duration of oocytes passage of vitellogenesis process affects the length of IV-th stage of gonad maturity. Furthermore, in different water basins in the gonads of bream females develop different number of fish roe portions. As evidenced by our study (Fulgha, Usatyi, 2008), the bream in Prut river and Dubasari reservoir is at a time spawning fish, whereas in Kuchurgan and Costesti-Stanca reservoirs live females with at a time spawning, as well as with portions spawning.

In the present work the morphological and functional characteristics of the reproductive system of bream females from the Prut River basins are given.

Costesti-Stanca Reservoir. In this reservoir there inhabit one-time, as well as portion spawning females. After spawning, the gonads of one-time spawning fish pass in the II stage of maturity, which continues until the second half of July, and the oocytes of new generation during this period are in different phases of protoplasmic growth.

The subsequent development of oocytes in the initial phases of massive growth period occurs simultaneously.

Vacuolization of cytoplasm in sexual cells begins in the second half of July and the gonads pass into stage III of maturity. In the third decade of August in the oocytes the process of vitellogenesis starts. The accumulation of yolk granules in oocytes occurs during the whole autumn period, before the onset of frost. The females overwinter with gonads at IVth unfinished maturity stage.

In females, preparing to spawn two egg portions the asynchronous development of sexual cells throughout the whole reproductive cycle is recorded. After the first spawning the ovary contains oocytes of the phase of completed vacuolization D_3 and early vitellogenesis D_4. This composition of germ cells corresponds to III-IV stage of maturity of the gonads. The process of histological studies revealed that the ovulation of the second egg generation does not occur. The reason is the unfavourable environmental conditions for the maturation and spawning of oocytes that completed the accumulation of trophic substances in the cytoplasm, which leads to their total resorption.

In the month of August in the portions spawning fishes, the vacuolization of cytoplasm in oocytes of new generation, proceeds in parallel with the resorption of not spawned yolk oocytes of second generation of the current year. The subsequent development of germ cells that are preparing for ovulation in the next spawning season is asynchronous in all the phases of tropho-plasmatic growth. In the gonads two generations of eggs are forming, the eldest of whom in the autumn is in a phase of intense vitellogenesis, while more young cells - in the phases of cytoplasm vacuolization and beginning of yolk granules accumulation.

Thus, in females with asynchronous development of oocytes to the beginning of spawning two generations of eggs are ready, but during the spawning season only one portion of eggs are spawned. The second generation of oocytes that had completed the accumulation of yolk undergoes resorption.

DATA UPON THE EVOLUTION OF A CRUSTACEOUS PARASITOSIS AT *CARASSIUS AURATUS AURATUS* (VARIETY VAILTAIL GOLDFISH)

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Introduction. The diseases caused to fish by parasite crustaceans are generically called crustaceous parasitosis. Lerneosis is such a parasitosis, taxonomically belonging to *phylum Arthropoda*, subphylum Crustacea, class Maxillopoda, order Cyclopodia, family Lernaeidae, genus Lernaea. It generally affects Cyprinids, as well as other species living in artificial basins, in the present case *Carassius auratus auratus* (variety vailtail goldfish). The parasitosis appeared at goldfish shortly after the introduction of the sampled specimens of *Carassius gibelio* and water in the artificial basin.

The disease is provoked by the females of the crustacean *Lernaea cyprinacea* L., 1758, which affects the tegument at the base of the scales of the pectoral, ventral and caudal fins (Figs. 1, 2). It is characterized by an elongated, cylindrical body with two pairs of chitinous anchor-like excrescences developed at the anterior extremity, by means of which they fix on the fish tegument. The male lives a free non-parasitic life.

Figure 1. Crustacean *Lernaea cyprinacea* fixed on the tegument of *Carassius auratus auratus* (original).
Figure 2. Lesions on the tegument of the fish infested with *Lernaea cyprinacea* (original).

Material and methods. In July 2010, we made some field research in the area of the small reservoirs built through the damming of the Preajba River (Cioboiu, 1999; Cioboiu & Brezeanu, 2002); the reservoirs are situated in the lower basin of the Jiu River and the ichthyologic material was sampled from these water bodies. In 2009, in the same basin, we identified parasitosis at two species belonging to the families Cyprinidae and Percidae (Goga, 2009, 2009a).

The identification of the ecotoparasite was achieved on the base of the general methods of ichthyoparasitological diagnosis, macroscopically by means of clinical examination and microscopically by means of tegumentary curettage from the tegument and fins, as well as through successive washing of the gills and tegument and visualisation at the optic microscope (lens 20x10X) and stereomicroscope (lens 2 and 4) in the parasitology laboratory of Dolj Sanitary Veterinary Directorate. After the examination of the tegument and gills, there were sampled the parasites with a clip and dissociation needles. The crustaceans were placed on a mount in a drop of water and then examined at a stereomicroscopic and optic microscope; at the same time, there were taken pictures. The description of the disease makes reference to its etiology and pathology, as well as to the prophylaxis and treatment measures stipulated in the literature in the field (Bogatu & Munteanu, 2008; Oţel & Constantin, 1989).

Results and discussion. The parasitation of the goldfish by *Lernaea cyprinacea* was emphasized at the optic microscope using the lenses 20x 10X. The body of the female is vermiform, long of 12.5 – 16.5 mm, and, in the region of the cephalothorax, it presents a segment with two pairs of excrescences that form the apparatus females use to fix on the body of the hosts. The excrescences are symmetrical, thin, almost cylindrical, the dorsal ones being branched, in the shape of T letter, while the ventral ones are shorter. At

the posterior part of the body, there appear two cylindrical and elongated egg sacs that reach 1/3 of the total length of the body.

The male has a cyclopean shape and a length of about 1.1mm. The development cycle is characterized by three nauplius stages and five copepodit stages, each of these stages being preceded by moulting. *Lernaea cyprinacea* is considered a warm water crustacean. The development of naupliuses takes three days at a water temperature of 23-30^{0}C. After 72 hours, they transform into copepodits, penetrate in the gill cavity of fish specimens, transform into cyclopoids and then sexual differentiation occurs.

Females start a parasite life deeply penetrating the tegument of the host with the fixation organ. The parasite sources are infested fish, as well as the water where the parasite lives in different larval stages. In the areas where they fix on the host body, the crustaceans provoke damages of the scales, haemorrhage, superficial or deep ulcerations, tissue damages.

The diagnosis is set on the basis of clinical visual observations of the crustaceans fixed on the tegument, as well as through visualisation of the curettage samples from lesions at the optic microscope.

The disease is hard to fight against in large basins; the prophylaxis measures recommended by the literature in the field are: compulsory quarantine of the populating material or preventive washing in an antiparasite solution, ensuring an optimum density of population, parasitological examination of fish specimens at shorter time intervals, exclusion of the infested fish from the aquaculture and from the water supplying the basins, periodical voiding of the basins and their disinfection with quick lime.

Conclusions:

- The appearance of the disease is due to the introduction of the sampled fish, which carried the pathogen agent, in the basin, as well as of the water sample they were brought in.
- *Lernaea cyprinacea* identified at the goldfish affect the tegument located at the base of the scales from the pectoral, ventral and caudal fins.
- The limited space favoured contact between species and increased contamination risk.
- It is important to avoid purchasing or collecting infested fish and to limit the contact between fish sampled from natural water bodies and fish breed in artificial facilities.

REFERENCES

Bănărescu P. 1964. *Fauna R:P:R. Pisces, Osteichthyes*. Edit. Academiei R.P.R. Bucureşti: 292-670.

Cioboiu Olivia. 1999. *Lacurile mici de baraj din Câmpia Olteniei-particularități ecologice*. Museum-revistă de cultură a Muzeului Olteniei. Craiova: 1-16.

Cioboiu Olivia, Brezeanu Gh. 2002. *Particularitățile hidrobiologice ale unor lacuri mici de baraj eutrofe din bazinul hidrografic al Jiului*. Conferința Internațională IAD. Tulcea. România : 275-287.

Goga Ionelia Claudia. 2009. *Boli parazitare semnalate la peştii dulcicoli din bazinul hidrografic Valea Preajba*. Diversitatea, valorificarea rațională şi protecția lumii animale" Chişinău. Edit . Ştiința. Moldova: 256-260.

Goga Ionelia Claudia. 2009a. *Basic data on the piscicultural comunites from the hydrographic basin Preajba Valley Conferința Internațională*. Oltenia . Studii şi Comunicări – Ştiințele Naturii. Craiova. **25**: 165 – 169.

Munteanu Gabriela, Bogatu D. 2008. *Tratat de ihtiopatologie*. Edit. Excelsior Art, Timisoara: 242 - 272 .

Oțel V. , Constantin Gh. 1989. *Ghid ihtiopatologic pentru piscicultura din Delta Dunării*. Edit. Bucureştii Noi. Bucureşti: 115 – 135.

THE INFLUENCE OF THERMAL POWER STATION ON THE ZOOPLANKTON COMMUNITIES IN THE COOLING-RESERVOIR CUCIURGAN

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Cuciurgan lake is valey water ecosistem on Dniester River. In 1964 lake has been transformed in accumulation refrigirating lake of Moldovan Thermal Power Station (MTPS), with aquatory of 2730 ha and volum of water 88 mln m3, 14-20 km long, and 3 km in width. Basin aquatory in natural mode consists of 3 sectores – superior, medium, inferior, which, in case of permanent water level, have surfaces 580, 800 and 1350 ha, respectively.

Materials were treated by the unic methods for collecting and treatment of hydrobiologic samples (Guide to Techniques Hydrobiological analysis of surface water and sediments, 1983).

Samples have been collected by the filtration of 100 liters of water through the zooplankton network type Apshtein, nr. 68. We fixed materials with 4% formol solution. Zooplankton species were identifide microscopic, by using the determinators and other materials (Kutikova L.A., 1970, Naberejnii A.I.,1984, Kuticova L.A., Starobogatov Ia.I.,1977). Organisms have been counted in Bogorov cell, numerical value (N) was determined in thousands of organisms in 1 m^3. Biomasses (B, mg/m^3) have been calculated according to organisms weight.

The studying of Cuciurgan reservoir showed the influence of thermic pressure of MTPS on hydrobiological and hydrochimical regimes and presents special interest as medium for biological processes development and regularities including taxonomic diversity and quantitative parameters of hydrobionts. Evacuation of heating waters in accumulating lake provoked modificating of hydrologic regime, especially thermic. This lake is the most heated. During the functioning on maximum regime (1981-1987), the water temperature increased the admisible values on 2-3 times. (Naberejnii A.I, Isaulenco V.A., 1988).

In development of the zooplankton in cooling-reservoir Cuciurgan have been determined some periods which depend on thermal pressure fluent on their reservoir. The first investigate of the zooplankton reservoir Cuciurgan had been done by Iu.Markovskii (Markovskii Iu.M.1953). It was followed by the more detailed research. Investigations have been continued by biodiversity composition, quantitative structure of hydrobionts communities, and capacity of reproducing and biotic echilibrum concomitant increasing of MTPS power from 200 thousand kW/hour in 1964 up to 2500 thousand kW/hour in 1982 (Naberejnii A.I, Isaulenco V.A.,1988; Naberejnii A.I, Krivtova O.T., 1965; Naberejnii A.I.,1973). Reservoir regulation and exploration of MTPS let to decreasing of biodiversity and quantitative compositions of zooplankton modification in some main groups in space-temporal dynamics. From 90`s MTPS begins to reduce. At result the reservoir ecosystem including zooplankton is under cardinal restructure of all levels of thermic pressure (Climenco V.,2003).

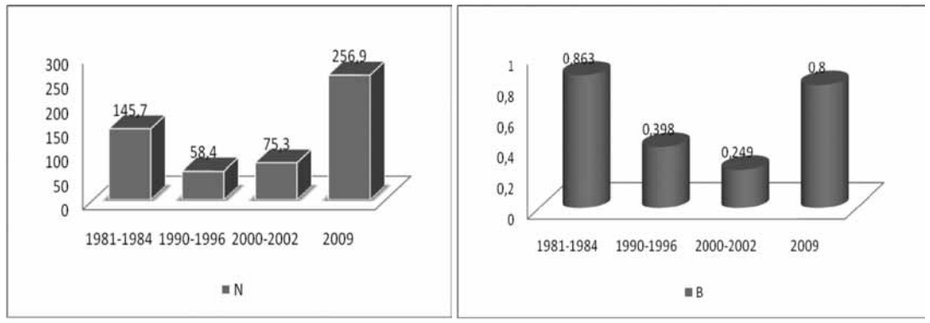

Fig. 1-2 Multianul dynamics of numeric value (N - thousands ind./m^3) and biomass (B - g/ m^3) of zooplankton from cooling-reservoir Cuciurgan (1981-2009).

Specific diversity and quantitative parametres of zooplankton communities in Cuciurgan lake is still in reducing. One of the most important factor which determines changes in qualitative and quantitative composition in zooplankton from Cuciurgan lake are the processes of MTPS functioning. In 1990-1996 the quantitative composition of zooplankton was drammatical reduced, but in 2009 was registrated the increasing, especially in the group of rotiphers, which are resistent on different conditions (Fig. 1-2).

As result, the lake ecosistem, including zooplankton, is changed cardinal on all levels, which led to reducing of qualitative diversity and quantitative development of zooplancton. We have to mention that during the way in cooling sistem of MTPS, and due to water stock we have the jump in temperature in 8-9° C, which led to 80% death of total number of zoolpancton (Naberejnii A.I, Isaulenco V.A., 1988).

Nowadays, the thermic pressure of thermocentral in semnificating reduced, and the more essential is negative influence in middle sector. The zooplankton development in middle sector (55,0 thous. ind/ m^3 and 55,25 mg/m^3) is 3 times less, comparing with superior sector (181,3 thous. ind/ m^3 and 109,25 mg/ m^3), in spring 2010. We can resume, due the influence of this factor the majority groups of zooplancton disapear, but in inferior sector (106,0 thous. ind/ m^3 and 349,2 mg/m^3) we can observe the increasing of development, especially in cladocera – the group of organisms with high sensibility.

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NEW SPECIES OF BDELLOID ROTIFERS TO THE FAUNA OF BELARUS

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Order Bdelloida Hudson, 1884 includes above 380 species from different water objects (rivers, lakes, temporary pools) and terrestrial habitats (mosses, lichens and soil). Bdelloids are possessed of uniform morphology, paired gonads, ramate mastax and thin covers. Presence of bdelloid species in habitats with extreme factors such as dryness and their wide distribution is possible because of parthenogenetic reproduction and ability to withstand unfavorable conditions through cryptobiosis. The term «cryptobiosis» was defined by Keilin (1959) as «the state of an organism when it shows no visible signs of life and when its metabolic activity becomes hardly measurable, or comes reversibly to a standstill».

At present the fauna of bdelloid rotifers in Belarus is investigated insufficiently comprising with investigations making in neighboring countries – Russia and Ukraine. Only 36 species and morphotypes are declared in the last rotifer catalog (Galkovskaya et al., 2001). These species have been found accidentally in water ecosystems by different authors since the beginning of the twentieth century to nowadays, and more than one half of species registrations have been sporadic. There are no any evidences related to species composition and species richness of bdelloids in such terrestrial habitats as mosses and lichens.

This paper shows the preliminary results of the research on bdelloid rotifers in various ecosystems. New data concerning of species composition and taxonomic structure of bdelloids in miscellaneous habitats and ecological distribution of separate taxes are obtained. A total of 68 species of *Bdelloida* is found, of which 40 species have not been previously recorded in Belarus. Two genuses new to Belarus – *Otostephanos* Milne, 1916 and *Didymodactylos* Milne, 1916 – are indicated.

Samples of mosses and lichens from terrestrial habitats and samples of benthos, plankton and periphyton from water objects were collected during April - October in 2008-2010. All specific identifications were carried out only on live individuals. List of new to Belarus species referencing the place of the species registration (kind of substrate, biotope, etc.) is presented below.

1. *Adineta oculata* (Milne, 1886) – benthos, rivers;
2. *A. bartosi* Wulfert,1960 – sphagnum (*Sphagnum sp*.), bog;
3. *A. steineri* Bartos, 1951 – 1) mat mosses (*Rhytidiadelphus triquetrus, Politrichum strictum*), spruce forest; 2) sphagnum (*Sphagnum magellanicum*), bog hubbles; 3) mat mosses (*P. strictum*, *Sanionia uncinata*), transitional marsh; 4) moss (*Brachythecium salebrosum)*, surface of stones; 5) epiphytic moss (*Pleuroium shreiberi*) on birch trunk, mixed forest; 6) mat mosses (*Br. salebrosum*, *Pl. shreiberi*), pine forest; 7) epiphytic moss (*Hypnum sp.*), mixed forest; 8) lichens on spruce trunk, mixed forest; 9) lichens near temporary pool, mixed forest; 10) mat lichens, pine forest;
4. *A. grandis* Murray, 1910 – mat moss (*Rh. triquetrus*), spruce forest;
5. *A. vaga vaga* (Davis, 1873) – 1) sphagnum (*Sph. magellanicum*), bog hubbles; 2) mat mosses (*P. strictum*, *S. uncinata*), transitional marsh; 3) moss (*Br. salebrosum)*, surface of stones; 4) epiphytic mosses (*Pylasiella polyantha, Orthodicranum montanum)*, mixed forest; 5) moss (*Tortura muralis*), foulings on concrete plates and surfaces of buildings; 6) moss (*S. uncinata*), floodplain of stream; 7) temporary pools; 8) plankton among macrophytes, rivers; 9) periphyton on *Potamogeton crispus*, rivers;
6. *A. vaga minor* Bryce, 1893 – 1) sphagnum (*Sph. magellanicum*), bog hubbles; 2) mat mosses (*Rh. triquetrus*; *Pl. shreiberi*), waterlogged black alder forest; 3) mat mosses (*Rh. triquetrus, P. strictum*), spruce forest; 4) moss (*Br. salebrosum)*, surface of stones; 5) epiphytic moss (*Pyl. polyantha)*, mixed forest; 6) temporary pools; 7) plankton among macrophytes, rivers and lakes; 8) benthos, lakes; 9) periphyton on *Potamogeton lucens*, *P. crispus* and *Carex sp*., rivers. 10) sphagnum (*Sph. sp*), submerged in lake;
7. *A. cuneata* Milne, 1916 - mat lichens, pine forest;
8. *Habrotrocha pusilla pusilla* (Bryce, 1897) - mat moss (*Pl. shreiberi*), mixed forest;
9. *H. lata lens* Donner, 1965 - sphagnum (*Sph. magellanicum*), bog hubbles;
10. *H. gracilis* Montet, 1915 - benthos, rivers;
11. *H. constricta* (Dujardin, 1841) – mat moss (*Pl. shreiberi*), waterlogged black alder forest;
12. *Otostephanos regalis* Milne, 1916 – moss (*T. muralis*), foulings on concrete plates and surfaces of buildings;
13. *Macrotrachela timida timida* Milne, 1916 – 1) mat moss (*Pl. shreiberi*), mixed forest; 2) mat moss (*Br. salebrosum*), pine forest;
14. *M. bilfingeri* (Bryce, 1913) – 1) mat moss (*Pl. shreiberi*), mixed forest; 2) mat moss (*Pl. shreiberi*), pine forest; 3) lichens near temporary pool, mixed forest;
15. *M. oblita* Donner, 1949 - sphagnum (*Sph. squarrosum*), bog hubbles;
16. *M. induta* Donner, 1951 - 1) mat moss (*Pl. shreiberi*), mixed forest; 2) mat moss (*Pl. shreiberi*), pine forest;
17. *M. libera libera* Donner, 1949 – 1) mat moss (*P. strictum*), transitional marsh; 2) lichens on willow trunk, mixed forest;
18. *M. insolita* De Koning, 1947 – mat lichens, pine forest;
19. *M. kallosoma* (Schulte, 1954) - mat moss (*Pl. shreiberi*), mixed forest;
20. *M. quadricornifera scutellata* Schulte, 1954 - mat moss (*Pl. shreiberi*), mixed forest;
21. *M. quadricornifera vanoyei* Schepens, 1954 – 1) sphagnum (*Sph. sp*), submerged in lake; 2) sphagnum (*Sph. magellanicum*), bog hubbles; 3) epiphytic moss (*Hypnum sp.*), mixed forest;
22. *M. ambigua* Donner, 1965 - mat moss (*Pl. shreiberi*), mixed forest;
23. *M. latior* Donner, 1951 – 1) epiphytic mosses (*Pyl. polyantha, Hypnum cupressiforme)*, mixed forest; 2) mat moss (*S. uncinata*), mixed forest; 3) lichens on spruce trunk, spruce forest;
24. *M. inermis* Donner, 1965 – 1) mat moss (*Pl. shreiberi*), waterlogged black alder forest; 2) mat moss (*Pl. shreiberi*), mixed forest;
25. *M. multispinosa brevispina* (Murray, 1908) - sphagnum (*Sph. sp*), submerged in lake;
26. *M. m. crassispinosa* (Murray, 1907) – mat moss (*Rh. triquetrus*), mixed wood;
27. *Rotaria neptunoida* Harring, 1913 – 1) temporary pool; 2) plankton among macrophytes, lakes; 3) benthos, lakes;
28. *R. tridens* (Montet, 1915) - periphyton on *Potamogeton crispus*, rivers;
29. *Dissotrocha aculeata octobullata* Hauer, 1958 - benthos, lakes;
30. *Philodina nemoralis* Bryce, 1903 - sphagnum (*Sph. magellanicum*), bog hubbles;
31. *Ph. megalotrocha* Ehrenberg, 1832 - plankton among macrophytes, rivers;
32. *Ph. vorax* (Janson, 1893) – epiphytic moss (*Pyl. polyantha)*, mixed forest;
33. *Ph. plena* (Bryce, 1894) – periphyton on *Ceratophyllum demersum*, lakes;
34. *Ph. rapida* Milne, 1916 - benthos, rivers;
35. *Ph. proterva* Milne, 1916 – mat moss (*Pl. shreiberi*), waterlogged black alder forest;
36. *Ph. arndti* Wulfert, 1961 – periphyton on *Typha angustifolia*, rivers;
37. *Didymodactylos carnosus* Milne, 1916 – 1) epiphytic moss (*Pl. shreiberi*) on birch trunk, mixed forest; 2) mat moss (*Pl. shreiberi*), mixed forest;
38. *Mniobia obtusicornis* Murray, 1911 – mat lichens, mixed forest;
39. *Mn. tetraodon* (Ehrenberg, 1848) – mat moss (*Pl. shreiberi*), mixed forest;
40. *Mn. russeola* (Zelinka, 1891) - epiphytic moss (*H. cupressiforme)*, mixed forest.

MORPHOMETRIC CHARACTERISTICS OF AMUR SLEEPER, *PERCCOTTUS GLENII* DYBOWSKI, 1877 IN THE BELARUSIAN SECTION OF THE DNIEPER RIVER

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The Amur sleeper *Perccottus glenii* (Perciformes: Odontobutidae) is one of the most invasive fish species in Eastern and Central Europe. In Belarus the *P. glenii* was recorded for the first time in the middle 1970s in the small ponds in Minsk (Rizevsky et al. 1999). Currently this alien species has widely spread in the country and recorded within all main river basins.

The first data of morphological features of *P. glenii* in Belarus was got by Rizevsky et al. (1999). The 25 individuals collected in spring 1996 in the small ponds in Minsk had been analyzed.

The aim of this work was provide data on morphometric features of *P. glenii* in the water bodies in Minsk and to analyze it morphometric variability.

The data had been collected from small lake in Minsk (Dnieper River basin) during 2009 – 2010. The main depth of the water body was 1 – 2 m. The lake-surface area is about 0.2 ha. The fish had been caught in the littoral zone at a water depth 0.2 – 0.8 m. As a fishing gear we used a hand-net. All samples were preserved in 4 % isotonic formaldehyde after catching.

A morphometric analysis of 62 mature fish ranged from 69.1 to 125.4 mm total length (TL) and from 59.1 to 104.3 mm standard length (SL) was performed. It body weight ranged from 4.46 to 28.14 g. 37 morphometric and 11 meristic characteristics were measured. The morphometric features of males and females were analyzed separately. Our morphometric data were compared with Rizevsky' data (Rizevsky et al., 1999). The mixed fish sample (30 individuals) that standard length range is equal to that of sample collected in 1996 in Minsk (SL = 66 – 82 mm) was used to comparison.

The meristic features for analyzed specimens of *P. glenii* are: the first dorsal fin: VI–IX (7.52±0.07); the second dorsal fin: I–II 10–13 (1.13±0.04 & 11.36±0.08); anal fin: I–II 9–12 (1.30±0.06 & 10.18±0.09); pectoral fin: 15–18 (16.98±0.09); pelvic fin: I 4–5 (4.98±0.02); gill rakers on first arch: 10–13 (11.59±0.10); scales in lateral row: 36–42 (39.28±0.18); vertebrae (without urostyle): 29–31 (30.05±0.06).

Although most meristic features of the analyzed population are in the range of those indicated by other authors for *P. glenii* from it original and invasive ranges, the variation of number of the soft rays in the pelvic fin (from 4 to 5) was recorded, that very rare note by other researchers (common 5 rays are noted).

The main morphometric measurements of the individuals are reported in Table 1.

Table 1. Morphometric measurements of the *Perccottus glenii* (Dybowski, 1877) captured from the small lake in Minsk (Dnieper River basin) 2009 – 2010

Character	Male (n=29)			Female (n=33)			t_{st}
	Range	Mean±SE	SD	Range	Mean±SE	SD	
Standard length (SL) [mm]	59.1–104.3	72.6±2.2	11.6	56.4–102.0	72.6±2.2	12.4	+
% of SL							
Trunk length	62.5–69.3	66.2±0.3	1.6	62.3–69.1	66.7±0.3	1.6	-
Head length	32.7–38.3	35.6±0.3	1.6	33.4–40.3	35.6±0.2	1.4	+
Snout length	9.4–12.6	10.7±0.1	0.8	9.2–12.1	10.3±0.1	0.7	+
Horizontal eye diameter	5.6–7.5	6.4±0.1	0.5	5.7–7.3	6.5±0.1	0.4	-
Postorbital length	17.3–21.2	19.5±0.2	1.0	16.6–22.3	19.2±0.2	1.3	+
Head depth at nape	22.6–27.7	24.8±0.2	1.2	21.0–27.8	24.8±0.2	1.4	+
Head depth at posterior margin of preopercle	19.8–24.6	22.1±0.2	1.1	19.8–23.5	21.9±0.2	1.0	+
Head depth at eye centre	13.2–16.7	15.0±0.2	0.9	13.1–16.4	14.6±0.1	0.7	+
Maximum body depth	24.4–30.0	27.5±0.3	1.6	23.5–30.4	27.4±0.3	1.9	+
Caudal peduncle depth	11.4–14.1	12.5±0.1	0.6	10.9–13.5	12.4±0.1	0.6	+
Head width at nape	18.8–25.3	22.0±0.3	1.6	18.3–24.3	21.8±0.2	1.3	+
Head width at posterior margin of preopercle	17.1–23.4	20.1±0.3	1.6	17.2–21.8	19.7±0.2	1.2	+
Interorbital width	6.1–8.6	7.4±0.1	0.6	6.0–8.5	7.2±0.1	0.6	+
Body width at dorsal fin origin	16.0–20.1	18.1±0.2	1.2	16.0–22.3	18.9±0.3	1.6	-*
Caudal peduncle length	25.0–30.5	28.1±0.2	1.2	26.5–30.9	28.5±0.2	1.2	-
Predorsal length	41.6–45.8	43.5±0.2	1.3	42.0–46.3	43.5±0.2	1.0	-
Postdorsal length at the first dorsal fin	45.7–53.7	49.6±0.4	2.1	46.7–53.5	50.5±0.3	1.9	-
Postdorsal length at the second dorsal fin	25.4–31.2	28.8±0.3	1.5	24.4–31.3	29.2±0.3	1.6	-
Prepelvic length	30.7–40.4	37.2±0.3	1.8	29.4–39.4	36.3±0.3	2.0	+*
Preanal length	56.1–63.1	59.5±0.3	1.8	57.3–62.9	59.9±0.3	1.5	-
Pelvic to anal fin origin distance	20.5–25.7	23.5±0.2	1.3	21.3–26.6	24.2±0.2	1.3	-*
Prepectoral length	35.3–41.0	37.9±0.3	1.5	35.3–41.1	37.2±0.2	1.2	+*
Pectoral to pelvic fin origin distance	13.2–17.5	15.3±0.2	1.1	13.5–18.5	15.7±0.2	1.2	-
Caudal-fin to anus distance	44.7–49.2	46.8±0.2	1.2	44.3–49.0	47.1±0.2	1.0	-
Anus to anal fin distance	4.1–6.2	4.8±0.1	0.5	3.7–6.1	5.2±0.1	0.5	-*
Upper jaw length	10.9–15.3	13.0±0.2	1.2	11.0–16.1	12.8±0.2	1.2	+
Lower jaw length	14.8–18.5	16.7±0.2	1.0	14.7–19.1	16.4±0.2	1.1	+
The first dorsal fin length	11.0–15.2	12.9±0.2	1.0	10.6–14.7	12.8±0.2	1.1	+
The second dorsal fin length	15.5–18.8	16.7±0.1	0.8	14.2–17.7	16.2±0.2	1.0	+*
The first to the second dorsal fin distance	1.3–4.5	2.3±0.1	0.7	1.3–4.9	2.7±0.2	0.9	-
The first dorsal fin depth	10.9–17.1	12.9±0.2	1.2	10.3–15.2	12.5±0.2	1.2	+
The second dorsal fin depth	15.2–19.5	17.4±0.2	0.9	14.4–20.5	16.2±0.2	1.4	+*
Pectoral fin length	19.4–24.2	22.3±0.2	1.0	18.9–23.3	21.3±0.2	1.1	+*
Pectoral fin width	8.1–10.4	9.2±0.1	0.6	7.9–10.1	9.0±0.1	0.6	+
Pelvic fin length	13.4–18.2	15.8±0.2	1.3	14.2–19.8	16.9±0.2	1.4	-*
Anal fin length	11.8–14.9	13.2±0.1	0.7	10.9–14.2	13.0±0.2	0.9	+
Anal fin depth	13.6–17.7	15.9±0.2	1.1	12.9–19.0	15.5±0.2	1.1	+

*: indicates significant difference at $p < 0.05$ between sexes; «-» & «+»: denote the lesser and greater value of measurement in males than in females; SE, standard error of mean; SD, standard deviation

Sex differentiating characters were observed only in morphometric features. The t-test showed that 9 from 37 morphometric measurements were significantly different between male and female fish (Table 1). Our results corresponds with the Elovenko' data (Elovenko 1985) and indicate the greater body width, pelvic length and the retrodisplacement of anal fin in females; the larger head, the second dorsal fin and pectoral fin measurements in males.

According to analyze 20 from 25 examined morphometric features were significantly different between two mixed fish samples collected in Minsk in 1996 (Rizevsky et al., 1999) and in 2009 – 2010 (our data) (Table 2). The present study showed that trunk length, caudal peduncle length, postdorsal length at the first dorsal fin, head depth at nape and interorbital width were significantly bigger in individuals collected in 2009 – 2010 than that of collected in 1996. The head length and some other measurements of the head, predorsal and preanal lengths, pelvic to anal fin distance and depths of body, measurements of the paired and unpaired fins were bigger in individuals captured in 1996. The recorded differences between populations of the *P. glenii* captured in different time from the water bodies in Minsk (Dnieper River basin) can indicate improvement of the species living conditions and successful establishment of *P. glenii* in Belarus.

Table 2. Morphometric measurements significantly different between the mixed populations of the *P. glenii* (Dybowski, 1877) captured in Minsk (Dnieper River basin) in 1996 and during 2009–2010 (% of SL)

Character	2009–2010 (our data) (n=30)		1996 (Rizevsky et al. 1999) (n=25)		t_{st}
	Mean±SE	SD	Mean±SE	SD	
Trunk length	66.2±0.3	1.7	64.9±0.5	2.3	+
Head length	35.6±0.3	1.4	39.1±0.2	1.1	-
Horizontal eye diameter	6.5±0.1	0.5	7.3±0.1	0.7	-
Postorbital length	19.5±0.2	1.1	21.5±0.1	0.7	-
Head depth at nape	24.8±0.2	1.4	19.1±0.2	0.7	+
Maximum body depth	27.5±0.3	0.7	28.8±0.3	1.4	-
Caudal peduncle depth	12.5±0.1	1.6	13.3±0.1	0.5	-
Interorbital width	7.2±0.1	0.5	5.4±0.1	0.6	+
Caudal peduncle length	28.3±0.2	1.1	23.3±0.2	1.0	+
Predorsal length	43.6±0.2	1.1	45.3±0.2	1.0	-
Postdorsal length at the first dorsal fin	50.1±0.4	2.2	45.7±0.4	2.0	+
Preanal length	59.7±0.3	1.7	61.4±0.2	1.1	-
Pelvic to anal fin origin distance	23.8±0.2	2.5	26.1±0.2	1.2	-
The second dorsal fin length	16.4±0.2	0.9	19.0±0.3	1.7	-
The first dorsal fin depth	12.5±0.2	1.1	14.7±0.2	1.1	-
The second dorsal fin depth	16.7±0.2	1.3	18.4±0.3	1.6	-
Pectoral fin length	22.0±0.2	0.9	23.1±0.3	1.4	-
Pectoral fin width	9.2±0.1	0.6	9.7±0.1	0.7	-
Anal fin length	12.9±0.1	0.8	14.2±0.2	0.8	-
Anal fin depth	15.6±0.2	1.2	16.6±0.2	1.1	-

«-» & «+»: denote the lesser and greater value of measurement in individuals collected in 2009 – 2010 than in that of collected in 1996;

DISTRIBUTION OF THE RUFFES (PERCIDAE*: GYMNOCEPHALUS)* IN MOLDOVA'S WATER BODIES AND ITS PROTISTIAN PARASITES (PROTISTA)

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The ruffes are a fresh and brackish water small Eurasian member (5 species) of the family of *Percidae* which is native to Central, Eastern Europe and part of Asia. It is supposed, that the Paleo-Danube (*sensu* Lindberg, 1955) was the centre of origin and subsequent expansion of the genus. Unlike other perches, the ruffes appear to be remarkably tolerable to a wide range of environmental conditions. For instance, the common ruffe (*G.cernua*) most recent expansion was to other areas in the world where it may have been responsible for harmful impacts on the local fish populations and functions of aquatic ecosystems. The general study of all the known data and our field sampling proves that the actual distribution, biology, significance of these fish species populations in the aquatic ecology of the region, rendering and assessment of its conservation state have not been determined in detail, have yet a lot of unknown but interesting both scientific and practical data to offer. Moreover, the data on the parasites of such closely-related fish-hosts taxa promote their physiological/ecological differentiation and give the important information both about spreading of these fish species and potential control of their number. Unfortunately, a little information is available about the all groups of parasites from ruffes from concerned region, and infestation in other neighbouring areas appears light.

The present paper summarizes data on the distribution of the ruffes and its protistian parasites in different freshwater bodies of the Prut-Dniester interfluvial hydrographical area, based on long-term (1991-2011 years) surveys carried out by the author. The parasitological data were obtained through a complete dissection of 437 fish specimens representing four species: 237 - common ruffe *G.cernua* (L., 1758), 117 - Don ruffe *G.acerina* (Gueldenstaedt, 1774), 35 - striped ruffe *G.schraetser* (L., 1758) and 48 - Danube ruffe *G.baloni* Holcik et Hensel, 1974.

Common ruffe is widely distributed and is very numerous in all the investigated waters. **Don ruffe** was more frequent and abundant in numbers in upper Dniester river (Novodnestrovsc reservoir, Naslavcea-Cosăuți portion) and is rare or very rare in a middle river portion (Soroca-Dubăsari). Occasionally findings of this fish took place in upper Prut River (Criva-Lipcani portion and Costeşti-Stânca reservoir). **Striped ruffe** is a highly rare fish, it occurs only in lower Prut river portion (Leova-Giurgiuleşti). **Danube ruffe** was collected by the author in 2011 in lower Danube (Reni-Vâlcov) and lower Prut (Leova-Giurgiuleşti), occasionally - in upper Prut drainage - Draghişte and Racovăț rivers, Corpaci and Costeşti-Stânca reservoirs. This species has been not registered so far and represents a faunistic novelty for water bodies of R. Moldova.

At present these fish species are considered to be not threatened (Least Concern) in the Black Sea basin according to IUCN (1994) status criteria. Also, in any documents on the protected fauna in regional plane they are not included. The results obtained suggest that ruffes from Moldovan waters (with the exception of **common ruffe** which is out of danger) in the near future must be considerate close to qualifying for a threatened category with a special protection status**. Striped ruffe** is an endemic of Danube River basin and in future is need to qualify it as especially threatened species – Endangered or Critically Endangered. **Don ruffe** need to include in Rare species or Near Threatened category. **Danube ruffe** has fragmentary spreading in Danube and Dnieper basins (and it expected in Dniester), but is very rare in most of its range. It must enlist as Vulnerable species.

The parasitological research has been resulted in revealing in the ruffes of 81 species of protistian parasites, which belong to the different taxonomical groups: *Zoomastigina* - 6, *Apicomplexa* - 5, *Microsporidia* - 4, *Cnidosporidia* – 25 and *Ciliophora* - 41. The richest protistian fauna was established in the common ruffe (68), followed by Danube ruffe (28), Don ruffe (19) and striped (12). The distribution of parasites in fish-hosts is: **common ruffe** – *Trypanosoma carassii, T.acerinae, T.percae?, Cryptobia branchialis, Ichthyobodo necator, Goussia cernui, G.gymnocephali, Eimeria percae?, Pleistophora acerinae, Loma acerinae, Myxidium pfeifferi, M.novum, M.rhodei, Sphaerospora markewitschi, S.pectinacia, S.danubialis, Sphaerspora sp.1**, Myxobolus pseudodispar, M.muelleri, M.karelicus, M.sandrae, M.magnus, M.ellipsoides, M.subepithelialis, M.exiguus, Henneguya creplini, H.psorospermica, H.lobosa?, Thelohanellus pyriformis, Amphileptus branchiarum, A.disciformis, Chilodonella piscicola, C.hexasticha, Tetrahymena pyriformis, Ichthyophthirius multifiliis, Capriniana piscium, Scyphidia sp.1**, Epistylis lwoffi, E.apiosomae, Apiosoma campanulatum, A.miniciliatum, A.carpellii, A.amoebae, A.robustum, A.piscicolum, A.baueri, A.minimicronucleatum, A.conicum, A. constrictum, A.doliare, A.schulmani, Trichodina nigra, T.percae, T.mutabilis, T.esocis, T.reticulata, T.acuta, T.domerguei, T.rostrata, T.reticulata, T.pediculus, T.rectangli, T.urinaria, Paratrichodina incisa, Tripartiella copiosa, Trichodinella epizootica, T.percarum, Foliella subtilis;* **Danube ruffe** – *T.carassii, Trypanosoma sp., I.necator, P.acerinae, M.novum, Myxidium sp., M.magnus, M.dogieli, Myxobolus sp.**, H.creplini, C.piscicola, I.multifiliis, Scyphidia sp.2**, E.lwoffi, A.baueri, A.campanulatum, A.constrictum, A.minimicronucleatum, A.piscicolum, T.acuta, T.nigra, T.pediculus, T.reticulata, Trichodina sp.1, P.incisa, T.copiosa, T.epizootica, T.percarum;* **Don ruffe** – *G.acerini, G.acerinae, P.acerinae, Pleistophora sp.1, S.markewitschi, S.danubialis, Sphaerospora sp.2**, M.tauricus, M.dogieli, M.nemachili, M.karelicus, M.magnus, M.ellipsoides, T.acuta, T.nigra, T.percae, P.incisa, T.copiosa, T.percarum;* **striped ruffe** - *Pleistophora sp2.**, S.danubialis, M.nemachili, H.creplini, A.baueri, A.campanulatum, A.constrictum, A.minimicronucleatum, T.acuta, T.nigra, Trichodina sp.2, T.percarum.*

Several (**) founded protistian species hypothetically are new for science. About 40 known protistian species are new for ruffes, especially Danube ruffe - for 28, common ruffe - for 15, Don ruffe - for 12 and striped ruffe - for 10 species met as new hosts. The fauna of protistian parasites of the ruffes from the target region in general is not specific and had been formed on the base of common and widely-distributed taxa in wide range of local fishes. Among recorded parasites only few species (*T.acerinae, G.cernui, G.gymnocephali, G.acerini, G.acerinae, L.acerinae, P.acerinae, S.markewitschi, S.danubialis, M.karelicus* and *M.magnus*) seems to be more and less specific for ruffes. The high similarity between common ruffe and Danube ruffe protistian fauna can be determined by close phylogenetical and ecological features: *G.baloni* apparently recently derived from *G.cernua*, its speciation probably resulted from ecological specialization and their populations appeared mainly eurybiontic (display both rheophilous and limnophilous patterns). The discovery in ruffes (especially in *G.cernua* and *G.baloni*) of widespread protistian species (*T.percae, E.percae, S.pectinacia, M.sandrae, H.creplini, H.psorospermica, H.lobosa?, A.campanulatum, A.minimicronucleatum, T.percae, T.urinaria, T.percarum* etc.), common with perch and other percids can be as consequence of they ecological/biotopical peculiarities likeness. The similarity between protistian fauna of striped ruffe and Don ruffe may be a consequence of them exclusively rheophilous preferences, while distinction is a result of its speciation in geographic isolation. On the whole, species composition of protistian fauna of ruffes from examined basins, in spite of having almost close structure, their numerical composition greatly varies. Diversity and level of infestations could be caused by the host species, its age, way of life and behaviour, distinction in nutrition, population density, fish fauna type and by certain peculiarities of the hydrobiotope.

The total prevalence of infestation of the examined fishes was 86%. Commonly, besides isolated lesions in sites of location provoked by some protistian (*Goussia, Sphaerospora, Myxobolus, Henneguya, Chilodonella, Apiosoma* and *Trichodinidae spp.*), no other abnormalities were documented among even in heavily infested fish specimens.

THE MALACOFAUNA OF LAKE BELEU

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Lake Beleu belongs to the Prut River basin. The Prut flows into the Danube in 174 km from the mouth and represents the last largest left tributary of this river. Beleu is a relict lake it is about 5000-6000 years old. The average length - 5 km, width – 2 km, depth 0.5 - 2 m. This is a shallow flowing lake with high quantity of suspended matter and muddy bottom.

Molluscs were hand-collected and with the usage of the Petersen Grab and determined with using standard Keys to the freshwater invertebrates (Kutikova & Starobogatov 1977, Tsalolihin 2004, Zhadin 1952).

Table 1. Density and biomass of mollusks from the Lake Beleu.

N	Species	ind/ g/m^2
	Lymnaea stagnalis (Linne,1758)	1/5,81
	Lymnaea auricularia (Linne,1758)	6/2,1
	Lymnaea peregra (Müller,1774)	*
	Lymnaea ovata (Draparnaud,1805)	6/1,45

	Lymnaea palustris (Müller,1774)	2/1,63
	Physa fontinalis (Linne,1758)	*
	Physa acuta (Draparnaud,1805)	*
	Planorbarius corneus (Linne,1758)	*
	Viviparus viviparus (Linne,1758)	*
	Viviparus contectus (Millet,1813)	0,6/1,02 3,2/10,8
	Borysthenia naticina (Menke, 1845)	*
	Anodonta cygnea (Linne,1758)	0,4/12,8
	Anodonta piscinalis (Nilsson, 1822)	*
	Anodonta zellensis (Gmelin,1791)	0,6/36,5
	Pseudoanodonta complanata (Rossmässler,1835)	0,13/2,2
	Sinanodonta woodiana (Lea, 1834)	0,4/54,7 1,4/262
	Unio pictorum (Linne,1758)	*
	Unio tumidus (Philipsson,1788) (Retzius)	0,4/16,7
	Dreissena polymorpha (Pallas,1771)	*

* living specimens in qualitative sample

19 species of Gastropoda and Bivalvia moluscs were founded during 2003-2010.

The most spread of them from Gastropoda are *L. auricularia, L. ovata, V. contectus,* from Bivalvia: *A. zellensis, U. tumidus* and *S. woodiana*.

Sinanodonta woodiana (Lea 1834) (Bivalvia, Unionidae) is an Eastern Asiatic freshwater species, appeared in Europe accidentally with the herbivorous cyprinid fishes from China. This is a large size representative of the Unionidae family in Europe. Size is 100-170 x 120-200 x 30-45 (height) mm. Shell is brown or blackish, sometimes with greenish hue, color very variable and habitat from slowly running rivers to eutrophic ponds. The living individuals of *S. woodiana* have been recorded for the first time in the Republic of Moldova in the Lake Beleu (Prut River basin) in 2008. In R. Moldova we found two empty shells of *S. woodiana* in the Lake Manta (Prut River basin) in 2003 (Munjiu & Shubernetski 2008).

We investigated the density and biomass of *S. woodiana* in the Lake Beleu: in 2008 they were 0,4 ex/m^2 and respectively, 54,7 g/m^2, but next year, 2009, they increased up to 1,4 ex/m^2 and respectively, 262 g/m^2. The results of this investigation showed that during the short time the established population of invasive species *S. woodiana* was formed and play a significant role in density (7%) and biomass (74%) of the Lake Beleu malacofauna. This may negatively effects on the native molluscs. Biological particularities of this species such as the growth rate and biomass provide some advantages in competition for food resources with native *Unionidae*. The largest living individual of *S. woodiana,* with total biomass of **472g**, and sizes of 166 x 96 x 52 mm, was found in the Lake Beleu.

The most of alien species have an insignificant effect on the new ecosystems and only some of them can become the pests. A strongest invader effect usually appears at the invasion of edificators species and concurrent species such as new species in malacofauna of R.Moldova - *Sinanodonta woodiana* (Lea 1834).

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References

1. Kutikova L.A., Starobogatov Ya.I. (Eds.). Keys to the freshwater invertebrates of the European. part of the USSR. 1977.510.
2. Munjiu O, Shubernetski I. First record of *Sinanodonta woodiana* (Lea, 1834) (Bivalvia: Unionidae) in Moldova. Aquatic Invasions. 2008.V. 3, Issue 4:441-442.
3. Tsalolihin S. Ya. Keys to the freshwater invertebrates of Russia and adjacent countries. 2004. Vol.6. 528.
4. Zhadin V.I. 1952. Mollusca of fresh and brackish waters of the USSR. Vol. 43. AN SSSR, M-L, 346.

CONTRIBUTIONS TO THE KNOWLEDGE OF THALLASOBATIAL ICHTHYOLOGICAL FAUNA ON THE SEAMOUNT CHAIN "WALVIS RIDGE"

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1. INTRODUCTION

The paper presents the results of two scientific fish exploratory expeditions carried out on board of vessels RTMS„Patriot" - Kaliningrad, Russia and STW„RODNA" - Tulcea, Romania, in January-March 1982 respectively March-April 1990, in the south and north of seamount chain Walvis Ridge, Atlantic Sud-Est/FAO 47.

Lead author, PhD. Nicholae C. Papadopol, participated in both expeditions, first as a guest of Atlant NIRO, Kaliningrad Russian Institute, and the latter being responsible for the action of the Romanian Marine Research Institute Constanta.

The work is dedicated to the memory of regretted PhD. **Ghenadi Petrovici ZAHAROV**, gone too soon of us, prestigious institute researcher Atlant NIRO, Kaliningrad.

2. GENERAL DATA REGARDING THE STUDIED ARIA

In 1982, has worked for the extreme southern banks, Beta Bank (31º45'S/2º10'E, ad.550m), Alfa $_2$ Bank (32º53'S/2º33'E, ad.450-550m), Alfa Bank (33º19'S/2º27'E, ad.780m). Romanian expedition in 1990 has focused on the work of on the North Bank (20 ° 46'S / 8 ° 40'E, ad.215-220m). All these formations, as well as the entire complex Walvis Ridge are outside of the exclusive economic zone of Namibia and South Africa, in the area of international waters.

The results of the two vessels fishing can be comparable given that both are Class Supertrauler Atlantic (GRT-4900t), first built in Stralsund / Germany, the second in Braila / Romania, but after German license (Papadopol 2001). Both vessels were performed exclusively for night fishing (Papadopol, 1982, 1991a, b, 1998). Climate is also similar during both expeditions hovering southern summer-autumn season, favorable fishing. The environmental conditions, in all, have been presented in detail in a previous paper. (Papadopol 1982,1998,1995).

3. FISHING RESULTS

The fish conducted with the RTMS„PATRIOT" its use the trawl 135/104-237 (RT135/624), and to the STW „RODNA" trawl 195/167-223m, both for pelagic species reinforcement. Fishing effort and productivity of these two ships are presented in the following table (Table 1).

Table 1. Fishing results conducted in Walvis Ridge area in 1982 and 1990 (Papadopol 1982,1998)

BANK	EFFORT			CAPTURE	CUE		
	Days	Hours	Trawling	Tone	t/zi	t/h	t/tr
a. RTMS "PATRIOT" – Kaliningrad (January-March 1982)							
Alfa 2	2	6	4	23,0	11,5	3,83	5,75
Alfa	15	60	45	420,33	20,02	7,00	9,34
Beta	2	6	3	2,20	1,10	0,37	0,73
TOTAL	19	72	52	445,53	23,49	6,18	8,57
b. STW "RODNA" (March-April 1990)							
Nord	4	25,15	9	61,5	15,37	2,43	6,79

In the fishing of the Russian vessel, *Beryx splendens* species has prevailed in a proportion of 97.53%, the additional range of species being only 2.07%. On the North Bank, in the Romanian fishing vessel, the *Beryx splendens* had a contribution of 84.15% completion being provided by Ruvettus pretiosus - 6.67%, *Lepidomus caudatus* - 6.19%, and other secondary species - 2.95% (Papadopol 1998.2005).

4. REGIONAL BIODIVERSITY, BIOLOGY AND ECOLOGY OF THE MAIN SPECIES

In his synthesis work concerning ichthyological fauna of Southeast Atlantic, Papadopol (1998) present in the chapter dedicated to this sector a complete list of species captured by these two ships.

The range of species identified in those two expeditions rise to 34 taxa, distributed in 19 families and 9 orders of two classes Chondrichthyes and Osteichthyes, consisting mostly of species with relatively limited distribution in thalassobathial from this region.

From dates of these two expeditions, we will focus on several important species (Papadopol 1991 and b, 1998; Papadopol and Maxim, 1995):

- *Beryx splendens* (Lowe,1834) - On the North Bank in 1990 the flocks have been formed from specimens of 19.5 to 37.5 cm size, on average of 28.5 cm, fish aged 1-5 years, 2-3 years dominating (88.7%), mostly at the beginning of a period of reproduction. In southern of the complex in 1982 the agglomerations have been formed from specimens of 19.5 to 61.5 cm size, on average 37.7 cm. Formations of the deep, in the horizons 400-680m, were composed mainly of fish of from 22-54 cm size, 2-5 years, dominated by four years (70%) by the end of a period of reproduction. For surface were identified concentrations of youth, from 19.5 to 44.5 cm, dominated by 2-3 years (71.9%). And in one case and in other the concentrations were formed and maintained between 19-06 hours GMT, with a maximum time between 23-04 GMT, which imposed a fishing almost exclusively nocturnal.

- *Pentaceros richardsoni* (Smith,1849) - It was fishing exclusively in the south. The formations were constituted from specimens of 34-58 cm size, 42-47 cm dominant. Fish, mature, they were in January-March in sexual rest.

- *Hyperogliphe antartica* (Trumov,1979) - Isolated specimens, of 45-110 cm size, have been reported in fishing of RTMS "PATRIOT", by the end of a reproduction period.

- *Lepidopus caudatus* (Euphrosen,1788) - Sword fishing was the surprise of 1990, flocks being composed by adults from 85-129 cm, 108 cm on average, aged 3-7 years, all in full reproduction.

The authors consider that the wide bench zone constitutes the main breeding area, species on the continental shelf is only meeting youth, juveniles.

- *Ruvettus pretiosus* (Cocco, 1829) - Were caught in fishing on the North Bank exemplaries of 70-164 cm size, all in the sexual rest.

5. ELEMENTS ON NUTRITIVE VALUE OF SPECIES

Without going into detail, we make some meat concerning chemical composition and nutritive value to the basic species, *Beryx splendens* (Papadopol, 1998):

Water: 77,73%; Carbohydrates: 0,64%;
Protein: 18,94 %; Mineral: 1,17%;
Fat: 1,61%; Energy value: 108,7 Kcal/100gr.

For *Pentaceros richardsoni*, the energy value of meat is 152.7 Kcal/100gr and 213.5 Kcal/100 gr. in the *Hyperogliphe antartica*, while the *Ruvettus pretiosus* concentration of lipid is amounts to 19.50%, which requires processing and freezing at the waist as fillets, well encased in glaze.

6. CONCLUSIONS

The studied area is relatively poorly known to the fleets operating in this region. Fishing, pelagic fishing by night, requires experience, a good operational research technique, beam performance, especially experience and ability to maneuver the tool at night on top of hard bottoms (Papadopol 1998). The species reserves are not important, ensuring productivity add-fishing only, the alternative in relation to fishing on the continental shelf. Currently working, accidentally, in the region, special ship from Japan and South African (Atlant NIRO inf. 2011).

The authors do not recommend a sustained fishing in this region and considers it necessary to introduce a severely moratorium, with the permission only of a fishery research, justified in writing.

7. BIBLIOGRAPHY

1. Papadopol C.N. - 1982 – *„Contributions to knowledget the resources in the area of South Ridge seamount Walvis Ridge, Southeast Atlantic"*, Halieutica nr. 3(23), p. 73-116;

2. Papadopol C.N. - 1991 b - *„ The biology of the main gregarious species of fish in the Southeast Atlantic area "* Halieutica nr.2(58), p.19-87;

3. Papadopol C.N. - 1991 c - *"Opinion concernant la posibilites de practiquer une pêche specialisée de Beryx splendens Lowe-1838 (Berycidae) au dessus des montagneuses sou marine du large de l"Atlantique du Sud-Est"*, Bul.APPR-Galați, nr.1, p.156-159;

4. Papadopol C.N., Maxim C. - 1995 - *„ Contributions to knowledge of the thalassobathial resources from the ridge of the seamount complex area Walvis Ridge(1982-1990)"*, Bul.Acad.Navale, Vol.I (1995), p.135-146;

5. Papadopol C.N. – 1998 - *"The systematic study of, zoogeography and population of ichthyological wild fauna to South East Atlantic. Data regarding the profitability of industrial fishery exploitation"*, Academia Română București, pp.400;

6. Papadopol C.N., Nicolaev S. - 2001 - *„ Evolution of livestock and structure of operational and expeditionary fishing fleet"*, Marea Noastră, nr.3(40), p.26-29;

7. Papadopol C.N. - 2005 - *" Three decades of Romanian fisheries research in South-East Atlantic"* Marea Noastră, nr.4(57), p.15-17.

FEEDING ECOLOGY OF THE BLACK SEA BENTHIC FISHES

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Abstract. Feeding ecology research is a fundamental tool for understanding fish roles within their ecosystems. Thus, fish diet reflects the prey availability and a fish can be considered as a "sampling tool" whereby its gastrointestinal content represents a sample of the prey items available in the aquatic environment. There is scarce information on feeding ecology and trophic interactions of the benthic fish species of the Romanian Black Sea coast. Based on this supposition there were sampled 914 individuals belonging to 7 dominant fish species (*Neogobius melanostomus* (Pallas 1814), *Mesogobius batrachocephalus* (Pallas 1814), *Gobius niger* Linnaeus 1758, *Scorpaena porcus* Linnaeus 1758, *Trachinus draco* Linnaeus 1758, *Mullus barbatus ponticus* Essipov 1927, and *Pegusa lascaris* (Risso 1810)) in order to analyze their trophic spectrum. The dominant food items in the gastro-intestinal tracts of the analyzed fish species were bivalves, gastropods, amphipods, chironomid larvae, decapods and different species of fish.

Introduction

Studies of feeding habits and diet are the key to understanding many aspects of the biology, ecology, physiology and behaviour of fishes (Rosecchi and Nouazi, 1987, Gonclaves and Erzini, 1998). Therefore the aim of this study is to investigate the feeding ecology of seven benthic fish species in order to elucidate their diet, the way they use different types of seabed and their niche characteristics (niche width, the degree of extra- and inter-specific overlap) with the purpose of their rational exploitation and protection.

Material and Methods

The present study was carried out in the Agigea-Eforie Nord area (the North-Western Black Sea). Fishes were sampled with a trap net placed at a depth of 9 m (Agigea) and 12 m (Eforie Nord) in 2008 and 2009. In order to determine the importance of each food category to the diet weight percent (%*W*), the frequency of occurrence (%*F*), the numerical dominance (%*N*) and the index of relative importance (*IRI*) were calculated (Rosecchi and Nouaze, 1987). Trophic interactions between species were estimated by their trophic niche breadth (Levins-Hulbert index) and dietary overlap (Pianka index)(Gomoiu and Skolka, 2001). In order to determine the niche breadth and overlap the EcoSim v7.0 software package was used (Gotelli and Entsminger, 2004).

Results

During the study the gastro-intestinal tracts content of 226 individuals of the round goby (*Neogobius melanostomus*), 227 individuals of the knout goby (*Mesogobius batrachocephalus*), 95 individuals of the black goby (*Gobius niger*), 212 individuals of the stripped mullet (*Mullus barbatus ponticus*), 133 individuals of the black scorpionfish (*Scorpaena porcus*), 136 individuals of the greater weever (*Trachinus draco*), and 141 individuals of the sand sole (*Pegusa lascaris*) were analyzed. The results showed that the analyzed species mostly preyed on bivalves (*Mytilus galloprovincialis*, *Mytilaster lineatus*, *Cerastoderma edule*, *Lentidium mediterraneum*), gastropods, amphipods, isopods (*Idotea balthica*), decapods (*Xantho poressa*), fish (gobiids, mullids), chironomid larvae and algae (*Ulothrix* sp., *Cladophora* sp.).

Trophic niche breadth for all the fish species ranged from 0 to 1 (Table 1). During the spring *N. melanostomus*, *M. batrachocephalus*, *S. porcus* and *P. lascaris* had a trophic niche larger than 0.5 which indicated a generalist type of feeding for these species. The same phenomenon was observed for the above mentioned species as well as for *M. barbatus ponticus* in summer. Almost all fish species presented a significantly broader trophic niche in spring and summer than in autumn.

Table 1. Niche breadth values for the benthic fishes of the Black Sea.

Species	Seasons		
	Spring	**Summer**	**Autumn**
Neogobius melanostomus (Pallas 1814)	0.661	0.55	0.297
Mesogobius batrachocephalus (Pallas 1814)	0.581	0.510	0.272
Gobius niger Linnaeus 1758	0.238	0.344	0.318
Mullus barbatus ponticus Essipov 1927	0.404	0.545	0.455
Scorpaena porcus Linnaeus 1758	0.541	0.591	0.477
Trachinus draco Linnaeus 1758	0.336	0.349	0.352
Pegusa lascaris (Risso 1810)	0.686	0.534	0.429

*the marked values prove a specialization of the species.

From the Table 2 it can be seen that the degree of niche overlap varied between seasons, but remained constant and very high between *N. melanostoms* and *M. batrachocephalus* (66.5%), *M. batrachocephalus* and *S. porcus* (70%), *M. batrachocephalus* and *T. draco* (83.5%), and between *S. porcus* and *T. draco* (69%).

Table 2. Niche overlap for the benthic fishes of the Black Sea.

	N.m.	***M.b.***	***G.n.***	***M.p.***	***S.p.***	***T.d.***	***P.l.***
N.m.	–	0.666	0.498	0.399	0.465	0.554	0.756
M.b.		–	0.455	0.289	0.699	0.837	0.071
G.n.			–	0.34	0.254	0.26	0.256
M.p.				–	0.356	0.173	0.411
S.p.					–	0.686	0.032
T.d.						–	0.137
P.l.							–

N.m.: Neogobius melanostomus, M.b.: Mesogobius batrachocephalus, G.n.: Gobius niger, M.p.: Mullus barbatus ponticus, S.p.: Scorpaena porcus, T.d.: Trachinus draco, P.l.: Pegusa lascaris

Discussion. Some species may be considered as generalists because they feed upon diversified prey and use in the same time the resources from different types of substratum (rocky, sandy or muddy), especially during the reproduction migrations. Other species may be considered as specialists because they feed upon limited types of resources offered by one type of substratum due to their less active mode of life and more limited reproductive migrations. Owing to these considerations the species such as *N. melanostomus*, *M. bachocephalus*, *S. porcus* and *M. barbatus ponticus* are regarded as generalists, whereas species like *G. niger*, *T. draco* and *P. lascaris* are considered as specialists. A high level of niche overlap is likely responsible for higher possibility for competition between species. However niche overlap does not indicate a competition unless it can be proved that there is a shortage of resources for a species or for both of them. Generally, in the near-shore waters, the food competition is constrained by a sharing strategy on a trophic, temporal and spatial scale.

References

Rosecchi, E., Nouaze, Y., 1987. Comparison de cinq indices alimentaires utilses dans l'analyse de contenus stomacaux. *Revue Travailles Insititut Peches Maritimes*, **49**: 111-123.

Goncalves, J.M.S., Erzini, K., 1998. Feeding habits of the twobanded sea brem (*Diplodus vulgaris*) and the black sea brem (*Spondyliosoma cantharus*)(Sparidae) from the south-west coast of Portugal. *Cybium*, **22**: 245-254.

Gotelli, N.J., Entsminger, G.L., 2004. *EcoSim: Null models software for ecology. Version 7*, Aquired Intelligence Inc. & Kesey-Bear, http://homepages.together.net/~gentsmin/ecosim.htm

Gomoiu, M.T., Skolka, M., 2001. *Ecologie. Metodologii pentru studii ecologice*. Ovidius University Press, Constanța. 170 p.

BIOINDICATOR FISH SPECIES IN SMALL RIVERS OF REPUBLIC OF MOLDOVA

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Small rivers ecosystems in Republic of Moldova at actual stage are strong fragmented, plugged and eutrophicated. Except this negative modification, their biota is in permanent pressing because of diverse and frequent discharges of antropic origin. As water is the only habit environment, in settled condition, fish species have no escape posibility. Sitting on the top of trophic pyramid, they are direct affected by that happened at inferior lavel and cumulative effect of polluted substance in superior link reflects the situation of the hole ecosystem.

On acount of different ecological valence, some eurybionte species proliphics in debased area, others, which have receded tolerance and high sensibility on habit area, become sporadic or disappear from this ecosystem.

This paper focuses on study about fish species and species association which can be used as bioindicators of environment quality in small rivers ecosystems from Republic of Moldova (Bac, Raut, Cubolta, Racovat, Cainari, Ciuhur, Cogalnic, Ciulucul de Mijloc, Vilia, Larga, Lopatnic, Copacianca, Draghiste).

We can mention that some species known as veritable bioindicators of environment quality, in some sectors, relative detached of small rivers and high polluted, have to adapted for surviving. Accordind to this, intensity value of limitativ factors in dinamics reach other uses. In those conditions speciation issues quicker and bioindicator species in small rivers from Republic of Moldova as: *bleak, gudgeons, ruffe, bitterling*, e.d. lick into shape different eco-forms. That is why except indicator species have to be studied and bioindicator associations, the structural-functional state of population and other important ecological parameters.

Quality environment estimation can be made not only with hyper-sensible species to area factors modification but also on hydrobiotop presence of some species repellent to pollution, serving as indicators of disadvantageous ecological situation. Yea bioinvasive phenomenon could be used in quality ecosystem evaluation of small rivers of Republic of Moldova.

As bigger is biotope diversity as richer is specifically diversity of it and its value is directly proportional with ecosystem stability state. In this context, analysis of small rivers ichtyocenosis from different sectors of Republic of Moldova demonstrate more diversity of bioindicator species (stone loach - *Barbatula barbatula*, species from *Gobio sp.* genus, ruffe - *Gymnocephalus cernuus,* bitterling - *Rhodeus amarus,* monkey goby - *Neogobius fluviatilis,* common dace – *Leuciscus leuciscus,* e.d.) in north zone of country. Also, meeting frequency, numerical abundance and constancy of these associations reach values much higher.

In category of ecosystems which are in way to eutophisation from all representative species and associations, *bitterling* is considered to be the best bioindicator. It is hardly ever met in strong polluted ecosystems and in non-eutrophic zones. Its biotope apparition can be considered as indicator of starting of eutrophication or de-eutrophication process. Its presence is indentified with bivalve mollusks presence (being an ostracophilous species) which active take part in process of biological water purification.

In this ecosystems frequently can be meet such species and association as: *pike-perch, european perch, racer goby and bleak*.

For ecosystems which are strong eutrophicated and antropical affected the most representative species are: *prussian carp* and *spined loach* which in this condition create durable and constant associations. Also, *european perch, spined loach, stone moroko* and *roach* are frequent met in zone unaffected by antropical factor, being species with high hydrobiotopic potential and with an exceptional valence value.

In some intense populated and industrialised zones could be observed obvious decrease of values of ichtyocenosis ecological indexes, fact that demonstrate esential disturbances in productional-destructional proces of biocenosis.

To conclude we mentioned that quality environment bioindication on species and association presence can be used as complimentar but not fundamental study. Investigation for this end of more hydrobionte groups, of different organisation levels, combining different analisys methods, will disclouse a result more convincing about functional state of biocenosis and of hole enviroment quality.

ASSESSMENT OF GENETIC VARIATION OF THE AZOV SEA GREAT STURGEON WITH A VIEW TO PRESERVING THIS BIOLOGICAL SPECIES

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Hydroelectric power stations built on the large rivers of the Ponto-Caspian basin in the middle of the twentieth century accounted for a dramatic drop of sturgeon species abundance because these constructions hindered the breeders' migration to the spawning grounds located in the upper reaches of the Basin rivers. Today the great sturgeon *Huso huso* as well as other twenty-four representatives of Acipenseriformes are considered among rare and vanishing species and included into the Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Raymakers, 2006) and Red Book of Russian Federation (2001).

We have studied the structure of this relict species and found it to be a complicated population system consisting of discrete subpopulations and strains (Berg, 1949; Podushka, 2003; Artyukhin, 2008). It is well-known that maintenance and restoration of such systems should not be restricted only by the use of a portion of the differentiated gene pool. The more varied the subpopulation structure is, the less possibilities exist to restore the whole by its separate parts (Altukhov, 2003).

The aim of the studies is to collect and analyze microsatellite markers in order to assess genetic diversity of the Azov and Caspian great sturgeon populations.

Materials and methods

We examined 76 individuals of great sturgeon caught in the Azov Sea and 50 individuals of the Caspian population.

Total DNA was isolated from a fin sample by the method of salt extraction (Aljanabi and Martinez, 1977).

At the preliminary stage of our studies we selected five polymorphic STR markers out of fourteen microsatellite loci for further genetic analysis of the great sturgeon. Nucleotide sequences of the primers were taken out from the published data (Zane et al, 2002; Henderson-Arzapalo and King, 2002; Welsh et al, 2003).

PCR products were separated in a 6% polyacrylamide gel (PAAG).

Results

Genetic typing of 126 individuals of great sturgeon from two populations revealed that An40; An20; Afug51; Afug41 and AoxD165 loci are polymorphic. The monomorphic loci such as Afug177; AoxD172; AoxD297; An16 can be used as specific markers.

In samplings of great sturgeon of different origin the character of allele frequencies' distribution is similar only in case of An40 locus, as to the other loci we observe statistically reliable differences in them (Table 1, test χ^2). The values of expected and observed heterozygosity associated with An40 tetraploid locus can be predicted as high vs. the other loci with a diploid set of alleles. On the whole the Azov population of great sturgeon is characterized by lesser values of genetic diversity parameters (average number of alleles per a fish; a set of alleles per a locus, and heterozygosity). Moreover, in the Azov Sea great sturgeon such a tendency is strengthened by deviation of the observed heterozygosity level (H_O) from the level of the expected heterozygosity (H_E), whereas in the Caspian fish these parameters are alike.

Table 1. The level of microsatellite variability of the Azov and Caspian great sturgeon populations

Locus	Sampling	L	N_a	H_O	H_E	Test χ^2 $p < 0,001$
An 20	Azov	5	1.72	0.648	0.688	55.13* (k=8, α=0.1%)
	Caspian	9	1.42	0.381	0.440	
An 40	Azov	10	3.3	0.971	0.996	6.96 (k=9, α=5%)
	Caspian	9	3.4	1.000	0.995	
Afug 41	Azov	11	1.77	0.649	0.716	29.86* (k=13, α=1%)
	Caspian	14	1.84	0.891	0.893	
Afug 51	Azov	3	1.49	0.486	0.568	50.12* (k=6, α=0.1%)
	Caspian	7	1.67	0.745	0.705	
AoxD165	Azov	2	1.25	0.243	0.349	284.91* (k=7, α=0.1%)
	Caspian	5	1.27	0.236	0.258	

Note: * – differences are reliable; N_a – average number of alleles per a fish; L – total number of alleles per a locus; H_e – expected heterozygosity; H_o – observed heterozygosity.

The absence of some rare alleles in all the loci of the Azov specimens can be explained by low abundance of the population. Characteristics of rare alleles in the genome of the Azov great sturgeon are shown in Table 2. In our opinion, the artificial reproduction of the Azov great sturgeon provokes the loss of some alleles and the increased frequency of other alleles. Genetic certification of breeders and controlled crossing will allow one to balance the process, and make the level of genetic variability and allele dispersion in STR loci of cultured great sturgeon population similar to the parameters of wild fish.

Table 2 . Characteristics of rare alleles in the genome of the Azov great sturgeon

Locus	Allele size range	Size of a rare allele, nucleotide pairs	Rare allele frequency q_{min}
An 20	143-175	159	0.069
An 40	134-170	134, 138	0.021
Afug 41	221-277	221, 249, 253, 261	0.017
Afug 51	242-250	242	0.069
AoxD165	176-184	184	0.236

Thus, fourteen STR loci were screened and five polymorphic markers (Afug41, Afug51, AoxD165, An 20, An40) were isolated. The STR loci Afug177, Afug177; AoxD172; AoxD297 and An16 were characterized by monomorphic diploid set of alleles. The highest polymorphism in the sampling studied was observed at the microsatellite locus Afug41, the lowest one was at the AoxD165 locus. STR analysis of five loci showed some decrease in the genetic variability of the great sturgeon population in the Azov Sea and an oppressed status of the species during more than a half century.

PROTECTIVE STATUS OF FISH SPECIES OF MIDDLE AND LOWER DNIESTER RIVER

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Red data book is the instrument to signalize to the government and the society about vulnerability of live nature. It could be efficient, when the State takes measures to prevent the species extinction, of ineffective if the document has been adopted only for the political reasons. It could be adopted on global, regional, national levels and in this respect the approaches could be different. The other differences could be linked with the approaches to different systematical groups. In accordance with IUCN, extinction is a chance process. The qualification of a species as having a high chance towards the extinction provokes its categorization as a such, and because the human pressure is raising, more and more species could be determined as having high chances for extinction. But the environment is changing and sometime the living conditions for concrete species improving, so we have periodically re-evaluate the status of populations. In accordance with IUCN, all taxa listed as Critically Endangered qualify for Vulnerable and Endangered, and all listed as Endangered qualify for Vulnerable. Together these categories are described as "threatened". The threatened categories form a part of the overall scheme. It will be possible to place all taxa into one of the categories (see Figure 1, www.iucn.org).

Regional Red Lists assist nations and regions in: determining the conservation status and trends of species; identifying species or ecosystems under greatest threat; informing conservation planning and priority setting; raising awareness of threatened species. A Regional Red List may be created by any country or region by following the clear, repeatable protocol. The process includes some steps. Among them are:

1. Collection of the known information on the species and its conservation status.
2. An assessment of extinction risk is made, using the IUCN Red List Categories and Criteria and the IUCN Regional Guidelines.
3. Public discussion with key local specialists has been done and corrections have been realised.
4. These assessments are then collated into a Regional Red List document.
5. A Summary Conservation Action Plan may also be created, detailing recommended conservation measures for each threatened species (see Figure 2, www.nationalredlist.org).

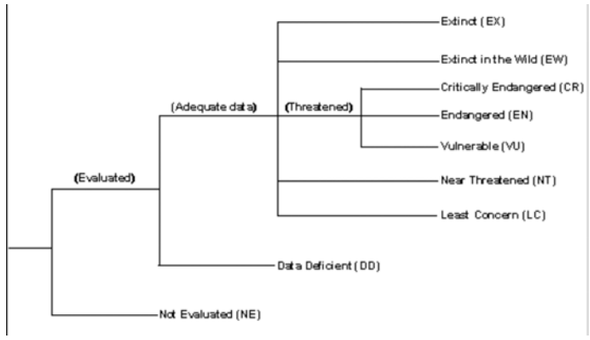

Figure 1. Structure of the categories of rarity

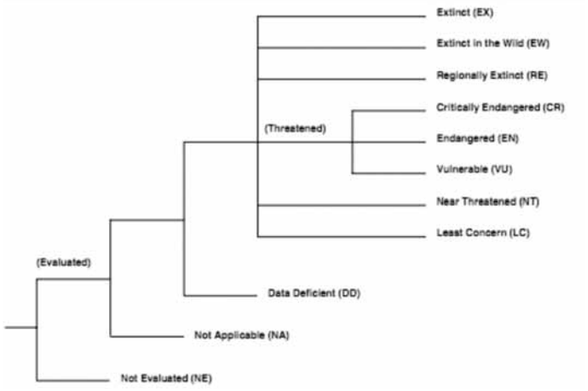

Figure 2. Classification of taxa on their vulnerability for national and regional RDBs, recommended by IUCN

Approaches to freshwater fishes have to have some specificity as distribution of freshwater organisms is linked with geographically separated water basins. The list of Law of Moldova on Animal Kingdom (1995) includes 16 species: *Lampetra mariae, Acipenser guldenstadti colchicus, Acipenser stellatus, Acipenser ruthenus, Huso huso, Barbus barbus borysthenucus, Barbus meridionalis petenyi, Rutilus frisii, Leuciscus leuciscus, Vimba vimba, Umbra krameri, Lota lota, Aspro streber, Aspro zingel.* Currently the national RDB of Moldova (2001) includes 13 species - *Acipenser guldenstadti colchicus*, *A.stellatus*, *Huso huso*, *Hucho hucho*, *Umbra krameri*, *Rutilus frisii*, *Leuciscus idus*, *Babrus barbus borysthenicus*, *B.petenyi*, *Lota lota*, *Zingel zingel, Z.streber* and *Eudontomyzon mariae.* Analysis of the current RDB species list of Moldova demonstrates that almost all RDB species belong to the objects of potential commercial or sport fishery. At the same time, the species with a short life circle, with exception of *U.krameri*, are absent in the list. At the same time, there are many predominantly anthropogenic factors which determine survival of fish populations. Main ones among them are: highly modified in the result of hydro construction the hydrologic regime; organic pollution dealing with communal, industrial and agricultural pollution; damming of the river and elimination of wetlands; biological pollution with alien species of fish and other hydrobionts; extraction of sand and gravel from the river bed.

The classification of rarity does not correspond to the current IUCN classification and includes categories on vulnerability:

Categories of species on rarity and vulnerability	Law of Moldova on Animal Kingdom (1995)	Modern IUCN classification
Extinct	Ex	EX
Extinct in the wild	-	EW
Regionally extinct	-	RE
Critically endangered	-	CR
Endangered	E	EN
Vulnerable	V	VU
Rare	R	-
Near threatened	-	NT
Rastockable tribes	Rt	-
Out of danger / Least concern	O	LC
Indetermined / Not evaluated	I	NE
Insufficiently known / Data deficient	K	DD
Not applicable	-	NA

Taking into consideration modern IUCN approaches to the categorization of species on vulnerability and new fish nomenclature and basing on own evaluations and a fresh literature data, we propose for the new 3rd edition of the Red Data Book of the Republic of Moldova to qualify fish species of the Middle and Lower Dniester in such way (Table):

Table. Proposed categories of vulnerability for fish species in the Middle and Lower Dniester River

Species	Proposed category	Species	Proposed category
Eudontomyzon mariae	CR	*Phoxinus phoxinus*	EN
Acipenser gueldenstaedtii	CR	*Ctenopharyngodon idella*	LC, ◄
Acipenser ruthenus	EN	*Pelecus cultratus*	EN
Acipenser stellatus	CR	*Tinca tinca*	EN
Acipenser nudiventris	CR	*Cobitis tanaitica*	LC
Huso huso	CR	*Cobitis elongatoides*	R
Anguilla anguilla	CR	*Misgurnus fossilis*	EN
Alosa immaculata	VU	*Sabanejewia baltica*	EN
Alosa tanaica	R	*Sabanejewia balcanica*	EN
Clupeonella cultriventris	R	*Barbatula barbatula*	R-VU
Rhodeus amarus	LC	*Silurus glanis*	R
Pseudorasbora parva	LC, ◄	*Esox lucius*	LC
Gobio sarmaticus	R	*Umbra krameri*	CR, ▼
Romanogobio kesslerii	VU, ▼	*Lota lota*	CR
Romanogobio belingi	VU	*Atherina boyeri*	LC
Barbus barbus	EN	*Gasterosteus aculeatus*	LC
Barbus petenyi	CR	*Pungitius platygaster*	LC
Carassius carassius	CR	*Syngnathus abaster*	LC
Carassius auratus	LC-R, ◄	*Cottus gobio*	R
Carassius gibelio	LC, ◄	*Cottus poecilopus*	VU
Cyprinus carpio	LC-R	*Lepomis gibbosus*	LC, ◄
Abramis brama	LC-R	*Gymnocephalus acerina*	R
Ballerus ballerus	EN	*Gymnocephalus cernua*	LC
Ballerus sapa	LC-R	*Perca fluviatilis*	LC
Blicca bjoerkna	LC	*Sander lucioperca*	LC-R
Alburnoides bipunctatus	EN	*Sander volgensis*	CR
Alburnus alburnus	LC	*Zingel streber*	CR, ▼
Alburnus sarmaticus	EN	*Zingel zingel*	EN, ▼
Leucaspius delineatus	LC	*Perccottus glenii*	LC, ◄
Leuciscus idus	EN	*Benthophilus nudus*	R
Leuciscus leuciscus	R-VU	*Caspiosoma caspium*	CR
Petroleuciscus borysthenicus	R-VU	*Knipowitchia longecaudata*	R
Rutilus frisii	VU-EN	*Mesogobius batrachocephalus*	R
Rutilus heckelii	LC-R	*Neogobius eurycephalus*	R
Rutilus rutilus	LC	*Neogobius fluviatilis*	LC
Scardinius erythrophthalmus	LC	*Neogobius gymnotrachelus*	LC
Squalius cephalus	LC	*Neogobius kessleri*	LC
Aspius aspius	R-VU	*Neogobius melanostomus*	LC
Chondrostoma nasus	VU-EN	*Proterorhinus semilunaris*	LC
Vimba vimba	VU	*Gobius niger*	R
Hypophthalmichthys molitrix	LC, ◄	*Platichthys flesus*	EN
Hypophthalmichthys nobilis	LC, ◄		

▼ - endemic species of Dniester and Danube; ◄ - alien species.

Proposed categorization have been realized for further discussion by key local specialists on national level for the next 3rd edition of the Red Data Book of the Republic of Moldova.

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DINOPHYTA ALGAE IN COMPOSITION OF PHYTOPLANKTON OF WATER ECOSYSTEMS OF REPUBLIC OF MOLDOVA

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Dinophyta algae identified in representative water ecosystems of the Republic of Moldova belong to class *Dinophyceae,* with two orders – *Gymnodiniales* and *Peridiniales* and two families – *Gymnodiniaceae* and *Peridiniaceae* (tab. 1). The species belong to 4 genera and are represented by a total number of 13 species and varieties, of which 10 have been identified in the last 20 years (1989-2009).

Table 1. Taxonomic spectrum of dinophyta algae in water ecosystems situated in hydrographic basin of Nistru and Prut rivers

Taxons	Nistru river		Dubăsari reservoir		Cuciurgan reservoir		Prut river		Costești-Stânca reservoir	
	1951-1988	1989-2009	1956-1988	1989-2009	1965-1988	1990-2009	1962-1983	1990-2009	1980-1983	1996-2005
CLASS DINOPHYCEAE	6	5	11	6	7	6	8	3	6	5
Order Gymnodiniales	1	2	1	1	2	2	2	1	2	1
Family Gymnodiniaceae	1	2	1	1	2	2	2	1	2	1
Genu s Gymnodinium	1	2	1	1	2	2	2	1	2	1
Order Peridiniales	5	3	10	5	5	4	6	2	4	4
Family Peridiniaceae	5	3	10	5	5	4	6	2	4	4
Genus Peridinium	2	0	4	1	1	1	3	0	2	1
Genus Glenodinium	2	2	5	4	3	2	2	1	1	2
Genus Ceratium	1	1	1	0	1	1	1	1	1	1

In Nistru river the dinophyta algae, represented by 5 species (*Gymnodinium aeruginosum* Stein et. Debl., f. *fuscum* (Ehr.) Stein., *Glenodinium quadridens* (Stein.) Schiller., *G. gymnodinium* Penard., *Ceratium hirundinella (O. F.M.) Bergh.),* were identified in 2003 in medial sector and in 1997, 2003, 2004 in lower sector**.**

În Prut river the diversity of dinophyfita decreased from 8 species identified in the period 1962-1983 to only 3 species (*Gymnodinium aeruginosum* Stein et. Debl., *Glenodinium gymnodinium* Penard., *Ceratium hirundinella* (O. F.M.) Bergh.) in the last years (1990-2009). Their number was reather low and varied between 0.01-0.02 mln. cells/l in Nistru river, as well as in Prut river, and the biomass varied between 0.03-0.6 g/m^3 in Nistru river and 0.1-0.4 g/m^3 in Prut river.

Dinophyta algae developed more frequent in paludous ecosystems, but their diversity was as low as in running water ecosystems.

Thus, **in Dubăsari reservoi** 6 species were identified, belonging to phylum *Dinophyta* (*Gymnodinium aeruginosum* Stein et. Debl., *Glenodinium berolinense* (Lemm.) Lind. var. *berolinense, G. quadridens* (Stein.) Schiller., *G. gymnodinium* Penard., *G.* sp. and *Peridinium cinctum* (O.F.M.) Ehr. var. *cinctum*), their number decreased in comparison with anterior study period by about 2 times.

The values of algae number varied within the limits 0,001-0,04 mln cel./l, and of biomass within 0,005-0,51 g/m^3 (fig. 1). The maximum value of the biomass was recorded in 2003, when in middle and lower sectors of the reservoir in summer and autumn periods the species *Glenodinium berolinense* (Lemm.) Lind. var. *berolinense, G. gymnodinium* Penard., *Gymnodinium aeruginosum* Stein et. Debl developed intensely. Later, starting with 2006 the quantitative parameters of dinophyta decreased until 2008, while in 2009 the algae weren't identified at all in the lake.

Dinophyta algae were present in phytoplankton composition of Dubăsari reservoir since the first years of its creation, but never developped in big number (0,003-0,91 g/m^3), thus having a low importance in the formation of lake productivity.

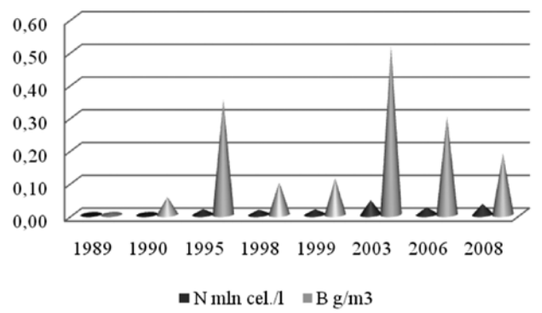

Figure 1. Number dynamics (N – mln cel./l) and biomass dynamics (B – g/m^3) of dinophyta algae in Dubăsari reservoir in period 1989-2008

In **Cuciurgan reservoir** the dinophyta algae were represented by 6 species – *Gymnodinium aeruginosum* Stein et. Debl., *G. fuscum* (Ehr.) Stein., *Glenodinium quadridens* (Stein.) Schiller., *G. gymnodinium* Penard., *Peridinium* sp. and *Ceratium hirundinella* (O. F.M.) Bergh.

The values of algae quantitative parameters were higher in the peiod 1991-1996, when in the upper sector of the lake in summer period the intense development of the species *Gymnodinium aeruginosum* occured. In this period the annual mean values of dinophyta number varied between 0,06-1,88 mln cel./l, and of biomass between 0,32-12,93 g/m^3 (fig. 2).

The species *Gymnodinium aeruginosum* was identified for the first time in Cuciurgan reservoir in 1973, first in low quantity in upper sector, then its biomass increased considerably and it spread till the lower sector of the lake [1].

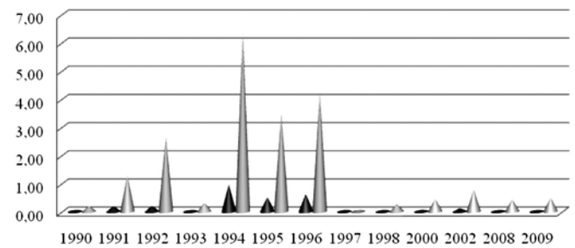

Figure 2. Number dynamics (N – mln cel./l) and biomass dynamics (B – g/m^3) of dinophyta algae in Cuciurgan reservoir in the period 1990-2009 (biomass value for 1991/10)

Starting with 1997 until 2009 the quantitative parameters of dinophyta algae decreased. They were represented mostly by the species *Gymnodinium aeruginosum* and its number didn't overpass the value of 0,5 mln cel./l.

In Costești-Stânca lake 5 species of dinophyta algae were identified. Four of them (*Gymnodinium aeruginosum, Glenodinium gymnodinium, G. quadridens* and *Ceratium hirundinella)* were registered in all studied ecosystems, while th species *Peridinium bipes* Stein is particular only for this ecosystem. From previously mentioned species the following weren't found in the last years: *Gymnodinium fuscum* (Ehr.) Stein. and *Peridinium wisconsinense* Eddy.

The values of algae quantitative parameters increased from 1996 to 1998, then decreased by about 2 times (fig. 3).

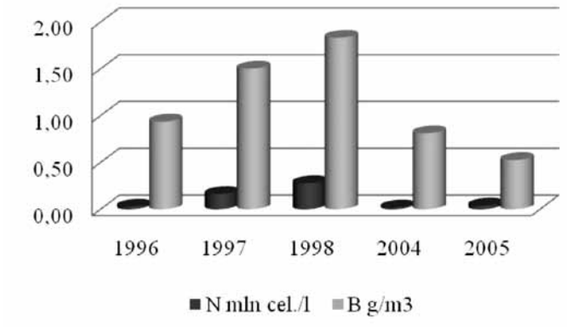

Figure 3. Figure 2. Number dynamics (N – mln cel./l) and biomass dynamics (B – g/m^3) of dinophyta algae in Costești-Stânca reservoir in the period 1996-2005

The highest persent in lake phytiplankton biomass formation had the species *Gymnodinium aeruginosum, Glenodinium gymnodinium* and *Ceratium hirundinella,* especially in summer period.

During the studies it was established that the algae from phylum *Dinophyta*, with rather low species diversity (13 species and varieties), inhabit the water ecosystems of the Republic of Moldova mostly in summer period. They have a reduced importance in formation of phytoplankton productivity, but periodically in Cuciurgan reservoir the species *Gymnodinium aeruginosum* provoke the phenomenon od water „flowering".

Bibliography

1. Шаларь В.М., Панфиле И.М., Грабко Н.И. Фитопланктон. В: Биопродукционные процессы в водохранилищах-охладителях ТЭС. Кишинев: Штиинца, 1988, с. 22-39.

THE CURRENT STATE OF THE IHTIOFAUNA BIODIVERSITY AND OF THE FISH POPULATIONS DENSITY VARIATIONS IN THE DIFFERENT AREAS OF THE DNIESTER RIVER

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The purpose of our research was the assessment of the current state of the ihtiofauna biodiversity and of the fish populations density variations on the middle and lower sectors of the Dniester River under the antropic press conditions.

As a result of scientific research carried out during the years 2006-2010 in the medial sector of Dniester River were identified 34 species and subspecies of fish that refers to 11 families, more numerous being the family Cyprinidae with 18 species, followed by families of Percidae- 4 species, Gobiidae - 3 species, Gasterosteidae - 2 species and families of Acipenseridae, Esocidae, Cottidae, Siluridae, Cobitidae, Eleotridae and Syngnatidae, with one species. In control fishery no were present so species such as Bighead carp, Silver carp, Grass carp, Ide, Burbot, Volga zander , Tench etc. From ecologically, ihtiofauna may be attributed to the complex of reofil-lymnofil belonging to typical reofils (Asp, European chub, Dace, Zingel, Barbel etc.) and typical limnofils (Carp, Gibel carp, Bream, Gudgeon, Spined loach etc.). Economic interest presents 9 species and subspecies of fish (Pike, Asp, Bream, Zander, Vimba, Barbel, Wels catfish, carp, Sterlet). Low economic value have 9 species (Roach, Gibel carp, European chub, Dace, Nose carp, White-eye bream, Rudd, Perch, White bream). The rest of the species (Gobies, Bleac, Gudgeon, Stickleback, Southern Stickleback ect.) there is not economic interest.

As a result of control fishery on the lower sector of Dniester River has revealed the presence of the 48 species and subspecies of fish allocated 12 families: Cyprinidae - 23 species; Gobiidae and Percidae - with 5 species, Clupeidae and Acipenseridae – with 3 species; Cobitidae and Gasterosteidae – with 2 species and families Siluridae, Atherinidae, Singnatidae, Esocidae and Centrarchidae - with one species. From ecologically, ihtiofauna may be attributed to the complex of reofil-limnofil belonging to typical reofils (Sterlet, Asp, Wels catfish, Kutum, European chub, Barbel, Vimba) and typical limnofils (Carp, Gibel carp, Bream, Pike etc.). Economic interest has 17 species and subspecies of fish - Sterlet, Shad, Pike, Carp, Tench, Asp, Bream, Bighead carp, Silver carp, Grass carp, Zander, Barbel, Vimba, Wels catfish etc.. Have a low economic value 8 species - Roach, Gibel carp, European chub, White-eye bream, Nose carp, Rudd, White bream, Perch. The rest of the species (Dace, Bleac, Gudgeon, Ruffe, Stickleback, Gobies, ect.) there is not economic interest.

Numerical analysis of the report of the species of fish has shown that in the ihtiofauna of medial sector dominates the Stickleback (9.0%), Perch (7.9%), Dace (7,0%), and Bleac (6.0%). Of fishery species are present Roach (5.1%), Pike (2.7%), Carp (1.3%), Zander (1.3%) and Bream (1.3%). Uncommon in were Asp (1,0%), Vimba (0,9%), Barbel (0.7%) and Wels catfish (0.05%). In the lower sector of Dniester River valuable species are present Gibel carp (6.5%), Bream (5.4%) and Roach (5.0%). Other species such as Shad (2.1%), Zander (1.6%), Asp (1.2%), White-eye bream (1,6%) and Nose carp (1.0%) are less common in catches. Rarely found in the catches have been Silver carp (0.8%), European chub (0.7%), Carp (0.6%), Bighead carp (0,4%), Barbel (0.2%), Wels catfish (0.3%), Pike (0,3%), Zingel (0.2%), Sterlet (0,1%), Vimba (0,1%) and Grass carp (0,1%). Of species which do not concern economic, dominant in the ihtiofauna have been Bleac (14.0%), Belica (8.6%) and Gudgeon (6.5%). At the same time has been registered extension areas and numerical values increase of economic not concern species so far (Belica, Stickleback, Southern Stickleback, Big-scale sand smelt, Pumpkinseed sunfish).

Analysis of population density and their variations have demonstrated that at all medial sector of Dniester River populations of Pike, Roach, Perch and Dace, Rudd, Southern Stickleback, Stickleback, Bleac and some other species without economic value has numeric values increased. Other groups of species populations (Carp, Zander, Gibel carp, Bream, Asp) have a redused numeric values on nominated sector, which increased gradually as they approach the accumulation Lake Dubasari. Group a third constituent species encountered less often, whose practical numeric values cannot be estimated because of their frequency reduced catches (Sterlet, Kutum, Wels catfish, Nose carp, Vimba, Barbel).

As a result of scientific research were highlighted species of fish that have numeric values at all lower sector of Dniester River - Pike, Perch and Ruffe, Bleac, with some other species without economic value.

Populations of White-eye bream, Roach, Gibel carp, Bream, Asp and Rudd are permanently present in catches at all length of the lower sector, but the density is great as you approach the Dniester Liman (subsector Olăneşti-Palanca). The populations of other species (Carp, Wels catfish, Topmouth gudgeon) have a redused numeric values through the subsector Dubasari -Vadul lui Voda, which increase gradually as they approach the Dniester Liman. Another group of species such as Dace, Barbel, Belica, Stickleback, Southern Stickleback and Zingel are found more frequently in the immediate vicinity of the dam of accumulation Lake Dubasari, but as you approach the Dniester Liman they are becoming increasingly rare. It should be noted that in recent years have expanded significantly the areas of Azov shad, Big-scale sand smelt and Pumpkinseed sunfish. If during the previous years Azov shad and Pumpkinseed sunfish lives in only Liman, now the area of distribution has extended upstream, forming large groups during replication in the immediate area downstream of the dam of Lake Dubăsari.

The data obtained shows that in ihtiofauna of the medial and lower sectors of Dniester River valuable species (Kutum, Barbel, Tench, Wels catfish) and those included in the Red Book (Starry Sturgeon, Russian Sturgeon, Sterlet, Barbel and Zingel) have become rare and occur in catches in very small amounts. Other species such as Europien hausen, Crucian carp, Volga zander, European Mudminnow and Ide were not present in the catches and therefore lies at the limit of disappearance. Have reduced the strength of such species such as Carp, Bream, White-eye bream, Asp and Zander. On the other hand, it was intensified the domination of the populations of species with low economic value (Rudd, Perch, White bream) and without economic value (Bleac, Southern Stickleback, Stickleback, Ruffe, Gudgeon etc.) in these ecosystems.

Analysis of the structure of the ihtiofaunei medial and lower sectors of Dniester River has shown that over a year and is the obvious changes of specific numerical values and diversity of species of fish in the sectors investigated, which confirms that ihtiofauna like all ecosistema Dniester is in a process of cardinal changes. In the present situation of ecological trend appeared to reduce the numerical values of valuable fish species (particularly of reofil species) and the progressive increase of fish without economic value. For example, currently in the category of species encountered frequently crossed species previously rarely encountered: Dace, Belica, Southern Stickleback and Stickleback. It should be mentioned that 4 species now found commonly in catches (Bullhead, Amur sleeper, Topmouth gudgeon and Pumpkinseed sunfish) in the past generally have not been reported in the medial and lower sectors of Dniester River .

ECOLOGICAL-TAXONOMIC STUDY OF AGUATIC OLIGOCHETES IN THE REPUBLIC OF MOLDOVA

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In the hydrographic basins, the taxonomic group of the aquatic oligochetes is the most spread in the hydrobiological zoocomplex. Generally, the hydrobiont organisms, inclusive aquatic oligochetes fauna in the hydrographic ecosystems of the Republic of Moldova, suffered qualitative- quantitative changes during last years as a result of waters pollution by the chemical, physical pollutants, pathogen bacteria, industrial rezidues, domestic, agricultural, biological wastes, which being discharged into hydrografic networx affects hidrofauna. The aim of investigations is to bring into evidence ecologo-faunistic of the aquatic oligochytes in the hydrografic basins of the R.of Moldova. Investigations were carried out in the hydrographic basins of the rivers Nistru, Prut, barrage lakes, rivers, fishponds, rivulets from the forest ecosystems. To bring inito evidence the taxonomic groups of aquatic oligochytes the common hydrobiologic methods of Jadin, Cecanovschi etc. were used.

In the frame of these investigations the fauna of aquatic Oligochytes in hydrographic biogeonosos of the R of. Moldova was studied, which consists of following taxons.

Ord.Haplotaxida.
Sord.Haplotaxina.
Suprafam.Tubificoidea.
I.Fam.Tubificidae.
1.Subfam.Tubifinae.
1.*Tubifex tubifex* Lamarck 1773
2.*T .ignotus* (Stole 1886)

3.*T. filum* Mich .1889
4.*T. insignis* (Last) 1924
5. *T. nevaensis* (Last) 1924
6.*Limnodrilus hoffmeisteri* (Claparede, 1862)
7.*L . helveticus* (Piguet 1913)
8.*l. profundcola* (Verrill) Brinkhurst,1871)
9.*L.claparedeianus Ratzel,1868*
10. *L. udekemianus* (Claparede), 1862
11.*L .newaensis* (Michaelsen) 1902
12.*Isochaeta virulenta* (Piguet 1913)
13.*Ilyodrilus hammoniensis* (Michaelsen) 1901
14. *I .vejdovskyi* Hrabe,1941
15.*I. moldaviensis moldaviensis* (Vejdovsky et Mrazek,1902)
16. *Aulodrilus limnobius* Bratscher,1899
17.*A. pluriseta* (Piguet,1906)
18.*Rhycodrilus coccineus* (Vejdovsky,1875)
19.*Psammoryctides albicola* (Micahaelsen 1901)
20.*Ps.moravicus* Hrabe,1934
21.*Ps.barbatus* (Grube 1861)
22.*Potamothrix bavaricus* (Oschmann / Brinkhurst,1913)
23.*P.isochaetus* Hrabe,1934
24.*P.vejdovskyi* (Hrabe)Brinkhurst,1941
25 *Peloscolex velutina* (Grube)Ude,1873
26 .*P.speciosus* **Hrabe,1931**
2.Subfam.Rhyacodrilinae Hrabe,1963
27.*Rhyacodrilus falciformis* (Bretscher,1901)
3. Subfam.Branchiurinae Hrabe 1966
28..*Branchiura soverbyi* Beddard,1892
II. Fam.Naididae
4.Subfam Chetogastrinae
29.*Chetogaster diastrophus* (Gruithuesen)
30.*Ch.setosus* Svetlor,1925,Vejdovskyi,1828.
31.*Ch.langi* Bretscher,1896
32.*Ch.diaphanus* (Gruithuesen) Orsted,1828
33.*Ch.limnaei* Baer,1827
34.*Amphichaeta leydidii* Tauber,1879
5.Subfam.Naidinae Lastockin1924
35.*Spercaria josinae* (Vejdovskii) Sperber,1883
36.*Uncinais uncinata* Levinsen,1842
37.*Nais communis* Piguet,1906
38 *N. simplex* **Piguet,1906**
39.*N.bretscheri* Michaelsen,1899
40.*N.barbata* Muller,1773
41.*N.psudobtusa* Piguet,1906
42.*N.behningi* Michaelsen,1923
43.*Slavina appendiculata* (d 'Udekem) Vejdovsky
44.*Vejdovskyella comata* (Vejdovsky) Michaelsen,1883
45.*Stylaria lacustris* (Linne) Johnston, 1767
46.*Piguetiella blanci* Piguet) Sperber,1906
47.*Dero digitata* (Muller) Grube,1773
48.*D. obtusa* d'Udekem,1855
6.Subfam.Pristininae Lastockin,1924
49.*Pristina rosea* (Piguet)Michaelsen,1906
50.*P.bilobata* (Bretscher)Michaelsen,1903
51.*P.aeguiseta* Bourne,1891
52.*P.longiseta* Ehrenberg,1828
III.Fam. Aeolosomatidae
53.*Aeolosoma hemprichi* Ehrenberg,1828
54. *A.heableyi* Beddard,1888
55. A.tenebrarum Vejdovsky,1884
56.*Rheomorpha neisvestnovae* Lastockin 1953
57. *Hystricosoma chappuisi* Michaelsen,1926
7.Subfam.Paranaidinae
58.*Paranais litoralis* (Muller,1784)
59.*P.friei* Hrabe,1941
IV.Fam.Enchytraeidae
60.Proppapus volki Michaelsen,1915
61.Henlea ventriculosa (Udekem,1854)
62.H.stolli Bretscher,1900
63.Fridericia callosa (Eisen , 1878)
64.F.bulbosa (Rosa,1887)
65.F.zykofi Vejdovsky,1903
66.Enchytraeus albidus Henle,1837
67.E.buchholzi Vejdovsky,1879
68.Lumbricillus lineatus (Muller),1771
69.Marionina argentea (Michaelsen,1889)
70.M.riparia (Bretscher,1899)
71.M.lobata(Bretscher,1899)
72.M.sphagnetorum (Vejdovsky,1877)
73.M.glandulosa (Michaelsen,1888)
V.Fam. Lumbriculidae.
74.Lumbriculus varegatus (Muller,1773)
75.Lamprodrilus pygmaeus Michaelsen,1901
76.L.isoporus Michaelsen,1901
77.L.nigrescens Michaelsen,1903
78.L.semenkewichi Michaelsen, 1901
79. L.pallidus Micahaelsen,1905
80.Teleuscolex korotneffi Michaelsen,1901
81.Agriodrilus vermivorus Michaelsen,1905
82.Trichodrilus pragensis (Vejdovsky)
83.Bythonomus subcarpaticus Hrabe,1929
84.Rhynchelmis limosella Hoffmeister,1843
85.R.vejdovsky Hrabe et Cernosvitov,1925
VI. Fam. Branchiobdellidae
86.Branchiobdella parasita Henle,1835
87.B.astaci Odier,1823
88.B.pentodonata Whitman,1882
VII. Fam.Lumbricidae.
89.Eiseniella tetraedra f.typica (Savigny,1826)
90.Allolobophora chlorotica (Sav. 1826)
91.A.dubiosa (Orley),1880
92.A.antipai (Mich.)1891
93.A.oculatus Hoffmeister,1843
94.A.rosea (Sav.)1826
95. Dendrobaena octaedra (Savigny,1826)
96.Octodrilus transpadanus (Rosa)1884
97.Octolasium lacteum (Orly)1885(Savigny,1826)

Bibliography

Diaconu, I.Studiul ecologic al unor populații de Oligochete din Delta Dunării. Rez. Tezei de doctorat. Univ. București,1986.

Hrabe ,S.Oligochaeta.2 Limicola – Zoologi. Iceland 2 (20b),1952,pp.1.10. Toderaș,I. Modelarea matematică și pronosticarea secun-dare în ecosistemele acvatice Chișinău, Știința, 1999-91p.

Ярошенко ,М.Ф. Олигохеты водоемов бассейна реки Днестр.1966

INVESTIGATION OF DISTRIBUTION, MIGRATION AND THE ROLE OF TRACE ELEMENTS IN AQUATIC ECOSYSTEMS

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The researches on trace element migration is considered to be today one of the topical interest in modern hydrobiology, ecology and hydrochemistry and has a great theoretical and practical significance. The development of the theory on freshwater ecosystem functioning is impossible without a proper understanding of the processes of chemical elements migration.

The above mentioned directions of study are very important for Moldova, taking in account that the main aquatic arteries of the country– Prut and Dniester rivers have a transboundary position, flowing from Ukraine and passing along Ukraine, Moldova and Romania. The cooling reservoir Cuciurgan and storage reservoir Costeshti-Stinca are also border reservoirs and have a complex destination.

Dams were built on both Dniester and Prut rivers, and important industrial centers of Ukraine, Moldova and Romania were concentrated here and as result, the river water quality depends on human impact in these regions, as well as on applying the environmental protection methods. The elaboration of regulations and protection methods for improving the water quality should be based on scientific achievements and knowledge on processes of migration and distribution of chemical elements occurring in freshwater ecosystems.

The current complex investigations, carried out according to well-established methods, allowed us to find the main patterns of the dynamics and migration of 16 trace elements in the Dniester and Prut rivers, affected by natural and anthropogenic factors. In premiere, using a polyfactorial analysis approach, the quantitative effect of main factors (water debit, amount of suspended matter, volume of discharged wastewaters, amount of pesticides and fertilizers used for agricultural purposes in Moldova, temperature values, pH etc.) on the dynamics of content and distribution of trace elements in water, suspended matter, silt sediments of rivers and reservoirs was revealed. Also, for the first time, the functional dependence of different migration forms of trace elements and their distribution within suspension fractions of aquatic sediments on their granulometric and chemical composition was studied. The geochemical mobility was appreciated and the values of the coefficient of aquatic migration of trace elements, which depends on the physico-chemical processes of denudation, were calculated.

The main accumulation patterns in aquatic plants and invertebrates were analyzed. In fish the aspects of accumulation of trace elements in tissue and organs were investigated at different ontogenetic stages and in regard to trace element content in water. Moreover, the parameters of the functional dependence between accumulation level of trace elements in invertebrates and their content in water, silt sediments and food were calculated. These results were used to assess the suitability of widespread species of hydrobionts as biomonitor organisms, and to establish the level of trace element pollution in aquatic ecosystems.

Many experimental investigations, as well as long-term field observations, allowed us to deeply analyze the effect of trace elements on production and destruction processes, on growth and development of fish at early stages of ontogenesis and to appreciate the buffer capacity of freshwater ecosystems. These results were useful for the elaboration of a new method of evaluation of the aquatic ecosystem status.

The multianual dynamics of the content of the majority of trace elements in water and suspended matter (mg/l) was dependent on water debit (Q, m^3/s), and suspended matter (S, mg/l). For exemple, for Dniester river these relationships are described by the equations:

Al = 0.012*Q + 0.023*S –0.8, R=0.84;
Ti = 0.029*Q + 0.018*S –1.1, R=0.89;
Zn=0.158*Q + 0.224* S-14.4 , R=0.89;
Ni = 0.598*Q +0.006*S –11.3, R= 0.85.

The discharged industrial wastewaters contribute to the freshwater pollution with Ni, Zn, Cu, Ag and Cd (r=0,73) and change the ratio of dissolved and suspended forms of trace elements, this being characteristic especially for Chisinau, Bender, Tiraspol, Soroca, Rybnitsa, and Cahul sites during the low water period. The use of fertilizers and pesticides for agricultural purposes affects directly the dynamics of Cu, Zn, Mn and F in aquatic systems (r=0,70-0,92), and the pollution is intensified by the dismembered relief, the peculiarities of rainfall and intensive erosion processes. All these led to a continuous increase in trace element content downstream the rivers.

The polyfactorial analyses was useful for finding the quantitative contribution of the main factors, such as water debit (Q, m^3/s), suspended matter (S, mg/l), amount of fertilizers and pesticides used in agriculture (P, t/yr), volume of discharged wastewaters (R, mln m^3/yr) to the dynamics and distribution of trace elements in water, suspended matter, water sediments. These relationships for the concentration of Zn, Cu and Ni in water (mg/l) of the Dniester river are described by the equations:

Zn= 0.370* Q + 0.0897 * P + 0.007 *R, R=0.99;
Cu=0.02 * Q + 0.0021 * P+ + 0.068 * R – 28.9, R = 0.98;
Ni=1.6 - 0.001 * Q + 0.080 * R + 0.021 * S, R=0.90;

The Moldavian Hydropower Station polluted the water of cooling reservoir with F, V, Mo, Ni, Cd and Mn, and the water sediments - with Pb, Zn and Cu, whose concentrations depend directly on the amount of burned fuel (r=0,76-0,97). The activity of the station has decreased during the last five years, as fuel was used the natural gas and, as consequence, this led to a decrease in trace element emissions and the pollution of water occurs from silt.

The building of hydrotechnical constructions on the rivers lead to changes in the ratio of dissolved and suspended forms of trace elements. The concentration of suspended forms decreased with 20-70% downstream the dams and in storage reservoirs the intensification of sedimentation processes occurred. At the same time, in the rivers, a dependence was kept between the geochemical mobility of trace elements and water debit and the amount of suspended matter (r=0,77-0,97). The suspended matter and water sediments from rivers and reservoirs are highly enriched with trace elements, the level being higher than in bed rocks and soils of the region. In adsorbed complexes, easily soluble carbonates and amorphous hydroxides of Fe and Mn, are concentrated 56-78% of trace elements bioavailable for hydrobionts. As a pioneering work, a functional dependence of the dynamics of different migration forms of trace elements and their distribution within the fractions of suspended matters and sediments on the amount of clay particles and organic matter was established (r=0,78-0,99).

The migration of trace elements within the system „water-suspended matter-water sediments" occurred from up to down, with few exceptions in the Cuciurgan reservoir, where an opposite situation was observed. High values of geochemical mobility, of aquatic migration coefficients and the ratio of the real to theoretical trace element input reveal the intense processes of denudation and errosion in Dniester and Prut rivers.

Water sediments are the most stable compounds of freshwater ecosystems. The concentration of Zn, Cu, Pb, Ni, Mo and V in silt was 2-7 times higher than in the soil. The highest concentrations of trace elements were found in Cuciurgan reservoir, whiles the lowest - in Dnester and Prut rivers. A direct dependence of the content of trace elements in silt on clay particles with a diameter smaller than 0,01 mm was found (r=0,86-0,97).

The determination of the tolerable and optimal limits of trace elements in the environment is of high importance. These limits are usually affected by the regional characteristics of ecosystems. Taking into account the above-mentioned statement, a number of experimental studies were carried out in rivers and reservoirs of Moldova. Firstly, the effect of trace elements on production and destruction of organic matter was studied, taking into account that these processes are the most important links for matter cycle and energy flux and are essential for ecosystem functioning. Secondly, the effect of trace element content on highly valued industrial species of fish in early ontogenesis was studied. These species are considered to be the most vulnerable steps of the food chains.

The purpose of these studies was to identify the optimal and critical concentration limits of trace elements in Dnester and Prut rivers, Dubasari, Costesti-Stinca and Cuciurgan reservoirs. Data analyses demonstrated that in all freshwater ecosystems, the same patterns work concerning the effect of trace elements on phytoplankton production and destruction of organic matter and most of them are described by polynoms of the 2-4 categories. The undertaken researches allowed us to assume that such trace element contents which do not oppress the production and destruction processes can be considered as ecologically admissible and according to these values the water buffer capacity of ecosystems can be appreciated. The concentrations of metals, which cause the sharply decreased of production and destruction processes, were also critical for fish growth and development. The experiments on *Dreissena sp.* demonstrated that those metal concentrations which were critical for production and destruction processes led to a sharp increase in accumulation level in the soft tissue of these mollusks.

Although this evaluation system of the status of freshwater ecosystems has many drawbacks, we consider it more objective than that which was based on the comparison of the content of trace element in water with the established MAC.

The aquatic plants are metal macroconcentrators and they can be used as effective biomonitor organism in biomonitoring programs; they play the role of water filtrators, but also can be secondary sources in water pollution. The contents of many trace elements in aquatic plants were highly correlated with their contents in water: r=0.87-0.91. The dynamics of trace element accumulation depends on seasonal factors.

The study on the dynamics and mechanisms of trace element accumulation in the aquatic invertebrates revealed a high dependence on their body weight. These correlations were calculated not only for individual species, but also for the whole taxonomical groups of hydrobionts. Aquatic animals play an important role in migration of trace elements in freshwater ecosystems, because they represent an intermediary step in transferring the trace elements into the food chains and they are more sensible to water pollution than the plants and form many ecological complex links.

THE ACCUMULATION AND THE INFLUENCE OF TRACE ELEMENTS ON GROWTH AN DEVELOPMENT OF FISH DURING EARLY ONTOGENESIS

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The research of trace element accumulation in fish organs and tissues is undertaken in different directions. One of them focuses on the study of trace element accumulation capacity of aquatic organisms, another – on trace element impact assessment on the growth and development of fish during ontogenesis and establishment of the main factors that influence accumulation of chemical elements in fish.

The goal of this research was to investigate the accumulation dynamics of trace elements (Cu, Zn, Mn, Co, Ni, Mo, V, Pb, Cd etc.) in organs and tissues of *Cyprinidae* and *Percidae* fish from the main aquatic ecosystems of Moldova and to establish the influence of trace elements on growth and development of fish during ontogenesis. Such dominant species of ichthyofauna of freshwater ecosystems of Moldova of *Cyprinidae* and *Percidae* families were used in the current investigation: *Cyprinus carpio, Carassius auratus gibelio, Rutilus rutilus heckeli, Abramis brama, Aristichthys nobilis, Hypophtalmichthys molitrix, Ctenopharyngodon idella, Stizostedion lucioperca, Perca fluviatilis)*. Besides their dominance among other fish groups, cyprinids are of the main interest in industrial fish farming.

The experiments were carried out with eggs, larvae and fish fry in aquariums, reproduction installations and fish tanks placed in fish ponds. In order to investigate the dynamics of trace element accumulation at early ontogenetic stages of fish (*Cyprinus carpio*, *Aristichthys nobilis, Hypophtalmichthys molitrix, Ctenopharyngodon idella*), samples of eggs were collected immediately after fertilization, at the stage of the formation of the blastodisc, morula, blastula, gastrula, at the beginning and end of organogenesis and immediately after egg hatching.

The concentration of trace elements in fish eggs and larvae varies within wide limits. During the period which follows egg fertilization and the end of organogenesis a gradual increase in trace element concentration has occurred. The maximum concentrations of biologically important trace elements (Mn, Cu, Zn, Co, Mo, Fe, Ni) were observed at the stage of embryo rotation, just before hatching. Even though there was a constant increase in trace element concentration at the beginning and end of embryogenesis stages, steady oscillations could also occur.

It is important to mention that the concentrations of Mn, Zn, Co, Cu, Mo, Ni showed an increase by leaps, however at the stage of blastula-gastrula their concentration reached the level which was two times higher than in unfertilized eggs. A gradual increase in the dynamics of iron content occurred during gastrulation stage with a steady increase at the end of gastrulation-beginning of organogenesis. During hatching and the following 2-3 days after it, the concentration level of most trace elements was minimal, due to the evacuation of accumulated trace elements (50-90%) together with the membrane and periviteline liquid.

Concentration of Cd, Pb and Sr in the water from the incubation section was insignificant and consequently the level of these elements in fish eggs was also low, close to analytical zero. The dynamics of accumulation of these elements was investigated under conditions of aquariums, by adding these elements in water in concentrations with no toxic effect on egg development (Pb - 3 ug/l, Cd - 0,1 ug/l, Sr - 5 ug/l). These experiments showed that concentration of Pb, Cd and Sr in fertilized eggs increased insignificantly, some effect was observed only at the gastrulation stage, but a steady decrease up to analitical zero occurred at the hatching stage. The analysis of egg membrane after hatching indicated there an accumulation of these metals. This data allowed us to conclude that the membrane served as a protective layer for embryo from the penetration and accumulation of chemical elements during embriogenesis.

Immediately after fertilization, an intense accumulation of trace elements occurs in fish eggs, oscillating within large limits. In the majority of cases a direct correlation (r>0,88) on the dynamics of trace element content in fish eggs and water was observed. The experimental research on the influence of Cd, As, Cr, and Cu+Zn+Mn, Co+Zn complexes on the development of cyprinid eggs and larvae allowed us to conclude that Cd, Cr and As are toxic for egg development even at low concentrations of 10 ug/l, while Cu+Zn+Mn and Co+Zn complexes had stimulatory effects. Thus, the control incubators with *Cyprinus carpio* had a hatching rate of 78-89%, those with Cd treatment at 10, 25 and 50 ug/l - up to 53-60%, 44-47% and even 8-3%; those with Cr at 10 ug/l and 25 ug/l – the hatching rate was 5-9% and 1-3 %, those with As (10 ug/l and 25 ug/l) - 3-5% and 0-2 %.

The phytophagous species showed lower hatching rates – as example, for *Ctenopharyngodon idella* this percentage was 46% in control incubators, 30%, 20% and even 0% in those with Cd treatment (10 ug/l, 25 ug/l and 50 ug/l) and only in those with Cr and As the eggs perished during the first stage of organogenesis. In the experiments with spawn of *Hypophtalmichthys molitrix* a hatching rate of 81% was observed in control incubators, while in those with Cd treatment the hatching rate was lower – up to 50%, 32% and 7%, respectively. In the samples treated with As and Cr there was a mass die off of eggs at the end of gastrulation – beginning of organogenesis.

The trace element complex Cu+Zn+Mn and Co+Zn concentrations which do not exceed 50 ug/l had an opposite effect on egg development of *Cyprinus carpio, Aristichthys nobilis, Hypophtalmichthys molitrix* and *Ctenopharyngodon idella,* the percent of viable embryo increased with at least 18-35%. The procedure of the utilization of cobalt+zinc complex will be approved and proposed in the future for patenting, having a good potential for improving reproduction and growth efficiency of fish under industrial production. The procedure of Cu+Zn+Mn application has been already protected by an invention patent [Zubcov E. at all, 1999].

The results of the current investigations indicated that the content of trace elements in fish fry belonging to the same age group and being collected from Cuciurgan and Dubasari reservoirs and Falesti fish ponds reflects evidently the dynamics of these elements in freshwater ecosystems. The maximum concentration of Mn was of 3,0 ug/g wet weight, Ni - 2,4 ug/g, Pb – 1,1 ug/g, Mo - 2,2 ug/g, V- 2,1 ug/g, Cu - 2,9 ug/g, Zn - 32 ug/g, Cd - 0,25 ug/g, Cr - 0,54 ug/g wet weight and they were observed in fish fry of Cuciurgan reservoir. The minimum concentrations of Zn (13 ug/g wet weight), Mn (1,5 ug/g), Cu (0,9 ug/g) and Mo (0,2 ug/g) were observed in Dubasari reservoir, while of Ni (1,0 ug/g wet weight), Pb (0,4 ug/g), V (0,3 ug/g), Cd (0,1 ug/g) and Cr (0,20 ug/g) - in Falesti fish ponds. The concentration in water of Ni (8,1 ug/l) and Pb (6,4 ug/l) in Cuciurgan reservoir was two times higher, of Cd (3,2 ug/l) – around four times higher, of V (9,4 ug/l) and Mo (14,5 ug/l) – 9-14 times higher than in Dubasari reservoir and Falesti fish ponds.

The experimental research has also revealed that concentrations of 10 ug/l and above of Cd, As and Cr had a negative impact on fish fry. When adding a concentration of 25 ug/l in water, the fry of *Cyprinus carpio* and phytophagous species (15 days old) had decreased their nutrition rates. During the ten days of exposure a lethal effect has occurred, which accounted for 56-78 % individuals in the case of As and Cr exposure and 43-54 %- of Cd one. The percentage of dead fish in control was quite low – only 3-5 %.

Therefore, the dynamics of trace element accumulation during early ontogenesis in fish is conditioned by the age patterns, physiological needs of fry for one or another element and of a direct dependence on environmental conditions.

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PALAEOZOOLOGY

EARLY PLEISTOCENE DEER *CERVUS NESTII* (CERVIDAE, MAMMALIA) AND THE EARLIEST DISPERSAL OF THE GENUS *CERVUS* (SENSU STRICTO) IN WESTERN EURASIA

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Cervus nestii (Azzaroli, 1947) is a rather small-sized (estimated body mass ca. 70 kg) cervid characterized by four-pointed thin antlers terminated with a simple fork oriented in the frontal plane, simple P_4, and comparatively long pedicles. This deer is known from Late Villafranchian (Early Pleistocene) of Upper Valdarno (Italy). Azzaroli (1947) originally regarded *C. nestii* as an ancient fallow deer and described as *Dama nestii nestii*, keeping separately at a subspecies level from the "advanced" form *D. nestii eurygonos*[1] (Azzaroli, 1947). Later, Azzaroli (1992) designated *Dama nestii nestii* as a type species of a new genus *Pseudodama*, which was considered close to the modern genera *Axis* and *Dama*. Azzaroli (1992) attributed to *Pseudodama* some old small-sized species like "*Cervus*" *pardinensis*, "*C.*" *rhenanus* (="*C.*" *philisi*), "*C.*" *perolensis* and two new species *P. lyra* and *P. farnetensis*. De Vos *et al*. (1995) ascribed the species with three pointed antlers (*pardinensis* and *rhenanus*) to the genus *Cervus*, while the species with four-pointed antlers (*nestii* and *farnetensis*) are retained to belong to the genus *Pseudodama*. Pfeifer (1997) regarded Azzaroli's *Pseudodama* as a subgenus of the genus *Dama*, taking in consideration mostly the morphology of postcranial bones. Di Stefano & Petronio (1998), using the postcranial morphology as an important argument, created a new genus *Euraxis* with type species *Dama nestii nestii* (a synonym of *Pseudodama*) for the Villafranchian small-sized deer and suggested their close relationship to the actual *Axis*. Croitor (2001) restricted the genus name *Pseudodama* only to the type species. The cranial morphology is essential for cervid genus definition and understanding of systematical position (Flerov, 1952). The almost complete skull IGF 243 (Museum of Geology and Paleontology, Florence) of *C. nestii* from Figline (Italy) is particularly interesting, since it brings important morphological arguments revealing the systematical position of the "*Dama*-like" deer from Upper Valdarno. Unlike *Dama*, *C. nestii* is characterised by a rather long and little flexed braincase with flat parietal bones, the comparatively long and some-what sloped backward from the face pedicles, the relatively long face with particularly elongated orbito-frontal part, the narrow nasal bones that do not reach behind the line connecting the anterior edges of orbits, the small ethmoidal openings that are bordered by the nasal bones at a comparatively short distance, the primitive P_4, and frontally oriented distal fork in antlers. Unlike *Axis*, *C. nestii* is characterised by the longer face, the shorter pedicles and the four-tined antlers. The cranial morphology of *C. nestii* and especially the peculiar long face, the shape of facial bones, and the outlines of bone sutures are similar to modern *C. elaphus*. The upper molars lacking hypoconal fold also approach *C. nestii* to *C. elaphus*. The cleft lingual wall of P^2 characteristic of *C. nestii* is occasionally present in the modern red deer as well. *C. elaphus* shows a stronger affinity in cranial morphology with *C. nestii* than *C. nippon* does. In my opinion, this is a good argument for including Azzaroli's *Dama nestii nestii* in the genus *Cervus sensu stricto* and to include *Pseudodama* in the synonymy list of *Cervus*. Antlers of *C. nestii* show a striking affinity with those of actual small-sized forms of red deer *C. elaphus barbarus* from North Africa and *C. elaphus corsicanus* from Corsica and Sardinia, which are characterised by four-pointed antlers with only one basal (brow) tine and frontally oriented distal bifurcation. The antlers of the first true red deer subspecies *C. elaphus acoronatus* and the primitive modern subspecies *C. elaphus bactrianus* have the additional bez tine, however they maintain the similar distal fork oriented in the frontal plane. It is very important to mention that *C. elaphus bactrianus* is characterized by the shortest predental part of the cranium among the modern subspecies of red deer (Heptner & Tzalkin, 1947; Flerow, 1952) that approach the Bactrian red deer to *C. nestii*. Therefore, *C. nestii* should be regarded as one of the earliest representative of the "*elaphus*" group. *C. nestii* already shows the basic primitive plane of antler morphology of the *elaphus* type and the peculiar elaphine cranial morphology. *C. abesalomi* Kahlke 2001 from Dmanisi (Georgia) seems to be closely related to *C. nestii*, but some-what more primitive in morphology of dentition.

The Villafranchian *Cervus* from Italy and Georgia may not represent the direct ancestral form of the "*elaphus*" group. The analysis of DNA sequence variation of the mitochondrial cytochrome *b* gene of modern populations of red deer (Ludt *et al*., 2003) gave interesting and exciting results on the origin and phylogeny of *Cervus elaphus* that may be helpful in the interpretation of the paleontologic record. According to Ludt *et al*. (2003), Central Asia and Tarim region are the area of origin of the genus *Cervus* where the primordial forms

1 Actually, *Dama eurygonos* Azzaroli 1947 is a true primitive fallow deer (Croitor, 2006).

C. elaphus bactrianus and *C. elaphus yarkandensis* come from. This conclusion is very interesting in the context of the cranial proportions affinity between the Bactrian red deer and the Villafranchian *C. nestii*. Perhaps, the first expansion of *Cervus* s.s. in Europe took place during the middle-late Villafranchian. The first elaphine immigrant *C. nestii* could give a start for radiation of various forms in the Mediterranean area that characterised by antlers with a single brow tine and unusually branched or palmed distal portions. Those endemic descent forms are *C. elaphus aretinus* Azzaroli with branched distal part of antler and very long braincase (Azzaroli, 1961; Di Stefano & Petronio, 1992) and *C. elaphus palmidactyloceros* with palmed antlers (Abbazzi, 1995). *C. elaphus simplicidens* from late Pleistocene of South-West France may also belong to the first expansion of archaic *Cervus* in Western Eurasia. Perhaps, those archaic forms of the *elaphus* group were absorbed by the new wave of red deer expansion (*C. elaphus acoronatus*) during the beginning of middle Pleistocene.

The Modern fauna of Western Mediterranean still contains a peculiar form of red deer both from morphological and from genetic points of view. This is a rather small-sized *C. elaphus barbarus* with primitive antlers similar to *C. nestii* and white spots on its body. *C. elaphus corsicanus* from Corsica and Sardinia is similar to the Atlas stag and supposed to be introduced on the islands by humans (Reutershan *et al*., 1999). The modern African red deer *C. elaphus barbarus* poses many questions. Geist (1987) considered the Atlas stag as the most primitive form of *C. elaphus*. Later, Geist (1998) regarded the Atlas and Corsican stags as pedomorphous isolated subspecies that acquired the primitive characters due to the regressive evolution. Ludt *et al*. (2003) obtained a surprisingly high genetic differentiation of the Atlas stag together with the Corsican deer from the rest subgroups of the modern red deer with the time of divergence cca. 2.2 Ma (since the Middle Villafranchian). Such a significant time of divergence was taken with caution as a possible overestimation (Ludt *et al*., 2003). However, the archaic morphology of Atlas and Corsican deer and their genetic segregation may be regarded as an evidence for a long-time isolation of primitive red deer in the Atlas refugia. Therefore, one can assume that the Atlas stag is a Villafranchian survivor derived from *C. nestii*.

Bibliography

Abbazzi, L. (1995): Occurrence of palmed *Cervus elaphus* from Italian late Pleistocene localities. *Atti della Accademia Nazionale dei lincei, Science fisiche e naturali*, ser. 9, 6 (3) : 189-206, Rome.

Azzaroli, A. (1947): I cervi fossili della Toscana. *Palaeontographia Italica*, 43: 46-81, Pisa.

Azzaroli, A. (1961): Il nanismo nei cervi insulari. *Palaeontographia Italica*, 26: 1-31, Pisa.

Azzaroli, A. (1992): The cervid genus *Pseudodama n.g.* in the Villafranchian of Tuscany. *Palaeontographia Italica*, 79: 1-41, Pisa.

Croitor, R. (2001): Functional morphology of small-sized deer from the early and middle Pleistocene of Italy: implication to the paleolandscape reconstruction. In: G. Cavarretta, P. Gioia, M. Mussi, M. R. Palombo (Eds.): *La Terra degli Elefanti, Proceedings of the First International Congress*: 97-102, Rome.

Croitor, R. (2006): Early Pleistocene small-sized deer of Europe. *Hellenic Journal of Geosciences*, 41: 89-117, Athens.

Di Stefano, G. & C. Petronio (1992): Nuove osservazioni su *Cervus elaphus acoronatus* Beninde del Pleistocene europeo. *Bolletino della Societa Paleontologica Italiana*, 31 (3): 295-315, Modena.

Di Stefano, G. & C. Petronio (1998): Origin and relationships among *Dama*-like cervids in Europe. *N. Jb. Geol. Palaeont. Abh*., 207, pp. 37—55, Stuttgart.

Flerow, K.K. (1952), Musk deer and deer (in Russian). *Fauna of the USSR. Mammalia*, 1(2): 3-255, Moscow—Leningrad.

Geist, V. (1998): *Deer of the World: Their Evolution, Behavior and Ecology*. 421 p., Stackpole Books.

Heptner, V. G. & V. I. Tzalkin (1947): Deer of the USSR (in Russian). *Transactions on Study of Fauna and Flora of the USSR*, 10 (25): 1-176, Moscow.

Kahlke, H.-D. (2001): Neufunde fon Cerviden-resten aus dem Unterpleistozän von Untermassfeld. *Das Pleistozän von Untermassfeld bei Meningen (Thüringen), Teil 2. Monographien des Römisch-Germanischen Zentralmuseums Mainz*, 40 (2): 461-482.

Ludt, Ch., W. Schroeder, O. Rottmann & R. Kuehn (2004): Mitochondrial DNA phylogeography of red deer (*Cervus elaphus*). *Molecular Phylogenetics and Evolution*, 31: 1064-1083.

Pfeifer, Th. (1997): *Dama* (*Pseudodama*) *reichenaiui* (Kahlke 1996) (Artyodactyla: Cervidae, Cervini) aus den Mosbach-Sanden (Wiesbaden-Biebrich). *Mainzer Naturwiss. Archiv*, 35, pp. 31-59.

Reutershan, T., R. Tiedemann, G. B. Hartl & M. Apollonio (1999): Origin of sardinian red deer (*Cervus elaphus corsicanus*) as revealed by sequence analysis of mtDNA-control region. *Advances in Deer Biology*: 200, Kaposvar.

Vos, J. De, D. Mol & J. W. F. Reumer (1995): Early pleistocene Cervidae (Mammalia, Artyodactyla) from the Oosterschelde (the Netherlands), with a revision of the cervid genus *Eucladoceros* Falconer, 1868. *Deinsea*, 2: 95-121.

THE MUSEUM OF FOSSIL FAUNISTIC ASSEMBLAGES FROM THE REPUBLIC OF MOLDOVA

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The Museum is situated in the Institute of Zoology of Academy of Sciences of Moldova serving as the visit card of the institute as well as the data&information base for the paleozoologists and geologists including young specialists, from the republic and other parts of the world. This have been officially registered on September 16, 1976 through Decision nr.13/54 of the General Committee of the Academy of Sciences of Moldova. The activity of the museum in time before the USSR collapse have been coordinated by the Council of the Museums of the Academy of Sciences of USSR, and currently it functions in the framework of the Museums of the Ministry of Culture of the Republic of Moldova (certification protocol №74 as of 31.01.2005).

The museum have been set on the ample fossil faunistic material, all unique and interesting, that have been collected mainly by paleozoologists, archeologists and geologists during the field scientific investigations as well as by some enthusiasts and just physical persons due to their occasional discoveries of materials from Late Neozoic time, mainly related to geological periods Neogene and Quaternary or Anthropogenic, aged about 18 millions years and that are relatively well characterized.

The above mentioned deposits of the small country Moldova are found in over 300 fossil localities (settlements, sites, loculus) where tens of thousands of skeleton remains of various animals – corals, bryozoa, foraminifers, ostracods, mollusks, fish, amphibians, birds and especially mammalia. Some scientific findings are of global importance; the new for paleozoology science species and genus have been identified that got to be known to scientists in the field outside of the country due to publications or during the conferences, symposiums or international congresses organized in Moldova.

The museum exhibition is organized on the basis of the known scientific validity specifying that each period and epoch in the history of Terra corresponds to the certain group (complex) of fossil organisms that coincides at the same time with a certain stage of evolution of the bios on the planet.

The vitrines of the museum of the total surface of just 60 m^2 expose about two thousands of exhibits, some of them quite important and unique representatives of various faunistic complexes taken from the scientific point and analytic point of view, and representing Upper Miocene till the Holocene-the last epochs from Earth History that lasts nowadays.

The faunistic complexes of Upper Miocene (Badenjan, the Sarmatians, Meotian and Pontianus) are scantily presented due to the fact that the majority of respective faunistic materials are exhibited at other organizations (Sate University from Tiraspol with head office in Chişinău, the Museum of Ethnography and Natural History of Moldova from Chişinău, the Paleontological Museum at the University from Odessa city (Ukraine), the Paleontological Institute "A.A.Boriseak" of the Academy of Sciences of Russia (Moscow), The Paleontological Museum of the University from Bucureşti and University "A.I.Cuza" from Iaşi city (România).

An additional point is that one of the window of the museum exposes a part of the calcar shelves from the North and central part of the republic (Şireuţi and Caracuşeni villages from Briceni region; Gordineşti, Trinca and Brînzeni villages from Edineţ region; Varatic, Şaptebani and Duruitoarea villages from Rîşcani region; Mileştii Mici village from Ialoveni region; Ghidighici and Petricani localities from Chişinău municipality etc.), that is nothing but enormous accumulations of the fossilized skeletons of the colonial marine organisms – corals, foraminifers, bryozoa, mollusks and other non-vertebrate animals that populated warm waters of Badenian and Sarmatian seas that about 18-19 mln years ago covering completely or partially (in Sarmatians time) the actual territory of Republic. Some exemplars of calcar from Petricani, Chişinău municipality, Saharna, Păpăuţi villages from Rezina region, Micăuţi villages from Străşeni region etc. also includes the fragments of the phoca, and those from Naslavcea village of Ocniţa region – imprints of fish skeleton. The special attention attracts the incomplete skeleton (cranium, vertebras) of dolphin from Ciuciuleni village, Glodeni region.

The vitrines demonstrates the fauna of terrestrial vertebrates of Sarmatian time that populated the lands and that appeared periodically as a result of Sarmatian Sea water withdrawal, the skeletal remains of some representatives of the ancient Sarmatian fauna from the Republic of Moldova discovered in Otovasca zone of Chişinău municipality, including the fragments of maxillas and isolated molars of minimum two species of mastodons - *Tetralophodon longirostris* and *Zygolophodon turicensis*, fragments of mandibles,

teeth and bones of extremities of the hipparion –*Hipparion sarmaticum* and hornless rhinoceros belonging to *Aceratherium* genus, skeleton remains of carnivores, one cranial fragment of plastron and several caudal plates of turtles- *Protestudo chişinauensis* (new for science specie) and others. The above mentioned vitrine includes also a fragment of mandible with 3 molars of mastodon – *Zygolophodon turicensis* from Pituşca village, Calaraşi region, maxilla fragments, isolated molars and postcranial skeleton remains of hipparions and rhinoceros, fragments of shield turtles from Pocşeşti village, Orhei region, Anenii Noi city etc.

The fauna of the next geological epoch - Miocene (about 8-5 mln years ago), corresponding to the Miocene faunistic complex is represented only by several skeletal remains of mammals and reptiles discovered in Cimişlia city, Cimişlia region (hipparion, mastodon, gazelle, turtles) and in Taraclia, Căuşeni region (hipparion). The reach faunistic collections from these two localities, as well as from Ciobruciu village, Ştefan Vodă region, discovered by other scientists, currently are kept as already mentioned above by other organizations from Moldova and other countries (România, Russia, Ukraine).

One of the vitrines exposes several remains of sediments of Pontian time, discovered on the limited territory of Codrii forest region, Ialpug river valley, all representing the valorous scientific value. The localities includes Sagaidac, Porumbrei, Mihailovca, Batîr, Cociulia and other villages where the skeleton remains of hipparion, similar to Hipparion crassum from France, rhinoceros *Stephanorhinus sp.*, small mastodon (this specie is not yet determined), camel –*Paracamelus sp.,* helobious boar – *Propotamochoerus sp.,* of carnivores big felid –*Homotherium cf. crenatidens*, of primitive cervids, gazelle etc. This faunistic association have been proposed to be identified in a separate complex – Sagaidac faunistic Complex.

Besides, the unique and interesting fossil skeleton remains of terrestrial vertebrate animals of Early Pliocene representing the specific complex – Moldovan faunistic complex, serving as a model of this period fauna on the territory of Eastern Europe aged approximately 4,8-3,0 mln years. The most significant exponents that could be mentioned are two fragments of maxillas of monkey, one is upper maxilla belonging to *Dolychopithecus ruscinensis* and inferior similar to *Macaca* genus; a maxilla, fragments of molars and many bones of extremities of mastodon *Anancus arvernensis;* one fragment of cranium of other species of mastodon - Mammuth *(Zigolophodon borsoni)*, incomplete cranial part with well developed saber form incisor teeth of carnivore –a big feline - *Homotherium crenatidens;* a cranium, fragments of mandibles, entire bones and big fragments of extremities of camels -*Paracamelus alexejevi*; one horn, fragments of mandibles and multiplies bones attributed to some antelopes of African type belonging to genus *Parabos, Protragelaphus, Gazellopsira;* fragments of bones belongings to ostriches *Struthio sp.;* a shield of turtles *Testudo kucurganica*, fragments of shield of other turtles such as *Melanochelys etuliensis* (new specie), *Chelydropsis nopcsai* etc.

The above mentioned skeletal remains as well as the whole collection of several thousand of bones of the representatives of the Moldovan faunistic complex originate from the alluvial sediments of Early Pliocene widely spread in South-Western part of Moldova, in the valleys of Prut river, Cahul and Salcia Mare localities, nearby Brînza, Văleni, Etulia, Găvănoasa, Pelinei, Tătăreşti, Luceşti, Musaitu, Dermenji, Moscovei villages and others.

The next faunistic complex refers to the Upper Pliocene called Haprovean (named according to the Haprî locality from North Caucasus), characterizing the time approximately between approximately 2,6 and 1,7 mln years ago in Eastern Europe and partially the North Asia. The museum collection is presented by the fragment of mandible with inferior M_3 from the south part of Giurgiuleşti village, Cahul region; fragments of molars from the inferior lower of alluvium mining from Salcia, Chirca and Cobusca Veche villages, Anenii Noi region; of elephant *Archidiskodon gromovi* - the ancients fossil elephant known in our territory, with molars and bones of extremities of the gigantic camels – *Paracamelus gigas*; molars of some amusing rhinoceros – *Elasmotheriu cf. pei*, of bison – *Bison cf. suchovi*, of big horse of *Equus (Allohippus) livenzovensis* type, one enormous horn of the gigantic deer *Arvernoceros vereschagini* – a new for science specie, fragments of bones and bones of the extremities belonging to other species of bid cervides with specific horns, fragments of shield of turtles.

The Haprovean faunistic complex have been replaced by Odessan complex belonging to the first part of Early Pleistocene period (1,7-1,2 mln years ago). This complex is represented in the museum by the fragments of molars and some bones of the extremities attributed to elephant –*Archidiskodon meridionalis* (=*A.m.meridionalis)* is the typical representative of the Odessan complex, found in the alluvial sediments of the upper lower from mining from Salcia and Chirca villages, Anenii Noi region; in ravines from Etulia village, Găgăuzia territory. The humerus slightly deteriorated with length of 1,6 m belonging to this ancient elephant is of particular interest, this being discovered in one of the mining from Talmaza village, Ştefan Vodă region. The Odessan complex is also represented in museum with skeleton remains of representatives of turtles - *Mauremis salciensis* (new specie), horse (*Allohippus) ex gr. stenonis*, of forest elephant –*Palaeoloxodon sp*., deer etc.

The second half of the Early Pleistocene (1,2-0,8 thousands of years ago) is characterized by Tamanian faunistic complex (called according the peninsula Tamani from North Casucaus) which representatives have been registered also on the territory of Moldova, this being confirmed by the skeleton remains of some species discovered in south and central part of the Republic. The corresponding vitrine from the museum enclose the unique collection of skeletal remains of various species of vertebrate animals found in one of the ravines from Cişmichioi village, including fragments of molars and bones of the tamanian elephant (*Archidiskodon tamanensis = A. meridionalis tamanensis*) and robust horse *Equus (Allohippus) sussenbornensis*- species specific for this complex, teeth of *Canis cf. tamanensis, Vulpes sp.,* a phalange of *Capreolus cf. susseborнensis*, right ramus of a mandible of a gigantic deer *Praemegaceros sp.,* a fragment of the basis of the horn belonging to an elk, *Cervalces (Libralces) galicus*, bones of bison- *Bison cf. tamanensis,* a reach collection of bones of micromamalia, a vast collection of skeleton remains of reptiles (turtles, snakes and lacertids), several skeletal remains of birds including two new for science species (К. Шушпанов,1983 ; A. David, O. Redcozubov, Viorica Pascaru and others, 2009). A mandible with molars from this paleontological settlement declared as the monument of nature from Moldova is kept in the Geologic Institute of the Academy of Sciences of Russian Federation (Moscow).

The several vitrines are filled with a reach, unique and varied collection of skeletal remains of small and big mammals, fresh-water mollusks and seed shrimps belonging to Tiraspolean faunistic complex typical for Middle Pleistocene (cca 0,8-0,5 mln years ago) from eastern Europe and partially of Northern Asia, serving as standard in identifying the faunistic associations of the similar geological age on the other territories of Eurasia.

The exhibited objects includes mandibles, more or less complete, the upper and lower molars, one big vigorous fragment of ivory, bone fragments of the extremities from the various age' elephants – *Mammuthus trogontherii wusti*, craniums, mandibles and bones from at least two species of rhinoceros – *Stephanorhinus etruscus* and *S.mercki*, various skeletal remains from minimum 4 species of horses –*Equus (Allohippus) cf. sussenbornensis, E. (Equus) mosbachensis, E. (Equus) sp*. and *E. (Asinus)cf. hidruntinus*, relics of horns, craniums, maxillaries and different bones from 5 species of deers- *Cervus acoronatus, C. cf. elaphoides, Praemegaceros verticornus, Praedama cf. sussenbornensis* and *Alces latifrons,* as well as bison – *Bison priscus tiraspolensis (=B. schoetensacki)*.

The above mentioned skeleton remains as well as the many others including fresh-water mollusks and seed shrimps exhibited in the museum and kept in museum premises originates from the alluvial minings from Tiraspol city, Mălăieşti, Blijnii Hutor, Sucleea villages and other localities from the inferior course of Nistru river.

The most diversified and reach from the scientific point of view for the fauna of Late Pleistocene from Moldova is considered the Paleolithic faunistic complex (cca 160-10 thousands of years ago) which significant skeletal exemplars are exposed in several vitrines. These skeleton remains are presented by "kitchen waste" of the prehistoric Paleolithic people, as a result of animals hunting in the nearest to their settlement surroundings. At the same time, the bones of the small animals especially of microtines, that occasionally got to the dwellings of the people.

The following skeletal remains from the human dwellings of the Early Paleolithic time (Ofatinți, Duruitoarea, levels III and IV) and Middle Paleolitics (Buzdujeni I, Trinca I-III, Buteşti) have been discovered and exhibited in the museum vitrines – mammoth (early forms) *Mammuthus primigenius,* wooly rhinocer (early forms) *Coelodonta antiquitatis*, cave bear *Spelaearctos spelaeus*, cave hyena *Crocuta spelaea*, cave lion *Panthera spelaea*, gigantic deer *Megaceros giganteus*, steppe marmot *Marmota bobac* as well as other small and big mammals. Taking into accountant the dominance of the bones from cave animals, the whole faunistic association from these localities constitute one specific subcomplex called spelaean.

The skeletal remains from human dwellings of human from Upper Paleolithic time (Brînzeni I, Climăuți II, Duruitoarea, level II, Cosăuți I etc.), aged between 40 and 10 thousands of years ago exhibited in museum vitrines demonstrates that such vertebrate terrestrial fauna of that time called glacier epoch (periglacier on the territory of our country) have been largely spread, specifically late species of mammoths , horse *Equus (Equus) latipes*, reindeer *Rangifer tarandus,* bison *Bison priscus*, red deer *Cervus elaphus*, tundra hare *Lepus tanaiticus*, bobak marmot *Marmota bobac*, as well as the various of species of small mammals of steppe, desert, forest and tundra, montane etc., such as *Ochotona pusilla, Dicrostonyx guilielmi, Alopex lagopus, Microtus (Stenocranius) gregalis, M.oeconomus, Lagurus lagurus, Eolagurus luteus, Cletrionomys glareolus, Apodemus flavicolis, Alactaga jaculus etc.,* forming the Upper Paleolithic complex.

The last faunistic complex represented in museum is Holocene complex which includes species of animals from the last historic epoch on the Terra -Holocene (cca 10 thousands of years), actual and extinct from the fauna of Moldova during this period. Thus, the visitors can observe in vitrines the fragment of cra-

nium with horns and bones of extremities of *Bos primigenius*, horns and fragments of bones of wisent *Bison bonasus*, molars and bones of brown bear *Ursus arctos*, mandibles and bones of European beaver *Castor fiber*, skeletal remains of lynx *Lynx lynx*, elk *Alces alces*, ass (European donkey) *Equus (Asinus) hidruntinus etc.*

A part of the exponents of the museum constitutes some amusing discovering priceless for the science and valorous for the didactical and cognitive work such as ivory and some bones of the impressing super gigantic dinoterium Deinotherium supragiganteum found in Codreanca village in Străşeni region; one inferior maxilla of enormous size and upper molars of the same gigantic mastodon of the type *Mammut borsoni,* found in Şipca village of Grigoriopol region; one intact cranium of cave bear Spelaearctos spelaeus from Saharna village of Rezina region; one incomplete cranium of mammoth (*Mammuthus primigenius*) discovered in a mining of Şireuţi village, Briceni region; also, quite sensational are the skeletal remains (fragments of ivory and mandibles, different molars and bones, some even intact bones) belonging to cca 20 animals of various individual ages of mammoth, late forms collected in Climăuţi village of Şoldăneşti region, etc.

The premise of the museum hosts many pictures that represent the landscape and way of living of many animals from Pliocene and Pleistocene time.

The osteologic material exhibited in the museum have been published in approximately 20 monographs and brochures, in several hundred of scientific and scientific-popular articles, these have been presented at dozen of conferences, symposiums, national and international congresses.

There is a hope that the surface of the museum exposition could be enlarged soon, hopefully the huge amount of exponents allows this.

PRELIMINARY DATA ON THE ARM-BONE OF MESOPITHECUS (PRIMATES, COLOBIDAE) FROM THE LUCHESHTY LOCALITY (MOLDOVA)

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A distal fragment of the left humeral bone of a cercopithecoid (IZ ASM № V-M-9/12) was found at the Lucheshty Locality (Kagul District, Moldova Republic) by a field team of the Zoological Institute, Academy of Sciences of Moldova, led by Prof. A. David. Geographical coordinates of the Locality are 28º 18′.539′′ E and 45º 59′.699′′ N. The find originates from the southern board of a ravine, absolute height 216 m above sea level. The total height of the Lucheshty section is about 50 m. From the bottom to the top of the section there are seven levels (cycles) of alluvial sediments related to the general cyclic elevation of the Carpathians. Judging by fossil mammal remains, the alluvial sediments of the Lucheshty Locality are dated the Early Pliocene (MN 15). The find of the monkey humerus originates from the upper (seventh) level of the sediments. The following species of the Moldavian (Ruscinian) mammalian assemblage were determined from the Lucheshty: *Promimomys moldavicum*, *Pliomys kowalskii*, *Dolomys gromovorum*, *Dolomys* sp., *Proochotona* sp., *Ursus* ex gr. *minimus*, *Pliohyaena perrieri–pyrenaica*, *Lynx* sp., *Anancus arvernensis*, *Tapirus arvernensis, Propotamochoerus provincialis*, *Paracamelus alexejevi*, *Croizetoceros ramosus*, *Pseudalces* sp., *Parabos* cf. *boodon*. The Stratum VII has the reverse magnetization (the top Gilbert epoch in the paleomagnetic scale, older than 3.58 mln years) and perhaps correlate to the late stage of the Moldavian mammalian association (MN 15).

To determine systematic position of the humerus from the Lucheshty, the morphology and proportions of the trochlea humeri, reflecting the type of locomotion, are crucial. Differences in the shape of transversal section of the diaphysis appear to be secondary. For the Cercopithecoidea Gray, 1821, these differences depend on the individual characters and sex. The transversal section of the specimen IZ ASM № V-M-9/12 is ellipsoid with well-developed projection on the medial surface in the area of tuberositas deltoidea and in the basement of crista deltoidea. The morphology of the trochlea and fossa olecranon has the following peculiarities. The epicondylus lateralis and epicondylus medialis are well developed. The epicondylus lateralis is strongly inclined distally (a terrestrial character). The trochlea height is relatively small and the transversal diameter of the trochlear is much greater (Table 1). The fossa olecranon is round and relatively shallow.

These morphological peculiarities allow one to determine the specimen IZ ASM № V-M-9/12 as genus

Mesopithecus Wagner, 1839. In addition to the characters mentioned, in the *Mesopithecus* as a terrestrial genus of the Miocene-Pliocene Colobidae, the distal end of humerus has the following featires: high capitulum and trochlea, with significant longitudinal diameters of epicondylus lateralis/medialis. Same peculiarities of trochlea humeri are typical of *Dolichopithecus* Dépéret, 1889. In the *Mesopithecus,* the capitulum is round, the medial crest of the trochlea is shallow and non-inclined. In the *Dolichopithecus,* the medial crest is very high and inclined laterally. The specimen IZ ASM № V-M-9/12 either has no such features, or they are expressed only slightly: the transverse diameter of the trochlea is relatively smaller than in *Mesopithecus*.

Arboreal Cercopithecoidea have a well-developed lateral and medial supracondylar ridge, and a wide groove of the trochlea. Capitulum is ovoid and elongated laterally. On the whole, the arboreal Cercopithecoidea have a wide distal junction, and fossa olecranon considerably widens downward. Sulcus nervi ulnaris is relatively wide and shallow, the medial crest of the trochlea is relatively low and is not inclined laterally. Beside weakly developed lateral and medial supracondylar ridge, other characters of specimen IZ ASM № V-M-9/12 are expressed moderately, similarly to *Mesopithecus*.

Comparison with modern Cercopithecoidea (*Papio*/*Macaca*) show differences in the proportions of the trochlea humeri (Table 1), specifically in the development and inclination of the trochlear medial crest. These characters bring *Papio*/*Macaca* closely to *Dolichopithecus*. Beside, the fossa olecranon in the *Papio* is round and practically does not widen from top to base similarly to *Mesopithecus,* and fossa olecranon is low, and considerably greater in width than in depth. In the specimen from the Lucheshty Locality, the fossa olecranon has similar proportions, thus providing a character indicative of the dominant terrestrial type of locomotion.

Table 1. The sizes of arm bone in the recent and fossil Cercopithecoidea (mm).

	IZ ASM № V-M-9/12, Lucheshty	*Mesopithecus pentelicus* (from different refferences)	*Macaca fuscata*, ♂, PIN 4355/12	*Papio hamadrias*, ♀, PIN 4355/255
Length	128.0 (the length of preserved fragment)	152.5-156.5	164.0	185.0
Distal epcondylar breadth Maximum transversal diameter distal edge	32.0/18.2	23.4-30.0/	33.2/	33.0/
Transversal/anteroposterior diameters of trochlea humery	26.0/10.2	22.0/10.0-10.8	25.0/	27.0/
Transversal/anteroposterior diameters of diaphysis at the level tuberositas deltoidea	17.0/15.3	19.6/	13.2.0/12.0	12.8/11.0
Olecranon fossa Width/Height	20.2/23.8	11.3–12.3 /11.4-11.8	13.0/10.5	13.7/18.7
Diameter from distal edge of trochlea to the top of olecranon fossa	37.9	15.5	21.3	22.0

The abovementioned peculiarities allow us to conclude that in the development, structure and proportions of trochlea humeri, proportions of fossa olecranon, and the structure and significant distal lateral inclination of epicondylus lateralis and epicondylus medialis (terrestrial locomotion character) , the specimen IZ ASM № V-M-9/12 form Lucheshty is similar to *Mesopithecus*. On the other hand, the proportions of trochlea humeri and epicondylus, as well as the relatively small transverse diameter of trochlea humeri and relatively narrow trochlear groove differ the Lucheshty monkey from *Mesopithecus,* and bring it closer to *Macaca* and *Papio*. It is possible that such a combination of features characterizing different genera of Cercopithecoidea with different locomotive adaptations might be typical of the early Pliocene *Macaca,* so long as data on the humeral joint are scarce. According to the numerous morphological characters of the trochlea humeri that are typical of *Mesopithecus*, the monkey from the Lucheshty should be placed in this genus.

Chronological distribution of *Mesopithecus* in South Europe is limited to the beginning of Pliocene. If the Lucheshty specimen is attributed to genus *Mesopithecus*, the chronological distribution of this genus of Cercopithecoidea in the South of Eastern Europe was much longer and covered the first half of Pliocene. At the time of the Moldavian fauna, the Black Sea Lowland represented a disintegrated plain with inundated forests that consisted of thermophilic and is moderate-thermophilic races. Open spaces occupied the subordinate position. The climate was warm and relatively humid, probably similar to the subtropical zone of the recent Mediterranean Region.

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MAMMALS HUNTED ABOUT 5000-6000 YEARS AGO IN CENTRAL PART OF CODRII ARIA IN BESSARABIA (CURRENTLY REPUBLIC OF MOLDOVA)

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Foreword

The earliest written information appeared about hunted mammal fauna from central part of *Codrii* from Bessarabia are known from the famous work of Governor Dmitrie Cantemir „Descriptio Moldaviae" or „Historical, geographical and political description of Moldova" published for the first time in 1716, so about 300 years ago. But how we can know what animals inhabited *Codrii* from Bessarabia before this time, thousands and millions years ago? The osteological materials discovered during archeological and palezoological excavations and belonging to the prehistoric epochs are of great help in this sense. Thus, the mammal fauna hunted about 5000-6000 years ago in central part of Codrii aria have been established based on the study of the skeletal remains identified in the ancient settlements of humans of early Tripoli archeological culture existed in Eneolitic epoch. One of the most interesting Tripoli settlement in this area taken from the perspective of archezoologists is considered *Ruseștii Noi I,* situated in Ialoveni region (Давид, Маркевич, 1967; Маркевич, 1970, 1973; Давид, 1982).

Materials and research methods

More than 1200 skeletal remains of hunted mammals served as study material; these have been collected at those 2 beds of early Tripoli culture attributed according to ceramic items that have been used in the second half of IV millennium B.C.E. The absolute age of the upper bed have been determined according C^{14} is 3520$\pm$100 years B.C.E. (Marchevici, 1970, 1973).

The traditional field and laboratory research methods have been applied which are widely used by archeologists and paleozoologists.

Research results

The analysis of the bones surface discovered during the excavations (crumbled craniums with extracted brain, corns chipped off the cranium, big tubular bones crashed in order to obtain medullar substance, corns' fragments with signs of treatment by Tripoli humans, presence of the hunting weapons and tools for meat and woolfell processing) demonstrates that osteological material represents the „kitchen remains" of the inhabitants of this valuable prehistoric settlement situated in the middle of Bessarabian *Codrii*. The settlement inhabitants preferred to hunt big grass-feeding animals that have been widely spread in the central part of the *Codrii* area, so hunting was the main occupation of this population. The Tripoli people from *Ruseștii Noi* have been employed also with breeding domestic animals, this fact being confirmed by presence of numerous skeletal remains of big and small cattle, horse and dog.

The comparative anatomic-morphological study of the osteological material found in early Tripoli settlement from *Ruseștii Noi I*, allowed to establish the compound of the wild hunted animals (presented in systematic order): steppe hare (*Lepus europaeus Linnaeus*), European beaver (*Castor fiber Linnaeus*), wolf (*Canis lupus Linnaeus*), fox (*Vulpes vulpes Linnaeus*), brown bear *(Ursus arctos Linnaeus*), badger (*Meles meles Linnaeus*), pine marten *(Martes foina Erxl*.), Eauropean wild cat *(Felis silvestris Linnaeus*), European lynx (*Lynx lynx Linnaeus)*, tarpan (*Equus gmelini Antonius*), wild ass (*Equus hemionus Pall?),* Eurasian pig (*Sus scrofa ferus Linnaeus*), roe deer (*Capreolus capreolus Linnaeus*), red deer (*Cervus elaphus Linnaeus)*, elk (*Alces alces Linnaeus*), bison (*Bison bonasus Linnaeus*).

The big number of skeletal remains of wild ox -300 pieces, and number of individuals (25) indicates that 5000-6000 years ago it was the most spread mammal in central part of *Codrii* area in Bessarabia being a preferred object for hunting by Tripoli people. There were have been found the part of the cranium with both corns, fragments of corns, maxillas, molars, ribs, vertebras and bones of extremities of this rangy and robustious animal considered as progenitor of the actual cattle. The dimensions of some skeletal pieces (length of the corn on its exterior part of those 4 exemplars constitute 643-698 mm, circumference of the corn at its base varies -49,1-54,7%, the width of the articulacy proximal part of humerus (9 exemplars) – 101,5-113 mm etc.) indicates the presence of some huge specimens, obviously males.

The remains of the red deer represented by the fragments of maxilla with some molars, various parts of the corns, some with signs of processing by Tripoli people, bones of extremities and other skeletal bones belong to 21 animals, in most cases to adult ones. Some of the skeletal remains are of big size, probably belonging to male animals. Thus, for example, the length of the upper premolars reaches up to 58 mm, length of inferior molars – up to 149 mm, length of the first phalanges fetch up 44 mm, the width of the distal articulary part constitutes 66,7 mm, and the proximal width of radius – 73 mm.

Those 18 individuals of hog identified according to the fragments of maxillas, canines, molars and bones of extremities and 19 individuals of roe deer represented by many integral corns and fragments of maxillas of different age animals, isolated molars and fragments of bones of extremities that morphologically does not differ from the contemporaneous deer from Moldova, suggests that these animals in the respecting epoch also were typical animals in the central part of *Codrii* area in Bessarabia, serving as important hunting object.

The incontestable determinant materials for bison (cranium and corns) are missing yet according to some morphological characters stressed by some researchers (Громова,1950; Бибикова, 1958) several fragments of humerus and radius, one calcaneus and four astragals could be attributed to bison. It may happen that those undeterminable fragments of bones of cattle belong to bison. Also it is possible that presence of bison may be limited by the spread of its main competitor – wild ox.

The elk and wild ass were probably the rare species in *Codrii* region of Moldova. The compound of the fauna from *Ruseștii Noi* reflects that each species is represented by insignificant skeletal remains of 5 individuals.

Among carnivores the most solicited animals were fox captured for its nice fell (11 individuals), wolf (9 individuals), brown beer hunted for its large and warm fell (8 individuals), badger hunted for its meat, fat and fell (8 individuals), rarely solicited lynx hunted for its fell and probably due to curiosity (3 individuals).

The presence of the beaver belonging to rodents indicates that the water space of *Botna* river was larger and dipper, and the small dimensions of the discovered skeletal remains (among them a fragment of inferior maxilla) indicate that animals needed certain life conditions. These animals have been hunted by Tripoli People from *Ruseștii Noi I* for its fell and meat.

Conclusions

The fauna compaund of the early Tripoli settlement in *Ruseștii Noi I* demonstrates that about 5000-6000 years ago the central part of *Codrii* area from Bessarabia have been enhabited at least by 17 species of wild animals hunted by humans, among them 9 species preserved their existance up to now, and the other ones (European beaver, brown bear, lynx, tarpan horse, wild ass, elk, wild ox and bison) have disappeared.

The most predominant mammals hunted by humans were wild ox, deer, roe deer, wild boar, fox, bear and badger.

Bibliography

Бибикова В.И. О некоторых отличительных чертах в костях конечностей зубра и тура // Бюл.МОИП. отд. Биолог., Т.63, вып., 1958.

Громова В.И. Определитель млекопитающих СССР по костям скелета. Вып.1. М.-Л., 1950.

Давид А.И. Формирование териофауны Молдавии в Антропогене. Кишинев., «Штиинца», 1982, 150с.

Давид А.И. Маркевич В.И. Фауна млекопитающих раннетрипольского поселения Новые Русешты //Изв. АН МССР, сер.биол. и хим. наук, №4, 1967.

Давид А.И., Чемыртан Г.Д. Распространение и численность тура в голоцене Молдавии// Фаунистические комплексы и флора кайнозоя Причерноморья. Кишинев, 1977, 23-31.

Маркевич В.И. Многослойное поселение Новые Русешты I //Краткие сообщения Ин-та Археологии АН СССР, вып. 123, 1970.

Маркевич В.И. Памятники неолита и энеолита. Археологическая карта МССР, вып.2, Кишинев, 1973.

David A. Bourul – strămoșul vitelor cornute mari. Cartea neagră a faunei R.Moldova. Revista „Natura"

LYTOCERATIDS FROM UPPER JURASSIC DEPOSITS OF THE HĂGHIMAŞ MTS. (THE EASTERN CARPATHIANS – ROMANIA)

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Keywords: *Lytoceratina*, Taxonomy, Kimmeridgian, Tithonian, Hăghimaş, East Carpathians

Introduction. Ammonites fauna described here comes from Hăghimaş Massif (Eastern Carpathians), Kimmeridgian and Lower Tithonian deposits - especially from outcrops of Ghilcoş Mountain (see D. Grigore, 2011).

Methodology. Determination of species was based on the comparison of our specimens with those of the Holotypes in external or internal morphology and morphometric features.

Results. In paper are described 8 taxa of the genera *Lytoceras* Suess, 1865 and *Protetragonites* Hyatt, 1900. Are reviewed here and species described by previous authors: Neumayr (1873), Herbich (1878) and Preda (1973), being analyzed the specimens from collections of Cluj, Bucharest or Piatra Neamt.

The species described in the paper, with some special regards as following:

Lytoceras polycyclum polycyclum Neumayr, 1871 emended Sarti, 1993 – including the Holotype description, which proceeds from this area;

Lytoceras polycyclum camertinum Canavari, 1896, emended Sarti, 1993 - first signalising in the region - Preda's specimen revised here;

Lytoceras montanum (Oppel, 1865) in Zittel, 1868, (Figs. 1 and 4 Preda's specimen);

Lytoceras orsinii Gemmellaro, 1872 - first signalising in the region (Figs. 2 and 3);

Lytoceras sutile (Oppel, 1865) in Zittel, 1868 - first signalising in the region (Fig. 6);

Lytoceras liebigi (Oppel, 1865) in Zittel, 1868 - first signalising in the region;

Lytoceras strambergense (Zittel, 1868) - first signalising in the region (Fig. 5);

Protetragonites quadrisulcatus (d'Orbigny, 1840) - confirmed now.

Conclusions. This lytoceratids fauna from East Carpathians rich eight taxa by tree knowed until now. Some species has special importance in establishing the Lower Tithonian presence in the region, i.e. biostratigraphic one.

References

Avram, E. 1976. Les fossiles du flysch eocretacee et des calcaires tithoniques des hautes vallees de la Doftana du Tirlung (Carpates Orientales). Mem.Inst.Geol.Roum., XXIV, p. 5 – 74, Bucuresti.

Canavari, M. 1896. La fauna degli strati con *Aspidoceras acanthicum* di Monte Serra presso Camerino. Parte prima (Anthozoa, Lamellibranchiata, Cephalopoda: *Phylloceras*, *Lytoceras*, *Oppelia*, *Eurynoticeras* n.gen., *Holcostephanus*). Palaeont.It.II, p. 25-52, Pisa.

Favre, E. 1875. La zone a Ammonites acanthicus dans les Alpes de la Suisse et de la Savoie. Mem.Soc. Paleont.Suisse. 4 (3), p.1-113, Geneve.

Fontannes, F. 1879. Description des Ammonites des calcaires du Chateau de Crussol (Ardeche). Trav. Univ., p.1-122, Lyon.

Gemmellaro, G.G. 1872. Sopra I cefalopodi della zona con Aspidoceras acanthicum Opp. sp. di Burgilami presso Favara, provincia di Grigenti. Giornale Sci.Nat.Econom, 8, p. 30-52.

Grigore, D. 2011. Kimmeridgian – Lower Tithonian ammonite assemblages from Ghilcoş - Hăghimaş Massif (Eastern Carpathians – Romania). Acta Palaeontologica Romaniae, **7,** p. 177-189, Cluj Napoca.

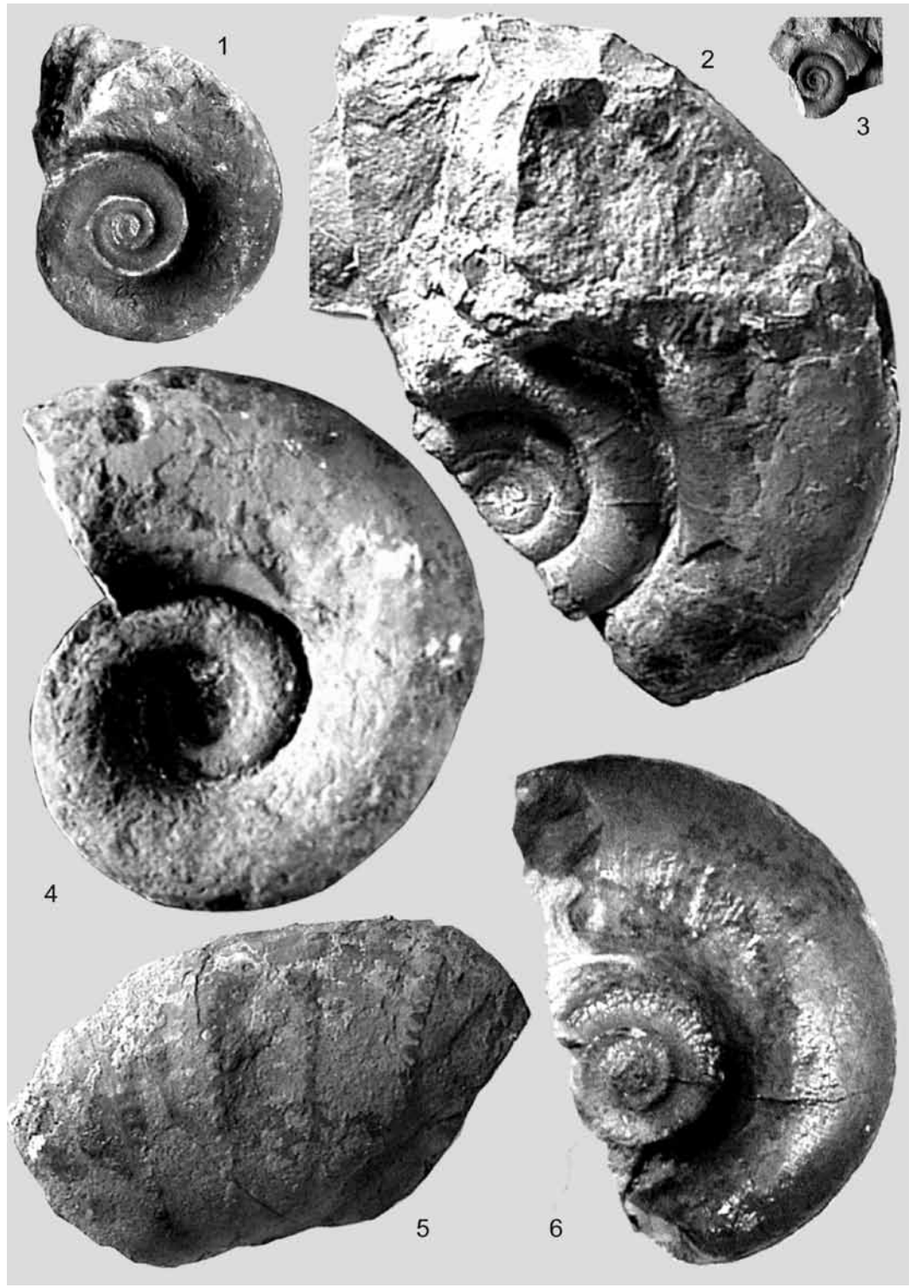
Herbich, F. 1878. Das szeclerland mit Berucksichtigung der Angrezenden Landesteile. Jb.K. ung.geol. Anst. 1, p. 19-363, Budapest.

Neumayr, M. 1873. Die Fauna der Schichten mit Aspidoceras acanthicum. Abh.K.K.geol. reichsanst. 5 (6), p. 141-257, Wien.

Orbigny, A. 1840. Paleontologie francaise. Terrains jurassiques. I. Cephalopodes. Masson et Cie. p. 1-642, Paris.

Preda, I. 1973. Variatiile de facies si biostratigrafia Jurasicului superior din Muntii Haghimas. Stud. Cerc. Geol. Geogr. Biol., Ser. Geol. Geogr., II, p. 11-21, Piatra Neamt.

Sapunov, I.G. 1979. Les fossiles de Bulgarie. III. 3. Jurassique superieur. Ammonoidea. Acad. Bulg.Sci., p. 1-263, Sofia.



Sarti, C. 1986. Considerazioni sul Rosso Ammonitico Veronese del Col santino (M. Pasubio) e raffronti con altre successioni del Trentino. Atti I Conv. Int. F.E.A., 84, p. 63-66, Pergola.

Sarti, C. 1993. Il Kimmeridgiano delle Prealpi Veneto-Trentine: fauna e biostratigrafia. Mem. Mus.Civ. St.Nat., Sez.Sci, Terra, 5, p. 1-144, Verona.

Zittel, K.A. 1868. Die Cephalopoden der Stramberg Schichten: Pal.Mitt.Mus.Staat.2(1): (I-VIII), p. 1- 188, Bayer.

THE DIVERSITY OF LATE PLEISTOCENE-HOLOCENE MICROTERRIOCOMPLEXES OF BELARUS

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Small mammals, being tight variable to environmental conditions and dependent on food resources, climate and other environmental factors are peculiar indicators of ecosystem. Therefore, the change in environmental conditions and the composition of phytocoenosis inevitably reflect in the structure of their species composition. In carrying out the work, to study the dynamics of species diversity, we used both fossil and recent mikroteriologic material, whose analysis was carried out on an 8-time slices. The total number of definable fossils was 4752. Number of recent copies exceeded 3100. In order to analise the community structure and estimate species diversity we used conventional indicators (diversity indices). The degree of favorable environmental conditions was evaluated on the index of "evenness» e.

Research work results are: 1. The number of species in communities of small mammals increased from Late to Middle Holocene. Minimum number of species was typical for Driassic glacial stages of Late Pleistocene, and the maximum - to the Atlantic period, the Middle Holocene. The beginning of late Holocene has been steadily declining number of species and to our days the recent community of small mammals are comparable on the number of species to those in the early Holocene. 2. Dominance index gradually decreased from the Late Glacial to middle Holocene. Maximum values of this index were typical for communities of Driassic stages of the Late Glacial and recent communities of small mammals. The lowest level of dominance was characteristic for microterriocomplexes of the Atlantic period of Middle Holocene. Shannon diversity index, species richness and evenness index Piel increases in the direction of the Late Glacial to middle Holocene. Recent communities of small mammals are characterized by some of the highest value of the index of dominance and some of the lowest index value of equalization, diversity and species richness. 3. According to the indices the environmental conditions valuation is made. For microterriocomplexes of Late Glacial time the environmental conditions can be assessed as "moderate" for the communities of early Holocene, they are evaluated as "moderate, soft close" in the middle Holocene environmental conditions were the best and most valued as "soft". The environment for recent communities of small mammals according to the diversity can be assessed as "moderate, close to the stern. " "Severity" of environmental conditions at the present time is not determined by the peculiarities of climate or any natural processes, as it was during the Holocene, and antropic factor.

FOSSIL MALACOFAUNA IN FRESH-WATER LIMY DEPOSITS OF THE ANCIENT THERMAL SOURCE OF NATURAL BOUNDARY PYMVASHOR: SPECIFIC STRUCTURE AND PALEOECOLOGYCAL VALUE

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Hydrothermal sources of Subarctic region are a habitat of many live organisms, including mollusks. It speaks rather constant and favorable microclimate a hydroterm within all year. Round a hot well it is formed extrazonal a biocenosis peculiar to more southern climatic zone. Well-known that the mollusks living in hot wells have changes ontogeny, and, as consequence, on dimensional parameters they essentially differ from representatives of similar kinds out of a hydroterm. It is necessary to notice also that fossil mollusks in adjournment of hot wells are an important material for paleogeographic and paleoecological reconstruction.

The travertine deposits of an ancient thermal source combined limy late-quaternary tuffs (a late Pleistocene – Holocene), has been found out by us in the thermal natural boundary Pymvashor located in a river basin of Adzvy (Bolshezemelsky tundra, a southeast part of Nenets autonomous region).

By results of landscape shooting of the given construction cascade presence the travertine terraces blocked by a layer of alluvial deposits by average capacity 35±4.3 has been revealed see. In boards of terraces, alluvium and on an exposure fossil bowls gastropods, belonging to 6 species, 2 genuses (Lymnaea and Anisus) have been found out.

It is necessary to notice that the greatest quantity of bowls was revealed us in a layer of alluvial deposits on a surface travertine terraces that testifies to existence of a cavity filled with thermal waters in which lived ancient gastropods. It is analogy of modern sources of natural boundary Pymvashor.

ESTIMATING TAXONOMIC DIVERSITY IN THE FOSSIL RECORD: MORPHOLOGICAL AND MOLECULAR METHODS TO IDENTIFY PUTATIVE TAXA OF MICROMAMMALS

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We address the problem of taxonomic diversity in the fossil record, namely the question to what extent we are able to identify specimens to biologically meaningful species groups using traditional morphological methods, and ancient DNA data. We present the results of a case study in the three Microtus species (M. *arvalis, M. rossiaemeridionalis, M. agrestis)*. Discriminant function (DF) analysis of linear measurements of lower first molar is employed for taxonomic identification using modern representatives of the species occurring in the Ural Mountains as learning groups. DF derived from modern data was applied to m1s of *M.* ex gr. *arvalis-agrestis* from Subatlanticum and Atlanticum layers of the Pershinskaya 1 cave (Middle Urals). From 27 mandibles with m1 from the morphological dataset 258 bp of cytochrome b were sequenced using ancient DNA techniques. Comparison of the morphological and molecular results reveals efficient discrimination between *M. arvalis* sensu lato and *M. agrestis*. However, morphological change since Holocene to modern time appears to be detrimental to DF designed to differentiate between the sibling species in the fossil record. The pros and cons of the two methods to identify putative taxa of micromammals in the fossil record are discussed in the context of estimating paleobiodiversity. The study is supported by RFBR (10-04-96102), the RAS Program "Biosphere Origin and Evolution" (09-P-04-1001), the Federal Program "Scientific and scientific-pedagogical personnel of innovative Russia" (02.740.11.0279).

ORIGINS OF EXTANT SUIDS: A MUCH DEBATED ISSUE

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Suids are at present widespread in Africa and Eurasia, and in the domesticated and feral states are almost worldwide in distribution. Fossil suids were first described more than a Century and three quarters ago, and are known from Europe, Asia and Africa, yet there has been little agreement about phylogeny within the group. It is evident that suids were more diverse during the Miocene (Hyotheriinae, Kubanochoerinae, Listriodontinae, Tetracondontinae, Cainochoerinae, Suinae) than they are today (Suinae only). Whilst there is some agreement that all extant suids belong to Suinae, there is little consensus concerning the number of living genera and species within the subfamily (*Potamochoerus*, *Hylochoerus*, *Phacochoerus*, *Babyrousa*, *Sus*, *Porcula*, *Dasychoerus*) an aspect that molecular biology has thrown some light on, but has not resolved.

Few scientists have attempted to link living taxa of suids to their Miocene ancestors, except in rather vague ways. Suinae were abundant and diverse during the Late Miocene, which is probably why it has proven difficult to suggest robust hypotheses about relationships between Miocene and extant genera.

The problem is exacerbated by the fact that most suids tend to possess rather plesiomorphic dentitions, with the result that fossil taxa have generally been defined on the basis of dental dimensions rather than morphology, and the discovery locus has often been an over-riding consideration for determining the taxon to which a fossil is attributed. For this reason there has developed a great amount of synonymy, with the same taxon being known by three or more names, depending on whether the fossils were found in China, India, Eastern Europe, Western Europe or Africa. The extant species *Sus scrofa*, as currently widely accepted, occurs in Europe and Asia, as well as North Africa, which indicates that the tendency to split up fossil taxa on the basis of geography needs to be reassessed. The Mio-Pliocene suid faunas of China, India and Europe, and to some extent those of Africa, had much more in common with each other than one would imagine from the literature. This arises because researchers have tended to focus their efforts on one or other of the continents, meaning that they lack a synoptic view of the subfamily at the scale of the Old World.

This contribution examines the diversity of Miocene, Pliocene and Pleistocene suids of Africa, Asia and Europe, and shows that several taxa currently interpreted to represent two or more species, belong instead to extremely widespread species. A reduction of the quantity of names of fossil suids by uncovering synonymy will simplify suid nomenclature, and it will reduce the quantity of potential ancestors of the extant suids. Misidentification of suid fossils has also blighted understanding, whereas the proper identification of such specimens resolves many of the problematic issues (Pickford, 1988). Whilst there remain some difficulties, the linking of Mio-Pliocene taxa to extant ones seems to be a more attainable goal now than it used to be even a few years ago. With this in mind, a review of published phylogenies has been undertaken which exposes some of the difficulties that our predecessors experienced when interpreting the fossil record.

One of the outcomes of this research is the realisation that the extremely speciose genus *Sus* needs to be subdivided into at least three genera, *Sus* for the *scrofa* group (non-warty pigs with scrofic canines), *Dasychoerus* for the *verrucosus* group (warty pigs with verrucosic canines), *Porcula* for the pygmy hog, and possibly a fourth genus for the « *philippensis* » hog. *Babyrousa*, *Phacochoerus*, *Potamochoerus* and *Hylochoerus* complete the list of extant Suinae.

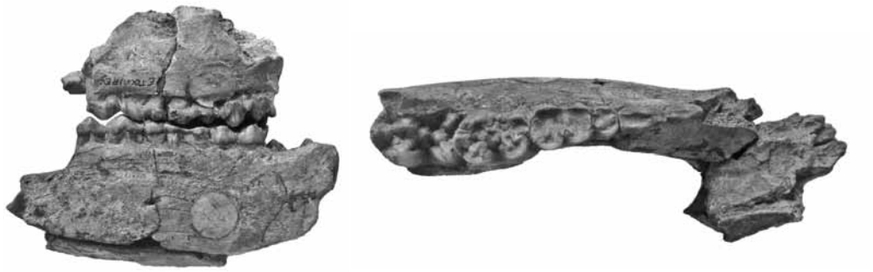

Figure 1. Holotype specimen of *Dasychoerus arvernensis* from Les Etouaires, Early Pliocene, France (lateral view of left maxilla and mandible and occlusal view of mandible
(not to same scale))

The extant species *Dasychoerus verrucosus* and its allies are related to Late Miocene to Early Pliocene *Dasychoerus arvernensis* (Fig. 1) as well as to *Potamochoerus*. Their late Miocene ancestor may be a species of *Propotamochoerus* but further research is required to settle the question, because there are indications of an undescribed genus of suid in the fossil record of Eurasia that may represent a lineage more closely related to *Dasychoerus* than to any other genus. The African genera *Potamochoerus*, *Kolpochoerus* and *Hylochoerus* are more closely related to *Dasychoerus* than to other genera of suids. *Phacochoerus* has traditionally been linked to *Kolpochoerus*, but Lydekker (1884) considered that « *Sus* » *falconeri* of India, which possibly belongs to *Dasychoerus*, could be its ancestor. *Sus scrofa* and its non-warty relatives seems to have descended from Late Miocene *Hippopotamodon* or a related genus The pygmy hog, *Porcula* may have descended from Late Miocene *Sivahyus*, as was thought by Pilgrim (1926).

References

Lydekker, R., 1884 – Siwalik and Narbada Bunodont Suina. *Palaeontologica indica*, **3**: 48-104.

Pickford, M., 1988 - Revision of the Miocene Suidae of the Indian Subcontinent. *Münchner Geowissenschaftliche Abhandlungen*, **12**: 1-91.

Pilgrim, G.E., 1926 – The Fossil Suidae of India. *Palaeontologica indica*, **8(4)**: 1-65.

FAUNA OF TERRESTRIAL MOLLUSKS OF LATE PALAEOLITHIC SITE VALEA MORILOR

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In 2009 was opened the Palaeolithic site Valea Morilor (Chișinău, Republic of Moldova) with credible evidence of hunting mammoths (*Mammuthus primigenius* Blumenbach, 1799). The monument has the following geographic coordinates: N 47°01′095″; E 28°48′400″. The absolute height of site cultural horizon is 68 m. The site is located on the left smooth slope of the valley of Durlești rivulet (right-bank tributary of Byc river), where the remains of the once extensive flood plain with an adjacent low floodplain terrace are preserved. Radiocarbon (^{14}C) analysis after a fragment of fossilized bone accomplished in Gröningen University, showed the date of 20 770 + / -90 BP (Obadă and van der Plicht, 2010). During the excavations in 2009-2010 an area of 1264 m^2 was uncovered.

During the fieldwork period on the study of the cultural layer remains of terrestrial molluscs were collected. The shells of these organisms could be observed on the dried surface of the excavation walls or pits. Therefore, some of the shells were extracted manually, but the main malakocenosis was washed directly from the cultural layer (collecting and washing the shells was performed by T. Obada).

The remains of terrestrial mollusks, in most cases are found in sediments that include traces of Paleolithic man in open sites in the Dniester river basin. The interest in these fossils is conditioned by the fact that their modern representatives are confined to certain habitats and on the basis of actualism principle the restoration of natural conditions of ancient people habitats becomes possible.

The revealed malakocenosis is represented by 4 species (tab. 1). All of them are present in actual malakofauna of given latitudes and have different ecological – zoogeographic peculiarities.

Thus, *Helicopsis striata* (Mull.) is an inhabitant of dry thoroughly warmed meadows and is spread in Western and Central Europe; *Pupilla muscorum* (L.) and *Vallonia pulchella* (Mull.) are found in various habitats, mainly open, and have a Holarctic distribution, while *Succinea oblonga* (Drap.) inhabits near as well as far from water bodies, in forests, bushes, being Euro-Asian species (Liharev I., Rammelimeier, 1952). The last three mollusc species are often found together in the actual habitats (Grossu, 1955).

Table 1. Species composition, quantity of shells and ecological features of mollusks from the site Valea Morilor

No	Species	Quantity of remains	Ecologica group (by V. Lozek,1964)	
1.	*Helicopsis striata* (Mull.)	78	Steppe	B
2.	*Vallonia pulchella* (Mull.)	7	Unforested biotopes (in general)	C
3.	*Pupilla muscorum* (L.)	73		
4.	*Succinea oblonga* (Drap.)	4	Forest and open wet biotopes	D

Based on the methodological principle of paleogeographic analysis of continental molluscs proposed by V. Lozek (1964), it should be noted that most of the remains in the fossil malakocenosis belong to *Helicopsis striata* (Mull.), representative of the steppe ecological group, and to the species *Pupilla muscorum* (L.) and *Vallonia pulchella* (Mull.) – inhabitants of open habitat whose ratio is respectively 48% and 50% (fig. 1). Such malacofauna is common for loess deposits of Prut-Dniester interfluve to the south of 48° North. Latitude (Prepelitsa, 2002). Its composition and ecological structure, in which the leading role has the steppe form *Helicopsis striata* (Mull.), prove the development of meadow-steppe landscape in the surroundings of the site. The absence of aquatic representatives in malacocenosis indicate that the area was not inundated, although the presence of shells of *Succinea oblonga* (Drap.) may indicate the proximity of a pond.

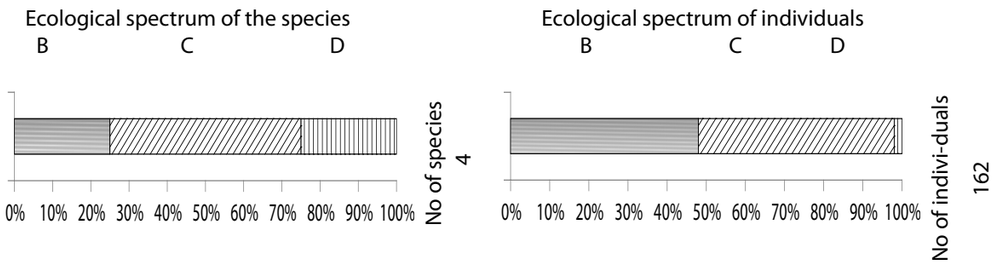

Figure 1. Ecological structure of malakocenosis from cultural layer of site Valea Morilor

The accumulation of sediments, including cultural remains, occurred in subaerial conditions, with the main role of deluvial processes. In this case it can be assumed that they were rather intense, as indicated by the good preservation of the shells, because of their rapid preservation and, accordingly, the excluding of their destruction under the influence of weathering. It should be also allowed the weak manifestation of soil formation processes during the formation of the cultural layer, because under their influenced the shells of land mollusks are usually destroyed, especially the thin-walled species from genera *Pupilla* and *Vallonia*.

Thus, based on the mentioned above features of ecological composition and taphonomy of fossil communities of terrestrial gastropods, we can conclude that the mammoth hunters from Valea Morilor lived in a relatively dry periglacial climate conditions, which caused the development of specific paleolandscapes around the loess steppe.

SPECIFIC DIVERSITY OF THE TURTLES OF SUPERIOR NEOGENE IN THE REPUBLICA MOLDOVA

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The specific diversity of the turtles of Superior Neocene in the Republic of Moldova is linked to the development of fossil faunistic complexes of vertebrates.

The ancient fossil remainders of terrestrial vertebrates on the territory of the country are known starting from the Middle Miocene. As a result of Carpathian Mountains rising the regress of Sarmatian basin with formation of lands and desalinated deltas are taking place. The conditions were favorable to the expansion of both terrestrial and freshwater vertebrates on the territory of the region. The expansion took place at the expense of Asian and South-European fauna in connection with climate change towards aridization.

For the Middle Sarmate two major faunistic complexes are identified - **Calfan** and **Varnitian**.

For the **Calfan** complex the representatives of turtles are characterized, mainly of freshwater fauna - Chelydropsis marchisoni, Trionyx moldaviensis, Melanochelys moldavica, Sarmatemis lungui. Terestrial turtles – Protestudo csakvarensis. P. chisinauensis.

Fauna of Reptiles gets a further development in Varnitian complex.

In that period further rising of Carpathian and increase of land areas is taking place along with the decreasing of river deltas on the territory of the region that is the cause of reducing the number of freshwater species of turtles. Only Protestudo darewski moldavica, Melanochelys sp. are present from the turtle fauna.

At the beginning of Meotic period on the territory of the country a not important transgression of the sea basin is observed, that conducted to the increase of salinity of the water in deltas.

Meotic complex in relation to the number of mammals is one of the richest, that is not noticed in the fauna of turtles, that is represented by Protestudo bessarabica. The fresh water turtles are missing due to the incompleteness of the paleontological annals or as a result of migration of this group from the territory of the region as a result of increasing of salinity of ancient rivers deltas.

For the early Pliocene fossil remainders of terrestrial vertebrate are not known because the territory of the region was under water and only to the end of early Pliocene became free of sea waters.

The Middle and Superior Pliocene are widely represented by turtle fauna due to important numbers of places with fossil fauna of **Moldovan, Khaprovian Tamanian faunistical** complexes.

For the **Moldovan faunistic** complex were discovered the fresh-water species of turtles Chelidropsis nopssai, Macrocephalochelys pontica, Melanochelis mossoczyi, M. pidoplickoi, M. sakyaformis, M.etuliensis, Sakya riabinini. Terrestrial turstles - Testudo cernovi, T. kucurganica.

Fauna of turtles of **Khaprovian faunistical complex** is represented by water turtles Mauremys salciensis, Melanochelis etuliensis, *:* Melanochelys mossoczyi, Sakya riabinini, Testudo sp. In this complex a new genus Mauremys is appearing and the number of terrestrial turtles is reducing.

The **Tamanian faunistical complex** consists of two periods of fauna development: **Early Tamanian (Odessan) and Late Tamanian**.

The **Odessan complex** is represented by turtle fauna - Melanochelys mossoczyi, Mauremis salciensis. Emys cf. antiqua. **Late Tamatian** complex is represented by one genus and specie Emys antique. In Tamatian period the further modification of Reptile fauna is continuing. An important change comparing to Moldovan complex the turtle fauna is suffering, where only some fresh water species are present. These are rare representatives of extinct or migrating in other warmer regions genera Melanochelys, Mauremis. At the beginning of the Late Tamatian only one genus and specie of fresh water turtle Emys antique is present.

As a result of natural changes since Middle Sarmatian till present from all diversity of turtles fauna on the territory of Republic of Moldova only one specie is living - Emys orbicularis .

THE NEW OSTEOLOGICAL MATERIALS OF BISON (Bison H. Smith, 1827) FROM THE PLIOCENE AND PLEISTOCENE TIME IN THE REPUBLIC OF MOLDOVA

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Several skeletal remains of mammal fauna from Pliocene and Pleistocene time of Moldova, including those of bison previously undescribed and that enlarge our knowledge about the history of this prehistoric bovine, have been found during the cataloguing process undertaken in the Museum of the Fossil Faunistic Complexes of the Republic of Moldova of Institute of Zoology, A.S.M. The short characteristic of some osteologic material is presented below.

One integral metatarsus (canon posterior) of bison have been found in a dark-brown stratum of gravel and sand of the inferior part of these alluvial sediments bared after a downfall in the immense career at the north-western part of Chirca village, Anenii Noi region, attributed to Upper Pliocene (according to geocronological scheme the most widely used by geologists and paleontologists) and characterized specifically by Happrovean Faunistic Complex from the western Europe and North Asia of the end of Upper Willafrank in Western Europe (aged 2,6-1,8 years). Such skeletal remains have not been discovered earlier in the sediments of inferior stream line of Dniester river of the similar geological age (David, Rusu, 2006) and generally in Moldova. This has the small dimensions, even smaller than those of the similar bone of the oldest (Eopleistocene, Superior levantim) and comparatively small species in Western Europe - *Bison (Eubison) suchovi Alexeeva, 1967* (see the Table) ignored by some researchers (Kahlke, 1999; Croitor, Burgal, 2007; Croitor, 2010) who actually consider it "junior synonym" (!) of more progressive (evolved) species of inferior Pleistocene – *Bison (Eobison) tamanensis Verestchagin* characteristic for Tamanensis Faunistic Complex (1,2 – 0,8 mln years ago). It is questionably to attribute the skeletal remains of bison, including bison from Chirca village described in abovementioned paper (David, Rusu, 2006) to "junior synonym" (!) - *Bison (Eobison) tamanensis,* the latter being known due to the only small fragment of braincase with basal part of horn (no postcranial bones) and somehow referred to an adult, senior individual.

In the context of the above mentioned metatarsis found in Chirca it should be stressed that this takes an additional argument demonstrating that bison' remains from Chirca, Salcia and Cobusca Veche careers known as unique alluvial sediments of the similar provenience and geological age, belong to a small form

of bison which indixes are close to *Bison (Eobison) suchovi* from South-Eastern Europe (Ukraine, Dolinsk), *B. (Eubison) n.sp.* from Greece (Apollonia-1) (Konstopoulos, 1997), *Eobison degiulii* from Italy (Capena locality) (Кроитор, 2010).

Incidentally, this year another bison remains piece have been found in Chirca career – a proximal part of a metacarpus (canon anterior), this also being of small dimensions (proximal width – 69 mm, anterior-posterior proximal diameter – 39 mm).

Among other findings of undescribed bison skeletal remains could be mentioned a part of frontal part of cranium with damaged horn (only a part of its basement have been preserved) discovered in the Pliocene alluvial sediments of a ravine in Bolduresti village, Nisporeni region. Its dimensions apparently demonstrate that this piece belong to an individual of *Bison sp.* of a small form. There were discovered the skeletal pieces (molars of mastodon *Zygolophodon turicensis*, *Mammut borsoni*) in the similar sediments of the respective zone – nearby Micleuseni, Nisporeni, Lozova and other localities.

Additionally, a basic part of a horn with a small frontal part of cranium found in the gravel and sand sediments of the second (?) terrace of Prut river in a career from Gremesti village, Briceni region, may be of interest, since it is a rare finding attributed to Upper Pleistocene of the Republic of Moldova. The horn dimensions (the length as of its base up to the rupture is 128 mm, horn base diameter – 380 mm, anterior-posterior diameter of horn base – 112 mm, superior-inferior diameter – 125 mm) demonstrates that this belong to a vigorous he-animal.

Table. The dimensions of the bison metatarsus compared with metatarsus of bison found in Chirca career

dimensions (mm)	Chirca	Dolinsk, Ukraine (Алексеева, 1967)	Middle Pleistocene, R.Moldova (Давид, 1980)	Upper Pleistocene, R.Moldova (Давид, 1980)
Total length	262	309	285-328 (312)	275-289 (283)
Proximal width	54	68,5	62-67 (66)	60,5-72 (67,1)
Anterior-posterior proximal diameter	53	68	60-69 (64)	-
Distal width	62	78	73-90 (80)	69,3-83 (76,5)
Anterior-posterior distal diameter	41	45	-	-
Minimal medial width	35	40,5	40-50 (45)	39,2-46 (42,4)

ASPECTS ABOUT THE EVOLUTION OF THE ECOSYSTEMS FROM THE MIDDLE AND LOWER COURSE OF THE NISTRU RIVER BASIN DURING THE SUPERIOR PLEISTOCENE

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The argument. The superior Pleistocene represents a separate stage of the natural ecosystems evolution. During that period of time the actual characteristics of the natural landscapes had outlined. The climatic oscillations, expressed by the succession in time of the glacial and interglacial phases, led to dramatic changes in the structure and floristic composition of the plant layer and animal associations. All this situations may serve as paleo-analogies in the assessment of the climate change impacts on the organic world at regional level.

Materials and methods. The regional aspects of paleogeographic conditions from the superior Pleistocene are reconstituted on the basis of palynological and malacological analysis of the deposits from the young terraces (I-III) of Nistru river (alluvia, fossil soils, loesses). As result of reminiscences research a series of sporo-polynical complexes and types of terrestrial clams fauna were identified that, thereupon, reflect the climate changes and modifications in the organic world. The sporo-polynical complexes are differentiated

by the percentage share of the tree and herbaceous plants pollen, as well as by its compound. The terrestrial gastropoda fauna types are also differentiated by the share of the clam ecological groups (forest or steppe species, euribionts etc), as well as by the presence of these groups representatives. The identification of the edifying elements in the complexes has special paleogeographic significance. For example, the boreal tundra plant species and the boreal-alpine clam species serve as indicators of a cool climate. On the other hand, the deciduous trees and forest gastropods indicate a warm climate. The reconstituted climatic oscillations and landscape types were referred to the superior Pleistocene chronostratigraphy from the periglacial regions of the East European Plain (Velichco, 1993).

Results. Taking into account the structure and compound of the sporo-polynical complexes and of the terrestrial gastrpoda fauna, the evolution of the plant layer and of the climatic oscillations of the mentioned area were reconstituted.

The Interglacial Cycle Miculino (Riss – Wurm, Eem) is characterized by the development of silvosteppe landscapes with mixed forests, which during the climatic optimum phase were made of deciduous trees: *Ulmus, Quercus, Carpinus, Fagus, Corylus, etc.,* mixed with some elements of relict flora: *Morus, Elaeagnus, Hippophae, Rhus* (Medianik, 1992). The spreading of this type of landscape is proved by the presence of the terrestrial clam fauna, namely *Helicigona banatica,* identified in the deposits of the III terrace of the Nistru river (Soroca open cast). The *Fauna with banatica* is constituted of forest elements such as: *Helicigona banatica, Helix pomatia, Clauzilia pumila, Bradibaena fruticum* and representatives of steppe biotopes: *Helicella condicans, Cepaea vindobonensis, Chondrula tridens, Helicopsis striata.* In the lower course of the Nistru river, the clams are represented by *Fauna with tridens* that reflects the spread of a steppe landscape. The presence of the deciduous trees relict elements and of the *Fauna with banatica* proves a warm climate with thermal and precipitation figures relatively higher that the actual one.

The Valdai (Wurm) Glacial cycle is characterized by specific heterogenic environment conditions caused by the climatic fluctuations that occurred against the background of climate cooling. During this period there may be outlined a series of interstadial and glacial evolution phases (stages) of ecosystems. During the early Valdai it is noticed the existence of some silvosteppe landscapes with pine elements combined with temperate mosotherm flora elements (mixed oakeries). The vegetation was mainly represented by herbaceous associations combined with different types of grazes. The silvosteppe landscape is specified by the *Fauna with Helix* in which the clams species *Helix pomatia, Vitreia crystallina*, *Clausilia sp.,* as representatives of forest biotopes, are spread in combination with such steppe elements as: *Chondrula tridens, Helicopsis striata, Cepaea vindobonensis, Helicella sp.* The last one predominates in the clams associations in the lower part of Nisrtu basin making the *Fauna with tridens*. The insignificant presence of deciduous elements and the absence of gastropoda fauna thermophile species *elicigona banatica,* as well as the predomination of steppe elements denotes a cooling of the climate. This phase was parallel with the Krutiţk interstadial (soil formation) from the periglacial regions during which the forest zones degradation on extended areas occurred. (Velichco, 1973).

The middle Valdai is marked by a climate cooling, which favored the extension of some "cold" periglacial steppe landscapes. The high share of the herbs in the polynical spectrum denotes a low degree of afforestation and the presence of the *Artemisia* species serves as indicator of a cold and arid climate. The trees associations were made of pine glades mixed with boreal cryophilic elements of *Betula humilis, B. nana, Alnaster fruticosus.* In the middle course of the basin the terrestrial gastropods were represented by *Fauna with Columela* having as indicator the boreal-alpine species of *Columella columella that* nowadays is spread in the alpine areas valleys. This type of fauna is dominated by steppe and euribiont species with *Pupilla muscorum, Vallonia pulchella, Sucinea oblonga* etc., as well as a wide spread of the North-Eurasia species of *Valonia tenuilabris* and, more seldom, the forest type *Clausilia pumila*. This fauna reflects a tundra-steppe landscape with trees and bushes groves. In the lower course of the basin there were spread *Fauna with striata* that denotes the presence of a "cold" steppe landscape. This stage may be correlated with Hotîleov phase of loess layer formation from the periglacial area of the East European Pain.

Late Valdai is characterized by particularly heterogenic environment conditions marked by accentuated climate fluctuations with recrudescences of very severe cold. That led to relatively rapid changes of the bio-geographical landscapes culminated by the actual structure and diversity of the landscapes. The beginning of this stage is marked by warmer climatic conditions that led to the development of predominant steppe vegetation, in which there were forest conifer associations combined with temperate flora elements of mixed oakery kind very resistant to cold. From chronological point of view this phase corresponds to the

interstadial Breansk (fossil sol formation) attested in the periglacial regions and that has the significance of an epoch with less outlined landscape zonal differences. (Velichco,1973). In the middle sector of the basin, this fossil soil layer is characterized by Fauna *with tenuilabris*, having as indicators the North-Asiatic species of *Valonia tenuilabris* and representatives of the steppe biotopes and euribiont forms. In the lower sector of the Nistru river basin the representatives of steppe clams and of the euribiont one represent the main ecological groups. The Breansk interstadial is followed by a glacial stage characterized by a pronounced cooling and drying of climate that led to the disappearance of the deciduous trees elements (oak, lime, elm) and appearance of herbaceous plants. The cryophilic boreal plants pollen granules are frequent in the polynical spectrum. The "cold" and dry steppe landscape, characteristic for the periglacial stages, had extended. The forest, as a zonal element, had degraded. This phase may be synchronized with the Desninsk loess layer formation stage from the periglacial zone of the East European Plain.

The glacial stage is again followed by a climatic amelioration that favored the increase of tree elements role in the vegetal cover and to the extension of silvosteppe landscape with pine-birch formations combined with mixed oakery elements. This phase coincides with the formation of the fossil soil layer, 14640+360 IGAN-633 age dated when using the C^{14} method. It can be synchronized with the Trubcevsk interstadial from periglacial regions. The climate amelioration phase is interrupted by a new wave of cold that led to the steppe landscape massive formation and to the extension of „cold" periglacial steppes with boreal flora elements and to the accumulation of loess deposits that may correspond to the Altînovsk layer from the periglacial zone. The terrestrial gastropoda associations represented by *Fauna with Columela* are included in the scenario of the postbreansk vegetation community's evolution through the cooling climate phases. The appearance in its compound of the forest elements may point out climate amelioration. This type of fauna was spread in the middle sector, while in the lower one there had persisted *Fauna with Helicopsis* noting a continuous development of the steppe landscape.