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SPECIES OF PREDATORY MITES (ARACHNIDA, ACARI) ASSOCIATED WITH THE PLANT *TANACETUM VULGARE* (L.) (ASTERALES, ASTERACEAE) IN THE NORTH-EAST OF ROMANIA

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Abstract. In the current catalogues of Arthropods associated with the plant *Tanacetum vulgare* appears until now only a phytophagous species of mites, *Eriophyes tuberculata* (Nal.) (Acari, Eriophyidae), found on this plant in Romania, as well. In this study it is analyzed the fauna of mites collected on plants in growth, beside that obtained through the growth of hibernant stems of *T. vulgare*. These species were multiplied in the Schmitz tubes from the eggs laid on the stems of *T. vulgare* in the previous autumn. There were identified 19 species of Acari, of which 6 phyto-saprophagous species and 13 predatory species. These species were multiplied in the Schmitz tubes from the eggs laid on the stems of *T. vulgare* in the previous autumn. From a faunistic point of view, among predatory taxa, the folowing are recorded for the first time in Romanian fauna: *Bdellodes longirostris* (Herm.) and *Bdella* sp. (Fam. Bdellidae), Fam. Anystidae and *Anystis* sp.; *Cunaxa* sp. (Fam. Cunaxidae); *Eupodes* sp. (Fam. Eupodidae). Beside these taxa, were identified *Androlaelaps casalis* Berl. and *Hypoaspis* sp. (Fam. Laelapidae), *Euseius* sp. (Fam. Phytoseiidae), *Leptus* sp. (Fam. Erythraeidae) and *Allothrombium fuliginosum* (Fam. Trombidiidae). Relations with *T. vulgare* of these taxa are reported for the first time within arthropod fauna associated with this plant, itself with economic and ecological importance.

Keywords: *Tanacetum vulgare,* associated fauna, arthropods, predatory mites, trophic relationships.

Rezumat. Specii de acarieni prădători (Arachnida, Acari) asociate cu planta *Tanacetum vulgare* (L.) (Asterales, Asteraceae) din nord-estul României. În cataloagele existente ale artropodelor asociate cu planta *Tanacetum vulgare* (L.) există menționată numai specia fitofagă *Eriophyes tuberculata* (Nal.) (Acari, Eriophyidae), care este cunoscută de pe această plantă și în România. În cadrul studiului de față se analizează fauna de acarieni colectată de pe plantele în vegetație, precum și cea obținută prin „creșterea” tulpinilor hibernante după metoda Schmitz. Aceste specii au fost multiplicate în tuburi Schmitz, din ouăle depuse pe tulpini de *T. vulgare* în toamna precedentă. În total au fost identificate 19 de specii de acarieni, 6 specii fito-saprofage și 13 specii prădătoare. Din punct de vedere faunistic, unii dintre taxonii prădători sunt semnalați pentru prima oară în fauna României: *Bdellodes longirostris* (Herm.) și *Bdella* sp. (Fam. Bdellidae), Fam. Anystidae și *Anystis* sp.; *Cunaxa* sp. (Fam. Cunaxidae); *Eupodes* sp. (Fam. Eupodidae). Alături de acești taxoni s-au identificat: *Androlaelaps casalis* Berl. și *Hypoaspis* sp. (Fam. Laelapidae), *Euseius* sp. (Fam. Phytoseiidae), *Leptus* sp. (Fam. Erythraeidae) și *Allothrombium fuliginosum* (Fam. Trombidiidae). Relațiile acestor taxoni cu *T. vulgare* sunt semnalate pentru prima dată cu privire la artropodofauna asociată acestei plante, ea însăși de mare importanță economică și ecologică.

Cuvinte cheie: *Tanacetum vulgare,* fauna asociată, artropode, acarieni prădători, relații trofice.

Introduction

Tanacetum vulgare (L.) is a plant species with Eurasian origin, frequent in the

steppe zone, beech floor, scrubs, ruderal places and wet meadows. It has a great chemotype diversity which gives multiple proprieties: antimicrobial, antihelminthic, allelopathic and repellent, defence against phytophagous etc. In Romania studies on this plant have investigated morphological, anatomical, histological aspects, and also pharmacognosy; biodiversity issues are not studied so far. A series of researches developed in Europe have shown that *T. vulgare* is one of the most useful plants within an ecosystem, providing by its associated fauna numerous predatory and parasitoid species necessary to maintain a natural dynamic equilibrium. On the other hand, in North America it is an invasive species, and the extensive research undertaken in Europe (Gassman, 1995; Schmitz, 1996a, 1996b, 1998; Wolf *et al.*, 2011) led to selection of phytophagous insects indicated to be introduced for biological control of this weed.

In the current catalogues of arthropods associated with *T. vulgare* is mentioned only one species of mites, the phytophagous *Aceria tuberculata* (Nal.) (=*Eriophyes tuberculatus* (Nal.), that was recorded on this plant in our country, too (Pașol *et al.*, 1986). The results presented in this article were obtained in the frame of the PhD thesis of one author (Chiriliuc, 2015), which refers on overall diversity of arthropod fauna associated with *T. vulgare* in North-East Romania.

Material and Methods

In order to collect the arthropod fauna associated with *Tanacetum vulgare* (L.) have used the following methods:

- collecting with entomological net on plants in growth (at Bucium, Iasi county, from May 21 to August 3, 2010);

- collecting using water traps within the clumps of *T. vulgare* (at Vicovu de Jos, Suceava County, on July 29, 2009);

- "growth" of hibernating stems, using the growth tube method imagined and used by Gregor Schmitz (1995) (at Vicovu de Jos and Vicovu de Sus, Suceava County, 2009-2010). This method provided most substantial results regarding mite diversity on *T. vulgare* (Table 1).

In total 388 specimens of mites – larvae, nymphs and adults were collected and obtained by rearing. Faunal material was studied using the optical microscope, on temporary slides after clarification in lactic acid 70%. Because most specimens represented immature stages of development, could be done the identification of species in 7 cases, in 10 cases was identified the genus, and in other two the family. Identification of mites and taxonomic affiliation were accomplished using current bibliography on mites (Ghiliarov & Krivolutsky, 1975; Ghiliarov, 1978; Karg, 1971, 1993; Krantz, 1978; Krantz & Walter, 2009; Weigmann, 2006).

Results and Discussion

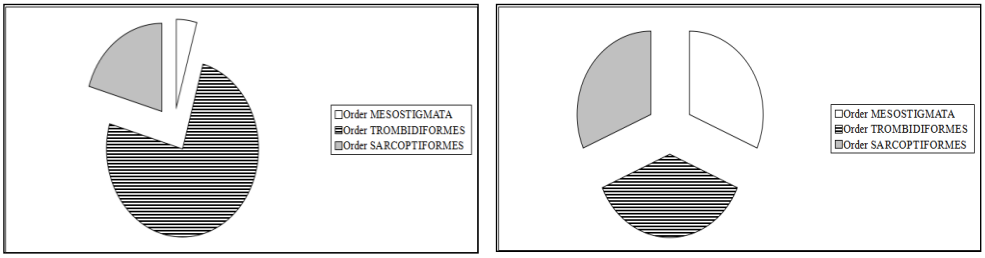
The mite fauna associated with plant *Tanacetum vulgare* (L.) was represented by 19 species/genera, from 16 families belonging to orders Mesostigmata, Trombidiformes and Sarcoptiformes. Predatory mites (ord. Mesotigmata and Trombidiformes) are best represented both in the number of taxa (68% of total) and individuals (80%) (Table 1). In terms of relative abundance of mites orders (Fig. 1a, b) the dominance of the order Trombidiformes is remarkable, especially as individual number, due to one species, *Allothrombium* aff. *fuliginosum* (Herm.) that holds 82% of predatory mites. As regards the

number of taxa, the representation of the three orders is more balanced, including predatory mites that belong to Mesostigmata and Trombidiformes.

Table 1. Diversity and abundance of mites (Subclass Acari) associated with *Tanacetum vulgare* (L.).

	Collecting method	Hibernating stems		Plants in growth/ entomological net		Plants in growth/ water traps		Total	
	Subclass ACARI Taxa	d m	z	d m	z	d m	z	d m	z
	Order MESOSTIGMATA								
	I. Fam. LAELAPIDAE								
1	*Androlaelaps casalis* (Berl.)	-	-	-	1	-	1	-	2
2	*Hypoaspis* sp.	-	2	-	-	-	3	-	5
	II. Fam. PARASITIDAE								
3	*Leptogamasus* sp.	-	1	-	-	-	-	-	1
	III. Fam. PHYTOSEIIDAE								
4	*Euseius* sp.	-	2	-	-	-	1	-	3
5	*Phytoseiidae* g. sp.	-	1	-	-	-	-	-	1
	IV. Cohorta UROPODINA								
6	*Uropodina* g. sp.	-	-	-	-	-	1	-	1
	Order TROMBIDIFORMES								
	V. Fam. BDELLIDAE								
7	*Bdellodes longirostris* (Herm.)	-	1	-	-	-	-	-	1
8	*Bdella* sp.	-	9	-	-	-	1	-	10
	VI. Fam. CUNAXIDAE								
9	*Cunaxa* sp.	-	2	-	-	-	-	-	2
	VII. EUPODIDAE								
10	*Eupodes* sp.	-	1	-	-	-	-	-	1
	VIII. Fam. ANYSTIDAE								
11	*Anystis* sp.	-	1	-	-	-	12	-	13
	IX. Fam. ERYTHRAEIDAE								
12	*Leptus* sp.	-	1	-	1	-	-	-	2
	X. Fam. TROMBIDIIDAE								
13	*Allothrombium* aff. *fuliginosum* (Herm.)	-	-	-	196	-	-	-	196
	Order SARCOPTIFORMES								
	Suborder ORIBATIDA								
	XI. Fam. GUSTAVIIDAE								
14	*Gustavia microcephala* (Nicol.)	-	-	-	-	1	-	1	-
	XII. Fam. CERATOZETIDAE								
15	*Trichoribates novus* (Selln.)	1	-	-	-	2	-	3	-
	XIII. Fam. SCHELORIBATIDAE								
16	*Scheloribates labyrinthicus* (Jel.)	-	-	-	-	1	-	1	-
	XIV. GALUMNIDAE								
17	*Pilogalumna crassiclava* (Berl.)	-	-	-	-	6	-	6	-
	XV. Fam. ACARIDAE								
18	*Tyrophagus* sp.	2	-	-	-	-	-	2	-
	XVI. Fam. GLYCYPHAGIDAE								
19	*Glycyphagus* sp.	48	-	-	-	-	-	48	-
	Number of species	3	10	-	3	4	6	6	13
	Number of specimens	51	21	-	198	10	19	61	238

Legend: d m – detrito-microphytophages; z – zoophages.



a b

Figure 1. Relative abundance of mites orders, as number of individuals (a) and taxa (b).

Analyzing diversity of fauna collected by the three methods can be noticed that highest number of taxa, including predatory mites, was obtained from the hibernating stems through the growth in Schmitz tubes. Among these taxa *Hypoasis* sp., *Euseius* sp., *Bdella* sp., *Anystis* sp. și *Leptus* sp. were obtained through the growth of hibernating stems, as well as by collecting on plants in vegetation (Table 1). It is probably that their trophic relationships within the arthropod fauna associated with *T. vulgare* are more complex and more stable.

The list of predatory mites found in our research in association with the plant *Tanacetum vulgare* (L.), with collecting data and a synthesis of significant information on the biology of each taxon is presented below.

I. Family Laelapidae

1. *Androlaelaps casalis* (Berl.). One deutonymph was collected on plant in vegetation at Bucium - Iași on 29.05.2010.

A. casalis is a predatory mite on other mites and small invertebrates, including some parasitic mites. According to Krantz & Walter members of the genus *Androlaelaps* are obligatorily nidicolous, living in rodent and bird nests. Some species of genus *Androlaelaps* consumes also, the eggs and larvae of some Chrysomelidae species which are corn pests, such as *Diabrotica virgifera virgifera* and *Diabrotica barber*, the first one being recently introduced in cultures from our country.

2. *Hypoaspis* sp. Two deutonymphs were obtained from hibernating stems of *Tanacetum vulgare* (L.) collected from Vicovu de Sus on 10.04.2010 and kept in Schmitz tubes of growth and three deutonymphs by water traps placed in clumps of *T. vulgare* on 29.07.2009 at Vicovu de Sus.

Members of the subfamily Hypoaspidinae often are collected in litter or soil substrates or encountered in the nests of mammals or arthropods some being directly associated with insects. Also they are consuming other mites, larvae and pupae of Diptera (phyto- and fungivorous ones), springtails. Some species show potential for use as biological control agents against fungus gnats (Diptera) and flower thrips in greenhouses (Krantz & Walter, 2009).

II. Family Parasitidae contains several genera of predatory mites with important species in biological pest control of harmful arthropods (Krantz & Walter, 2009).

3. *Leptogamasus* sp. One juvenile (nymph) was obtained between 17.06.2010-15.07.2010 from hibernating stems of *Tanacetum vulgare* (L.) collected on 28.04.2010 from Vicovu de Jos (Suceava) and kept in Schmitz tubes.

III. Family Phytoseiidae is probably the most widely and best known assemblage of phytophilous mite predators, because some of its members are important in the control of spider mites (Tetranychidae) and eriophyoid mites in commercial orchard and vine crops. Many of these species may feed also with insects and their eggs, and some may supplement their arthropod diet with plant juices, pollen and honeydew (Krantz and Walter, 2009). Some species, which are already commercialized, are used in greenhouses and strawberry cultures as biological control agents. In Romania ample studies, theoretic and applicative for this domain, were done by Iacob (1975, 1978).

4. *Euseius* sp. Two males were obtained from hibernating stems of *Tanacetum vulgare* (L.): 1 ♂ between 17.06 and 15.07.2010, from stems collected at Vicovu de Jos, on 28.04.2010 and 1 ♂ between 20.04 and 20.07 from stems collected at Vicovu de Sus, on 10.04.2010; 1 ♀ from water traps on 29.07.2009 at Vicovu de Jos.

In USA and in some other countries, certain species of *Euseius* are used in biological control of spider mites, especially in citrus and other exotic fruits groves (at least 9 species). Other species are used against Aleyrodidae insects that feed on tobacco, cotton and bean plants (Coombs & Coombs, 2003; Hajek, 2004).

5. *Phytoseiidae* g. sp. One deutonymph was obtained from hibernating stems of *Tanacetum vulgare* (L.) collected at Vicovu de Jos on 28.04.2010, growth in Schmitz tubes from which was collected between 28.04 -17.06.2010.

IV. Cohort Uropodina comprises species characteristic of ephemeral habitats such as compost, manure, dung and also in food storage. Some uropodoid genera seem to prefer soil and humus substrates. Most uropodine deutonymphs are phoretic and typically attach to their carriers (beetles, other insects and even small vertebrates) by an anal pedicel (Krantz & Walter, 2009).

6. *Uropodina,* fam. g. sp. One specimen was collected in water traps placed in clumps of *Tanacetum vulgare* (L.) at Vicovu de Sus, on 29.07.2009.

V. Family Bdellidae comprises mites often named snout mites, which are found in various habitats, e.g. soil, plants, caverns, intertidal zone of sea shores etc. They are predatory species of small arthropods and their eggs, including pests, as springtails, aphids, other phytophagous mites and Diptera larvae. Some species are important agents in biological control of phytophagous mites in vineyards from California, or of some harmful springtails in Australia (Coombs & Coombs, 2003; Hajek, 2004).

7. *Bdellodes longirostris* (Herm.): 1 ♀ was obtained from hibernating stems of *Tanacetum vulgare* (L.) collected at Vicovu de Jos (Suceava), on 28.04.2010 and arose in the Schmitz tubes between 17.06 and 15.07.2010. *B. longirostris* is known as predator, as other *Bdellodes* species, that are important agent of biological control of harmful collembolans. The genus and species are new to Romanian fauna.

8. *Bdella* sp. From dead hibernating stems kept in Schmitz tubes were obtained: 2 specimens between 17.06 and 15.07 from the stems collected at Vicovu de Jos (Suceava) on 28.04.2010 and 7 specimens between 10.04 and 20.07 from the stems collected on 10.04 in Vicovu de Sus (Suceava). One specimen was collected in water traps at Vicovu de Jos on 29.07.2009. Biology of *Bdella* species and the economic importance arise from the mentions concerning Family Bdellidae. The genus *Bdella* is recorded now for the first time in Romanian fauna.

VI. Family Cunaxidae includes small to large size predators, frequently found in soil, moss, plant debris, even in stored products, feeding on microarthropods. Also, many

cunaxids are aerial forms that prey on phytophagous mites, insects (collembolans, thrips etc.), and nematodes. Thus, some species were observed to prey on eriophyid mites infesting vineyards, other are frequent on bark of fruit trees infested by spider mites (Tetranychidae), but their effectiveness on pest populations has not been determined (Krantz & Walter, 2009). Other authors reported cunaxids to be auxiliary predators that are useful for crops, but not main predators used in integrated control techniques (Skvarla *et al.*, 2014).

9. *Cunaxa* sp.: 2 specimens were obtained between 20.04 and 20.07 from hibernating stems of *Tanacetum vulgare* (L.) collected at Vicovu de Sus on 10.04.2010.

The genus *Cunaxa* is a new record for Romanian fauna.

VII. Family Eupodidae includes mites which are common in litter, damp soil, humus, moss, lichens or on low vegetation. They have a predaceous, fungivorous or phytophagous trophic regime, some being even parasitic on snakes (Krantz et Walter, 2009).

10. *Eupodes* sp. One specimen was obtained from hibernating stems of *Tanacetum vulgare* (L.) collected at Vicovu de Sus on 10.04.2010 and kept in Schmitz tubes. Morphology of chelicera with movable cheliceral digit chelate and opposed to fixed digit indicates predatory feeding habit of the studied specimen.

VIII. Family Anystidae is a family of mites that contains generalist predators found on a variety of habitats including plants (Duso *et al.*, 2012). Some species of the genus (e. g. *Anystis baccarum*) are predators of phytophagous mites and insects in Europe, Australia, Africa and North America. *Anystis salicinus* and *Anystis wallacei* were introduced in Australia to control certain phytophagus mites, and *Anystis agilis* prey on citrus thrips and nymphs of Cicadellidae (Homoptera) (Coombs & Coombs, 2003; Hajek, 2004).

11. *Anystis* sp. One protonymph was obtained between 17.06 and 15.07 from hibernating stems of the plant *Tanacetum vulgare* (L.) collected in Vicovu de Jos (Suceava County) on 28.04.2010 and kept in Schmitz tubes. Another 12 specimens including 2 ♀ with eggs were caught in water traps at Vicovu de Jos (Suceava County) on 29.07.2009.

Family *Anystidae* and genus *Anystis* are mentioned hereby for the first time in Romanian fauna.

IX. Family Erythraeidae – a large and diverse family comprising mites found in a broad range of edaphic and arboreal habitats. Larvae are typically parasitic on other arthropods, although those of some species are parasites on vertebrates, while others are free living forms. Postlarval stages are active predators feeding on small invertebrates (Krantz & Walter, 2009).

12. *Leptus* sp. One specimen was obtained between 17.06 and 15.07 from stems of *Tanacetum vulgare* (L.) collected at Vicovu de Jos (Suceava County) on 28.04.2010. Another specimen was collected on plant in vegetation at Bucium (Iași County) on 29.05.2010.

As regards the biology, adults and nymphs of *Leptus* species are large predators in litter and herbaceous plant habitats (Krantz & Walter, 2009). *Leptus treati* feed on eggs and can be used in biological control of spruce budworm, *Choristoneura fumiferana* (Tortricidae) (Coombs & Coombs, 2003; Hajek, 2004). In Romania two species were described by Feider, *Leptus phyllotretae* (Feider, 1956) and *Leptus galerucae* (Feider, 1967) with parasitic larvae on Chrysomelidae (Coleoptera).

X. Family Trombidiidae – a large family of mites, those deutonymphs and adults densely setose and bright colored in red (named velvet mites) are conspicuous and readily recognized. These instars are voracious predators of small invertebrates, some species being known to attack important agricultural pests, while larvae are parasitic on arthropods.

13. *Allotrombium* sp. aff. *fuliginosum* Herm. Our material consists of 196 juveniles, material collected from the plant in vegetation at Bucium (Iași County), on 29.05.2010.

According to Feider (1955) spring population comes from the previous year and only individuals collected from July to autumn represent first generation of the current year. Larvae are parasitic on aphids or other arthropods, as spiders, insect larvae, harmful Heteroptera etc., while the adults are predators.

Another species, *Allothrombium pulvinum* is studied with a view to control aphids in peach orchards from China (Coombs & Coombs, 2003). Some other authors mentioned that *A. pulvinum* larvae are important early season parasites of damaging aphids in cotton fields or in pea crops, and conclude that species of this genus have considerable potential as agents of biological pest control (Zhang & Chen, 1993; Zhang *et al*., 1993; Chen *et al*., 1994 cited by Krantz & Walter, 2009).

Along with predatory mites were collected on *Tanacetum vulgare* detrito-microphytophagous mites belonging to order Sarcoptiformes, which represent about 32% of the number of taxa and 20% of individuals (Fig. 1a, b). Regarding oribatid mites, many species are hemi-edaphic and are found frequently on herbaceous plants, while others are arboricolous forms that feed especially on lichens (Norton & Behan-Pelletier, in Krantz & Walter, 2009). In this case, presence of oribatid and astigmatid mites on *Tanacetum* plants may be linked to the proliferation of fungi, in addition with organic debris and/or microbial exudates which may constitute trophic basis for these mites. An argument supporting this hypothesis is that the largest number of mites in this trophic category (all specimens of *Tyrophagus* and *Glycyphagus*) were obtained by growth of hibernating stems in Schmitz tubes (Table 1).

The present study, as part of research regarding arthropod fauna associated with *Tanacetum vulgare* (L.), brings original contribution on diversity of predatory mites. Further investigations are needed in order to elucidate trophic relationships within the assemblage of arthropods associated with this plant, and also the role of predatory mites.

Nowadays it is recognized that zoophagous arthropods have an important role in sustainable agriculture as natural enemies of pests. Predatory mites can provide biological control of phytophagous mites which affect a wide range of plants, and several species are major pest causing substantial economic damage to crops. In this context, should be mentioned the ecological and economic importance of the plant species *Tanacetum vulgare* (L.) through the diversity of predatory mites that favorably influences the surrounding environment or ecosystems.

Conclusions

The plant *Tanacetum vulgare* (L.) represents an important source of biodiversity for arthropods in general and concerning zoophagous mites as well, being registered 13 species / genera from 10 families belonging to orders Mesostigmata and Trombidiformes. Among these taxa, especially those belonging Fam. Phytoseiidae have economic importance in biological and integrated control of pests.

In terms of fauna, the following taxa are new to Romanian fauna: *Bdellodes longirostris* (Herm.) (genus and species), *Bdella* sp., Fam. Anystidae and *Anystis* sp., *Cunaxa* sp. and *Eupodes* sp. Meanwhile, relations with *T. vulgaris* of the 13 taxa were mentioned for the first time within the arthropod fauna associated with this plant, itself with economic and ecological importance.

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SPECIES OF PSOCOPTERA (INSECTA, PSOCOPTERA) ASSOCIATED WITH THE PLANT *TANACETUM VULGARE* (L.) (ASTERALES, ASTERACEAE) IN THE NORTH-EAST OF ROMANIA

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Abstract. The paper presents data on the species of Psocoptera not mentioned in the existing catalogue of species of Arthropoda associated with the plant *Tanacetum vulgare* (L.). For collecting and obtaining the material of Psocoptera there was used the classic entomological net on plants, and, especially, the “Schmitz” photo-selector. In this photo-selector, there were kept the dry, hibernating stems of the plant, collected from three stationaries, Vicovu de Jos and Vicovu de Sus (Suceava County), located approximately 100 km SE from the third stationary from Cotu-Copalău (Botoşani County). Thus, there were obtained three species belonging to three families: *Lepinotus reticulatus* End. (Family Trogiidae), *Liposcelis* sp. (Family Liposcelididae) and *Lachesilla pedicularia* (L.) (Family Lachesillidae) which belong to the entomofauna associated with the plant *Tanacetum vulgare* (L.). From a zoogeographical point of view, *L. reticulatus* is reported for the first time in the north-east of Romania, and for *L. pedicularia* there are presented new data regarding the distribution in Romania. There are also presented data about the abundance of species in the three stationaries as well as the dynamics of multiplication during the season. Thus, it is established the quality of resource and support of biodiversity of the plant *Tanacetum vulgare* (L.).

Keywords: Psocoptera (Insecta), *Tanacetum vulgare* (L.), North-Eastern Romania.

Rezumat. **Specii de Psocoptera (Insecta) asociate cu planta *Tanacetum vulgare* (L.) (Asterales, Asteraceae) în nord-estul României**. Articolul prezintă date asupra speciilor de Psocoptera, nemenţionate în catalogul existent al speciilor de Artropode asociate cu planta *Tanacetum vulgare* (L.). Pentru colectarea şi obţinerea materialului de Psocoptera a fost utilizat fileul entomologic clasic, pe planta în vegetaţie, şi, mai ales fotoselectorul „Schmitz”. În acest fotoselector au fost păstrate tulpinile uscate, hibernante, ale plantei, colectate în trei staţionare, Vicovu de Jos şi Vicovu de Sus (judeţul Suceava) fiind situate la aproximativ 100 km. SE de cel de al treilea staţionar de la Cotu-Copalău (judeţul Botoşani). Astfel, au fost obţinute trei specii aparţinând la trei familii: *Lepinotus reticulatus* End. (Fam. Trogiidae), *Liposcelis* sp. (Fam. Liposcelididae) şi *Lachesilla pedicularia* (L.) (Fam. Lachesillidae), ca aparţinând la entomofauna asociată cu planta *Tanacetum vulgare* (L.). Din punct de vedere zoogeografic, *L. reticulatus* este semnalată pentru prima dată din NE României, iar pentru *L. pedicularia* (L.) se prezintă noi date privind distribuţia în România. Se prezintă, de asemenea, date despre abundenţa speciilor în cele trei staţionare precum şi dinamica înmulţirii în timpul sezonului. Astfel, se stabileşte calitatea de resursă şi suport de biodiversitate a plantei *Tanacetum vulgare* (L.).

Cuvinte cheie: Psocoptera (Insecta), *Tanacetum vulgare* (L.), nord-estul României.

Introduction

The study of entomofauna associated with the plant *Tanacetum vulgare* (L.) was initially determined by its ecological and partially economic importance, in and for the European, Natural, anthropogenic and urban Space, (Klausnitzer, 1966, 1968, 1985, 2008;

Klausnitzer & Klausnitzer, 1993; Haus, 1971; Frei & Manhart, 1992; Schmitz, 1995, 1996, 1998).

Due to the fact that the plant *Tanacetum vulgare* (L.), accidentally introduced in North America (Canada and USA), became a very harmful weed compromising the grasslands without being a fodder plant, it was raised the problem of searching the main phytophagous insects of the plant in Europe in order to be introduced in North America within some biological control programmes.

This situation determined the development of some intensive research especially related to the biology of phytophagous insects associated with the plant, under the aegis of the International Institute of Biological Control, the European Station from Delémont – Switzerland (CAB International) (Freise & Schroeder, 1996; Gassmann, 1995; Gassmann *et al*., 2007, 2008).

Material and Methods

For collecting the study material, there was also used the classic method, namely the entomological net for collecting from plants in vegetation, but especially the method of "Schmitz" photo-selector (Schmitz, 1995, 1996), which enabled us to obtain the biological material associated with the stems of the plant, in our case, dead, hibernating stems, collected in spring after wintering in nature and stored in the tubes of the photo-selector. In these tubes, there emerged, over time, the insects which developed from the eggs or pupae remaining from the previous autumn on stems. These insects came out of the "Schmitz" tubes and they were periodically collected from the bottles with ethylene glycol into which they fell.

But, for some groups of arthropods, these tubes constituted an environment in which they developed as a community of restricted "populations" (Acarina, Collembola, Psocoptera), which had a detritophagous and predatory trophic regime. In this sense, dead stems of *Tanacetum vulgare* (L.), which hibernated in natural conditions, were collected from three stationaries (Fig.1; Table 1), Vicovu de Jos, Vicovu de Sus (Suceava County) – in the north-west, and Cotu-Copalău (Botoșani County) located approximately 100 km, SE and stored in the "Schmitz" tubes (Fig. 2).

The material extracted from the "Schmitz" tubes was sorted and subsequently identified, prepared, photographed, etc., then preserved in alcohol or in microscopic preparations.

Results and Discussion

From those three stationaries (Table 1), from dead, hibernating stems of *Tanacetum vulgare* (L.), there were obtained 5560 specimens of Psocoptera belonging to three species of three families, *Lepinotus reticulatus* End. (Family Trogiidae), *Liposcelis* sp. (Family Liposcelididae) and *Lachesilla pedicularia* (L.) (Family Lachesillidae).

a

b

c

Figure 1. Stationary aspect: a. Vicovu de Jos (Suceava County), 15th of June, 2009; b. Vicovu de Jos (Suceava County), 20th of August, 2009; c. Cotu-Copălău (Botoșani), 22nd of May, 2009.

Figure 2. Photo-selector (built according to the Schmitz model) - side view.

Table 1. Synthetic data on the diversity and abundance of Psocoptera (from the dry, hibernating stems collected in the next spring and kept in the tubes of the "Schmitz" photo-selector till autumn).

No.	Locality	Date of harvest of the stems in the nature	No. of stems / no. totaled of the meters	*Lepinotus reticulatus* End.		*Liposcelis* sp.	*Lachesilla pedicularia* L.		Total
				$A_{(no.)}$	no. /1m	$A_{(no.)}$	$A_{(no.)}$	no. /1m	
1	Vicovu de Jos (Sv)	28.04.2010	1779 / 1854 m	1685	0.91	1	240	0.13	1926
2	Vicovu de Sus (Sv)	28.04.2010	191 / 189 m	474	2.51		1260	6.66	1734
3	Cotu-Copalău (Bt)	19.02.2011	351 / 402 m	1610	4.01	1	289	0.72	1900
Totals		**2010-2011**	**2321/2445 m**	**3769**	**1.54**	**2**	**1789**	**0.73**	**5560**

1. Faunal results

Family Trogiidae

Lepinotus reticulatus End. (Fig. 3) (Table 1)

From the dead, hibernating stems of *Tanacetum vulgar*e (L.) collected in nature at Vicovu de Jos (Suceava County) on the 28th of April, 2010, and kept in the "Schmitz" photo-selector, there were obtained 1685 specimens and at Vicovu de Sus, the neighbour stationary where collecting was made on the same date, there were obtained 474 specimens.

From the samples collected at Cotu-Copalău (Botoșani County) on the 19th of February, 2011, in the same way, 1610 specimens were obtained. So, in total, from the samples of dead, hibernating stems in nature, collected in those three stationaries, 3769 specimens were obtained. As the males are very rare in case of this species, there was not estimated their number, considering that all the specimens were females, this species being parthenogenetic.

Biology and Distribution – it is a cosmopolitan species (Lienhard, 1998), which was reported in 23 of those 40 countries belonging to the Western Palearctic zone (57.5%), more common in the Mediterranean zone, but rarer and localized in the central and northern Europe. It is met in the litter and shrubs of dried herbs, in damp dwellings or food warehouses, and in the country, in straws from sheds, barns.

In our area, it was cited by Marcu (1938) in Cernăuți (Czernowitz) (now Ukraine), and in Romania it was rarely found (Moldovan, 2007). We report it for the first time in the north-eastern part of Romania.

Family Liposcelididae

Liposcelis sp. From the samples of dry, hibernating stems of *Tanacetum vulgare* (L.) there were obtained only two specimens unidentified to species, one individual in the sample from Vicovu de Jos (Suceava County), collected on the 28th of April, 2010 and one specimen from Cotu-Copalău (Botoșani County), collected on, the 19th of February, 2011.

Family Lachesillidae

Lachesilla pedicularia (L.). From the samples collected at Vicovu de Jos (Suceava County), on the 28th of April, 2010, there were obtained 240 specimens, and at Vicovu de Sus (Suceava County) 1250 specimens from the samples collected on th 15th of July, 2010; at Cotu-Copalău, by the same method from the samples of hibernating, dry stems collected, on the 19th of February, there were obtained 298 specimens until the 15th of September, 2011.

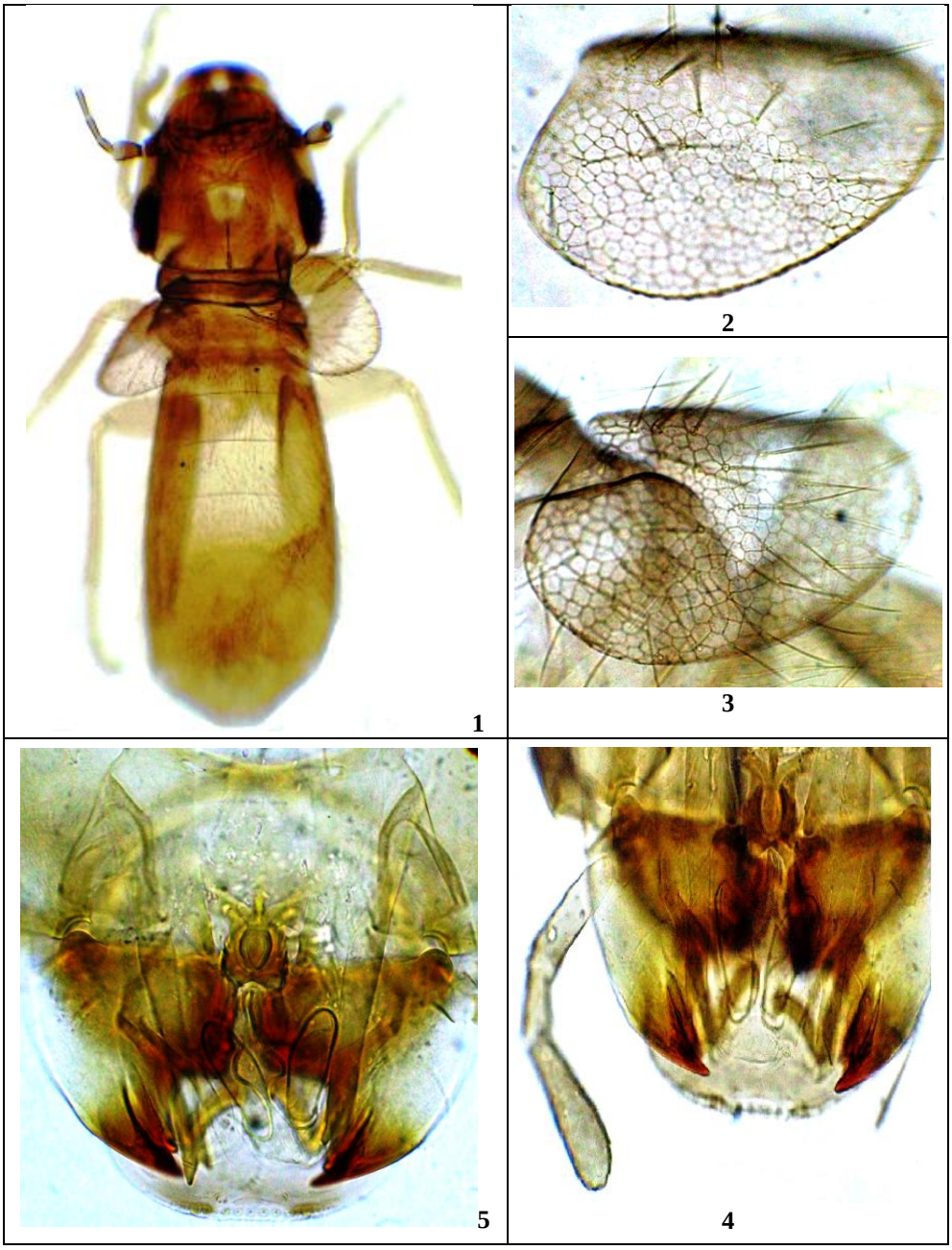

Figure 3. *Lepinotus reticulas* End (Trogiidae): 1. dorsal habitus; 2-3. the fore right wing; 4. the front part of the head with the maxillary palps; 5. buccal pieces highlighting the mandible and of lacinia.

With regard to the brachypterism of the species, in case of Vicovu de Sus (Suceava County), among those 523 adult females, 26 were brachypterous individuals, which is approximately 5%.

Biology and Distribution – according to Lienhard (1998) it is a cosmopolitan species. Thus, the species has been reported in 33 of the 40 countries considered in the West Palearctic which represents a frequency of 83%. The numerical ratio of sexes in the samples from Vicovu de Sus (Suceava County) was 5% males, but in Turzii Gorges, Bechet (1970b) found a sex-ratio of 39%. In nature, the species populations develop much in grasses and dry thistles, in litter or trees, shrubs, sometimes conifers, but it can be also met in stables with hay. It is polyvoltine and winters as egg. In Romania, it is mentioned in Rădăuți (Marcu, 1938), Maramureș (Sziraki, 2006), Arcalia (Cluj), Retezat National Park, Turzii Gorges (Bechet, 1969, 1970, 1975, 1985).

2. Some aspects of the abundance of Psocopterans in the collected samples

According to Table 1, at Vicovu de Jos (Suceava County), there were collected 1779 stems of *Tanacetum vulgare* (L.) which totalized 1854 metres. From these it was developed a population of 1685 specimens of *Lepinotus reticulatus* (End.) that is 0.91 specimens/1 linear metre of strain and 240 specimens of *Lachesilla pedicularia* (L.), i.e. 0.13 specimens / 1 linear metre of stem. In total, 1926 Psocopterans, (including 1 spec. Liposcelis sp.) i.e. 1.04 specimens / 1 linear metre of stem (Fig. 4).

At Vicovu de Sus (Suceava County) there were collected 191 stems, totalizing 189 linear meters from which 474 specimens of *Lepinotus reticulatu*s (End.), i.e. 2.51 specimens/1 linear metre of stem and 1260 specimens of *Lachesilla pedicularia* (L.), that is, 6.66 specimens/1 linear metre of stem. In total, there were obtained 1734 Psocopterans, i.e. 9.44 specimens/1 linear metre of stem.

At Cotu-Copalău (Botoșani), there were collected 351 stems, totalizing 402 linear meters, from which 1610 specimens of *Lepinotus reticulatus* (End.) were obtained, i.e. 4.01 specimens/1 linear metre of stem and 289 specimens of *Lachesilla pedicularia* (L.), that is, 0.72 specimens/1 linear metre of stem. In total, at the Cotu-Copalău there were obtained 1900 Psocopterans, i.e. 4.73 specimens/1 linear metre of stem.

On the whole, the 5560 specimens of Psocopterans obtained were distributed as follows: *Lepinotus reticulatus* (End.) 3769 specimens, in comparison with 2445 meters of stem, 1.54 specimens/1 linear metre of stem; *Lachesilla pedicularia* (L.) 1789 specimens, i.e. 0.73 specimens /1 linear metre of stem.

It is remarked the fact that the population of *Lepinotus reticulatus* (End.) was 2.11 times more abundant than that of the species *Lachesilla pedicularia* (L.), but also the obvious association of these psocopterans with the stem of the plant *Tanacetum vulgare* (L.) on which the eggs of Psocopterans were laid down in the previous autumn.

It should be also mentioned that there were collected one specimen of *Lepinotus reticulatus* (End.) and one specimen of *Lachesilla pedicularia* (L.) from the plant of *Tanacetum vulgare* (L.) in vegetation with the entomological net, on the 28th of June, 2009, which attests a certain association of these species with *Tanacetum vulgare* (L.).

3. Some aspects of the dynamics of development of the species of Psocopterans recorded on dead stems of *Tanacetum vulgare* (L.). From Figure 4, it results the fact that at Vicovul de Jos (Suceava County), 36.67% of the specimens of *Lachesilla pedicularia* (L.) flew till the 17th of June, and the rest of 63.33% till the 15th of July. *Lepinotus reticulatus*

(End.) was obtained only in proportion of 4.04% until the 17th of June and the rest of 95.96% until the 15th of July.

This attests the fact that *Lachesilla pedicularia* (L.) presents an obvious precocity of development compared to *Lepinotus reticulatus* (End.). This precocity in the development of the species *Lachesilla pedicularia* (L.) compared to that of *Lepinotus reticulatus* (End.) was observed at Cotu-Copalău (Botoșani County), in 2011, as well. Thus, it results that the summer generation develops between the beginning of June and the beginning of September. As it concerns the species *Lepinotus reticulatus* (End.), from Figure 5, it results that in this generation, the emergence of adults took place between the 20th of July and the 15th of September, but the preimaginal population (larvae) from one specimen on the 20th of July reached 1610 specimens on the 15th of September.

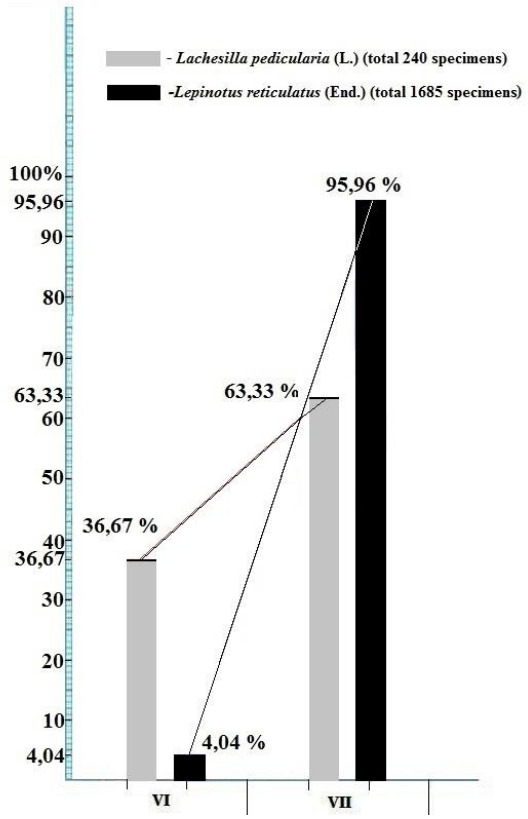

Figure 4. Population dynamics of the two species of Psocoptera at Vicovu de Jos (Suceava County), during 28.04 – 15.07.2011.

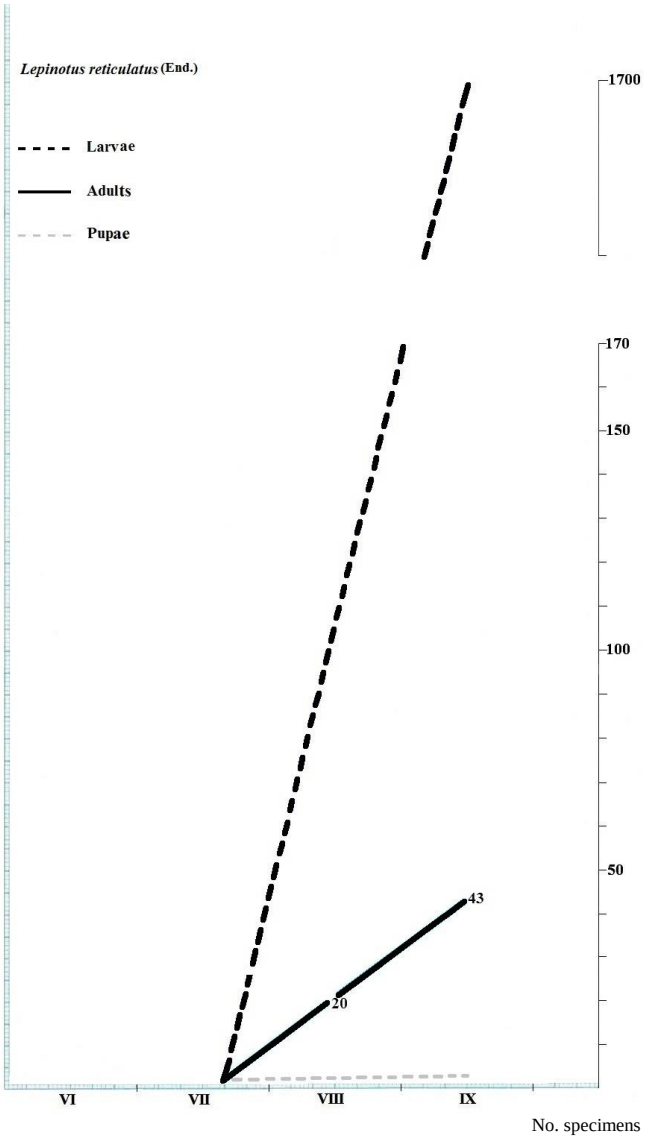

Figure 5. Dynamics of the life stages of *Lepinotus reticulatus* (End.) at Cotu Copalău (Botoșani County) in 2011.

Conclusions

In the north-eastern area of Romania, on the dead, hibernating stems in nature and observed during the next season in the “Schmitz” photo-selector tubes, there were developed mainly two species of Psocoptera belonging to two families: *Lepinotus reticulatus* (End.) (Family Trogiidae) and *Lachesilla pedicularia* (L.) (Family Lachesillidae).

The abundance of these two species (3769 specimens for *Lepinotus reticulatus* (End.) and 1789 specimens for *Lachesilla pedicularia* (L.) is not too big if we refer to the big number of dry stems that they had as support (2321 totalizing 2445 linear meters); *Lepinotus reticulatus* (End.) presented an abundance twice as high as *Lachesilla pedicularia* (L.). The first species was dominant at Vicovu de Jos (Suceava County) and at Cotu-Copalău (Botoșani County), and the second species at Vicovu de Sus (Suceava County).

As it concerns the dynamics of development of the populations of the two species in the “Schmitz” tubes throughout the warm season, *Lachesilla pedicularia* (L.) presented precocity of about a month to *Lepinotus reticulatus* (End.). It was otherwise known as being a polyvoltine species.

It is attested the fact that the plant *Tanacetum vulgare* (L.) by the dead stems constitutes the source and support of the persistence in the natural environment for some species of Psocoptera.

There are presented new data with regard to the distribution of those two species of Psocoptera in Romania and especially of the species *Lepinotus reticulatus* (End.).

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COCCINELIDES (COLEOPTERA: COCCINELLIDAE) FROM THE RYE CROP IN THE NORTHERN PART OF MOLDOVA

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Abstract. The material collections and the observations were based on observing these rye cultures in 4 villages from Suceava County (Rădăuți, Horodnic de Jos, Marginea și Poieni-Solca) and one village from Botoșani County, Mihăileni. The material collections were made using entomological net during April-July 2014. One with another, there have been collected 93 coccinelides samples and have been identified 9 species: 8 species of coccinelides aphidiphagus (*Coccinella septempunctata, C. 11-punctata, C. 14-pustulata, Adonia variegata, Adalia bipunctata, Propylea 14-punctata, Hippodamia 13-punctata* and *Anatis ocellata*) and one mycetofagus species (*Thea 22-punctata*). The constancy and dominance with the highest values was found at *C. 7-punctata* species. The highest point of activity of aphidiphagus coccinelides was reached in May and the beginning of June, when there could be found a large number of aphides, their feed.

Keywords: rye crop, diversity of coccinelides, North of Moldova, abundance, constancy, dominance, ecological significance index, dynamic of flight.

Rezumat. Coccinelidele (Coleoptera: Coccinellidae) din cultura de secară din zona de nord a Moldovei. Colectările de material și observațiile s-au făcut din cultura de secară din 4 localități din județul Suceava (Rădăuți, Horodnic de Jos, Marginea și Poieni-Solca) și o localitate din județul Botoșani (Mihăileni). Colectările de material s-au făcut cu fileul entomologic, în perioada aprilie - iulie 2014. În total, s-au colectat 93 de exemplare de coccinelide și au fost identificate 9 specii: 8 specii de coccinelide afidifage (*Coccinella septempunctata, C. 11-punctata, C. 14-pustulata, Adonia variegata, Adalia bipunctata, Propylea 14-punctata, Hippodamia 13-punctata și Anatis ocellata*) și o specie micetofagă (*Thea 22-punctata*). Constanța și dominanța cu valorile cele mai mari s-au constatat în cazul speciei *C. 7-punctata*. Maximum de activitate a coccinelidelor afidifage s-a înregistrat în luna mai și în prima parte a lunii iunie, când în cultura de secară, s-a înregistrat cel mai mare număr de indivizi de afide, hrana lor.

Cuvinte cheie: cultura de secară, diversitatea coccinelidelor, zona de nord a Moldovei, abundență, constanță, dominanță, indicele de semnificație ecologică, dinamica de zbor.

Introduction

Coccinelides or ladybugs consists of a group of insects that posses relevant importance for natural ecosystems, as well as in agroecosystems. They contribute to downsizing of plant pests, mainly of aphids. Research on this group of predatory coleoptera and their role in different types of ecosystems have been made all over the world, of which we mention only some: Hodek (1973) in the former Czechoslovakia, Klausnitzer & Klausnitzer (1983) in Germany, Iperti (1974) in Canada. In Romania, such researches were made by: Malschi (2007), Malschi & Mustea (1998), Baniță *et al*. (1999), Voicu *et al*. (1993), Moglan (1990, 1992), Bărbulescu (2001), Popov (2003).

Material and Methods

The entomological material collections were made with entomological net from the upper part of the rye threads, during April-July 2014, in 5 villages from Northern part of

Moldova - 4 villages from Suceava County (Rădăuți, Horodnic de Jos, Marginea, Poieni - Solca) and one village from Botosani County (Mihăileni). In April and July there was made a single sampling for each month and in May and June, two sampling for each month. The collections were made within 14 days, 100 mowings with entomological net per each sampling, for each village 50 mowings from the outer part of the rye culture and another 50 mowings from the inner side of it. The constancy of the species, the dominance and the index of ecological significance are calculated with the mathematical formulaes:

$C_A = n_pA/N_p.100$;

$D_A = nA/N.100$;

$W_A = C_A.D_A/100$; unde

C_A= the constancy of the species; D_A = the dominance of the species; W_A = index of ecological significance

n_pA = number of samples where can be found species A; N_p = total number of samples;

nA – total number of individuals from species A; N = total number of individuals from all species.

Results and Discussion

Considering all villages, there have been collected 93 samples of coccinelides and there were identified 9 species: *Coccinella septempunctata* Linné, *Coccinella undecimpunctata* Linné, *Coccinella quatordecimpustulata* Linné, *Adonia variegata* Goeze, *Adalia bipunctata* Linné, *Propylea quatordecimpunctata* Linné, *Hippodamia tredecimpunctata* Linné, *Anatis ocellata* Linné and *Thea vigintiduopunctata* Deg. 8 out of these species are aphidiphagus and the other one left is mycetofagus (*Thea 22-punctata*). Most of the individuals were located in the culture from Mihăileni (22 individuals), followed by Rădăuți (20 individuals) and the least of them in Horodnic de Jos (14). The highest value of specific diversity was registered in Rădăuți and Poieni-Solca (7 species in each village) and the lowest in Horodnic de Jos and Marginea (3 species in each culture) (Table 1). The highest value of individuals abundance was observed at *C. 7-punctata* species (46 specimens), followed by *P. 14-punctata* (20 specimens) and the lowest values of this ecological parameter was registered at *H. 13-punctata*, *A. ocellata* and *Thea 22-punctata* (Table 1).

Table 1. Coccinelides species identified in the rye culture from the Northern part of Moldova (*C.7p - Coccinella septempunctata, C. 11p – Coccinella 11 punctata, C.14p - Coccinella quatordecimpustulata, Ad. v.- Adonia variegata, Adl. b.- Adalia bipunctata, Pr. 14p .- Propylea quatordecimpunctata, H. 13p.- Hippodamia tredecimpunctata, A. oc .- Anatis ocellata, Th.22p .- Thea vigintiduopunctata*).

No	Locality	Date	Species / No individuals									Total
			C. 7p.	C. 11p.	C. 14p	Ad. v.	Adl. b.	Pr. 14p.	H. 13p.	A. oc.	Th. 22p.	
1.	RĂDĂUȚI (SV)	17 April	5	1	-	1	-	-	-	-	-	7
		11 May	2	-	-	-	1	1	1	-	-	5
		25 May	2	-	-	-	-	1	-	-	1	4
		10 June	1	-	-	-	-	-	-	-	-	1

No	Locality	Date	Species / No individuals									Total
			C. 7p.	C. 11p.	C. 14p	Ad. v.	Adl. b.	Pr. 14p.	H. 13p.	A. oc.	Th. 22p.	
		26 June	1	-	-	-	-	1	-	-	-	2
		12 July	1	-	-	-	-	-	-	-	-	1
		TOTAL	12	1	-	1	1	3	1	-	1	20
2.	HORODNIC DE JOS (SV)	17 April	1	-	-	-	-	1	-	-	-	2
		11 May	1	-	-	1	-	1	-	-	-	3
		25 May	3	-	-	1	-	1	-	-	-	5
		10 June	1	-	-	-	-	1	-	-	-	2
		26 June	1	-	-	-	-	-	-	-	-	1
		12 July	-	-	-	1	-	-	-	-	-	1
		TOTAL	7	-	-	3	-	4	-	-	-	14
3.	MARGINEA (SV)	18 April	1	-	-	-	-	1	-	-	-	2
		12 May	2	-	-	-	-	-	-	-	-	2
		26 May	2	-	-	1	-	2	-	-	-	5
		12 June	1	-	-	1	-	1	-	-	-	3
		28 June	3	-	-	-	-	-	-	-	-	3
		11 July	2	-	-	-	-	1	-	-	-	3
		TOTAL	11	-	-	2	-	5	-	-	-	18
4.	POIENI-SOLCA (SV)	19 April	2	-	-	-	1	2	-	-	-	5
		13 May	-	-	-	-	-	-	-	-	-	-
		27 May	3	-	-	1	2	1	-	-	-	7
		11 June	1	-	-	1	1	1	-	-	-	4
		27 June	2	-	-	-	1	-	-	-	-	3
		14 July	-	-	-	-	-	-	-	-	-	-
		TOTAL	8	-	-	2	5	4	-	-	-	19
5.	MIHĂILENI (BT)	18 April	2	-	-	-	1	1	-	-	-	4
		12 May	1	-	-	1	1	1	-	-	-	4
		26 May	2	-	1	-	-	1	-	-	-	4
		12 June	2	1	1	1	-	1	-	1	-	7
		28 June	1	-	-	-	-	-	-	-	-	1
		11 July	-	-	-	1	1	-	-	-	-	2
		TOTAL	8	1	2	3	3	4	-	1	-	22
TOTAL			**46**	**2**	**2**	**11**	**9**	**20**	**1**	**1**	**1**	**93**

The applied statistical calculation reveals that this family of Coleoptera species *C. 7-punctata* and *P.14-punctata* are euconstant and eudominant, characteristic for this type of agroecosystem and best adapted to local ecological conditions. The rest of the species, 77% of them are rare and accidentally present and own only 17.21% of the individuals (Table 2).

Table 2. Abundance (A), constancy (C), dominance (D) and ecological significance index (W) for coccinelides individuals identified in the rye crop from the Norther part of Moldova.

No	Species	A	C		D		W	
			%	Class	%	Class	%	Class
1.	*Coccinella 7-punctata*	46	86.67	C4	49.47	D5	42.88	W5
2.	*Propylea 14-punctata*	20	60.00	C3	21.51	D5	12.91	W5
3.	*Adonia variegata*	11	36.67	C2	11.83	D5	4.34	W3
4.	*Adalia bipunctata*	9	26.67	C2	9.68	D4	2.58	W3
5.	*Coccinella 11-punctata*	2	6.67	C1	2.15	D3	0.15	W2
6.	*Coccinella 14-pustulata*	2	6.67	C1	2.15	D3	0.15	W2
7.	*Hippodamia 13-punctata*	1	3.34	C1	1.08	D1	0.04	W1
8.	*Anatis ocellata*	1	3.34	C1	1.08	D1	0.04	W1
9.	*Thea 22- punctata*	1	3.34	C1	1.08	D1	0.04	W1
TOTAL		**93**	-	-	-	-	-	-

In what aphidiphagus coccinelides and *C. 7-punctata* species (the most populated species of all) dynamic are concerned, results show that the highest value of activity of this predator category was registered during May and June in cultures from Horodnic de Jos, Marginea, Poieni-Solca, Mihăileni and in Rădăuți, during April and May (Table 3). These values were the most relevant in the matter (*Sitobion avenae* Fallen and *Schizaphis graminum* Rond.). The maximum of activity registered earlier in Rădăuți can be explained by the influence of a higher temperature in this town or by the large number of aphides in that peculiar place.

Consulting speciality literature from our country, there could not be found information regarding coccinelides species from "Rye culture„ agroecosystem. Even so, few pieces of information could be compared with further explanation about "wheat cultures" and "threaded cereals" considering the specific structure of Coleoptera family. Therefore, in Câmpia Olteniei, Baniță *et al*. (1999), Popov (2003) and Bărbulescu (2001) there are reminded 9 species of coccinellidae (same species), Voicu *et al*. (1993), regarding wheat, in Podișul Moldovenesc there can be found 10 species, and last but not least, Malschi & Mustea (1998) at SCA Turda for „theared cereals" mentions 7 species (Table 4).

Table 3. Dynamic of aphidiphagus coccinelides in the rye crop.

No.	Locality	Species	Month (%)				Total
			April	May	June	July	
1.	RĂDĂUŢI (SV)	Total Aphidiphagus Coccinelides	36.84	42.10	15.78	5.26	19
		C. 7-punctata	41.66	33.33	16.66	8.30	12
2.	HORODNIC DE JOS (SV)	Total Aphidiphagus Coccinelides	14.28	57.14	21.42	7.14	14
		C. 7-punctata	14.28	57.14	28.57	-	7
3.	MARGINEA (SV)	Total Aphidiphagus Coccinelides	11.11	38.88	33.33	16.66	18
		C. 7-punctata	9.09	36.36	36.36	18.18	11
4.	POIENI-SOLCA (SV)	Total Aphidiphagus Coccinelides	27.77	38.88	33.33	-	18
		C. 7-punctata	25.00	37.50	37.50	-	8
5.	MIHĂILENI (BT)	Total Aphidiphagus Coccinelides	18.18	36.36	36.36	9.09	22
		C. 7-punctata	25.00	37.50	37.50	-	8

Table 4. Comparative analisys of coccinelides from rye crop with wheat crop. (1) after Popov, 2003; (2) Baniţă *et al*., 1999; (3) after Voicu *et al*., 1993; (4) after Malschi & Mustea, 1998; (5) after Bărbulescu, 2001; (6) author.

No	Species	Wheat Câmpia Olteniei (1)	Wheat Câmpia Olteniei (2) (1991-1995)	Wheat Podişul Moldovenesc (3) (1983-1991)	Straw cereals SCA Turda (4)	Wheat Câmpia Olteniei (5)	Rye (6)
1	*Coccinella 7-punctata*	+	+	+	+	+	+
2	*C. 14-pustulata*	+	+	+	-	+	+
3	*C. 11-punctata*	-	-	-	-	-	+
4	*Propylea 14-punctata*	+	+	+	+	+	+
5	*Adonia variegata*	+	+	+	+	+	+
6	*Stethorus* sp.	+	+	-	-	+	-
7	*Stethorus punctillum*	-	-	+	-	-	-
8	*Scymnus* sp.	+	+	+	-	+	-

No	Species	Wheat Câmpia Olteniei (1)	Wheat Câmpia Olteniei (2) (1991-1995)	Wheat Podișul Moldovenesc (3) (1983-1991)	Straw cereals SCA Turda (4)	Wheat Câmpia Olteniei (5)	Rye (6)
9	*Halysia* sp.	+	+	-	-	+	-
10	*Thea 22-punctata*	+	+	-	-	+	+
11	*Tytthaspis 17-punctata*	+	+	-	-	+	-
12	*Micraspis 12-punctata*	-	-	+	-	-	-
13	*Halysia sedecimguttata*	-	-	+	-	-	-
14	*Adalia bipunctata*	-	-	+	+	-	+
15	*Hippodamia 13-punctata*	-	-	+	+	-	+
16	*Anatis ocellata*	-	-	-	+	-	+
17	*Chilocorus bipustulatus*	-	-	-	+	-	-

Conclusions

Considering all villages (Horodnic de Jos, Marginea, Poieni Solca, Rădăuți, Mihăileni) there have been collected 93 samples of coccinellidae and there were identified 9 species: *Coccinella septempunctata* Linné, *Coccinella undecimpunctata* Linné, *Coccinella quatordecimpustulata* Linné, *Adonia variegata* Goeze, *Adalia bipunctata* Linné, *Propylea quatordecimpunctata* Linné, *Hippodamia tredecimpunctata* Linné, *Anatis ocellata* Linné and *Thea vigintiduopunctata* Deg. Eight out of these species are aphidiphagus and the other one left is mycetofagus (*Thea 22-punctata*).

The applied statistical calculation reveals that this family of Coleoptera species *C.7-punctata* and *Propylea 14-punctata* are euconstant and eudominant, characteristic for this type of agroecosystem and best adapted to local ecological conditions.

In what aphidiphagus coccinelides and *C. 7-punctata* species dynamic are concerned, results show that the highest value of activity of this predator category was registered during May and June in cultures from Horodnic de Jos, Marginea, Poieni-Solca, Mihăileni and in Rădăuți, during April and May

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AGATHIS NIGRA (NEES) (HYMENOPTERA, BRACONIDAE) AS PARAZITOID SPECIES OF THE SMALL BUTERFLY *DICHOMERIS MARGINELLA* (F.) (LEPIDOPTERA, GELECHIIDAE) ON *TANACETUM VULGARE* (L.) (ASTERALES, ASTERACEAE) ÎN ROMANIA, WITH SOME CONSIDERATIONS ON THE SPECIES OF THE GENUS *AGATHIS* LATREILLE IN THE FAUNA OF ROMANIA AND THE REPUBLIC OF MOLDAVIA

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Abstract. *Agathis nigra* Nees (Hymenoptera, Braconidae), a parasitoid species of the small butterfly *Dichomeris marginella* (F.) (Lepidoptera, Gelechiidae) on *Tanacetum vulgare* (L.) (Asterales, Asteraceae) in Romania, with some considerations on the species of the genus *Agathis* Latreille in the Fauna of Romania and the Republic of Moldova, a similar territory to that of Romania from the ecological viewpoint. Thus, through rearing in the laboratory and observation in the field, the species *Agathis nigra* was obtained from the larvae of the small butterfly *Dichomeris marginella* (F.), a phytophagous species that develops in the stems of the host plant *Tanacetum vulgare* (L.), the parasitoid – host relationship being reported for the first time in Romania. On the other hand, in the “Fauna Europaea” it is mentioned the presence of just one species of *Agathis breviseta* Nees 1814 in the fauna of Romania, due to the distribution of faunal data in lesser known publications. This situation has determined us to present a synthesis on these data, referring to 12 species of the genus *Agathis* Latr. present in Romania and the Republic of Moldova, namely: *Agathis anglica* Marsh., *Agathis assimilis* Kok., *Agathis breviseta* Nees, *Agathis glaucoptera* Nees, *Agathis griseifrons* Thoms., *Agathis malvacearum* Latr., *Agathis nigra* Nees, *Agathis rufipalpis* Nees, *Agathis semiaciculata* Ivan., *Agathis tibialis* Nees and *Agathis umbellatarum* Nees (for Romania) and, in addition, *Agathis montana* Shest., for the Republic of Moldova, beside other seven species common to the territories of the two countries. For all the treated species there are presented the values of some parameters referring to the geographical distribution, the frequency in area and climate affinities, ecological affinities, hosts and frequented plants, periods of flight and number of possible generations, the numerical ratio of sexes (sex-ratio), etc.

Keywords: A*gathis nigra*, *Dichomeris marginella*, parasitoid species, Romania, Republic of Moldova.

Rezumat. *Agathis nigra* Nees (Hymenoptera, Braconidae), specie parazitoidă a fluturașului *Dichomeris marginella* (F.) (Lepidoptera, Gelechiidae) pe *Tanacetum vulgare* (L.) (Asterales, Asteraceae) în România, cu unele considerații asupra speciilor genului *Agathis* Latreille din Fauna României și a Republicii Moldova, teritoriu asemănător din punct de vedere ecologic cu cel al României. Astfel, prin creșteri de laborator și observații în teren, *A. nigra* a fost obținută din larvele fluturașului *Dichomeris marginella* (F.), specie fitofagă ce se dezvoltă în tulpinile plantei gazdă, *Tanacetum vulgare* (L.), relația parazitoid gazdă fiind semnalată prima dată în România. Pe de altă parte în „Fauna Europaea” este menționată ca prezentă în fauna României doar o singură specie *Agathis breviseta* Nees, 1814, din cauza răspândirii datelor faunistice în publicații mai puțin cunoscute. Această situație ne-a determinat să prezentăm o sinteză asupra acestor date, referitoare la 12 specii ale genului *Agathis* Latr. prezente în România și Republica Moldova și anume: *Agathis anglica* Marsh., *Agathis assimilis* Kok., *Agathis breviseta* Nees, *Agathis glaucoptera* Nees, *Agathis griseifrons* Thoms., *Agathis malvacearum* Latr., *Agathis nigra* Nees, *Agathis rufipalpis* Nees, *Agathis semiaciculata* Ivan., *Agathis tibialis* Nees și *Agathis umbellatarum* Nees (pentru România) și, în plus, *Agathis montana* Shest., pentru Republica Moldova, alături de alte șapte specii comune ambelor teritorii ale celor două țări. Pentru toate speciile tratate, se prezintă valorile unor parametri referitori la distribuția geografică, frecvența în areal și afinități climatice, afinități ecologice, gazde și plante frecventate, perioade de zbor și număr de generații posibile, raportul numeric al sexelor (sex-ratio) etc.

Cuvinte cheie: *Agathis nigra*, *Dichomeris marginella*, specii parazitoide, România, Republica Moldova.

Introduction

The species of the genus *Agathis* Latreille are little known in Romania. Thus, the synthesis on the terrestrial and freshwater fauna in Romania, carried out by the collective of prestigious researchers from the "Emil Racoviță Institute of Speleology" Cluj-Napoca (Director PhD Teodora Moldovan, 2007), mentioned one species of *Agathis breviseta* Ness 1814 in the genus *Agathis*.

This situation is, of course, because of scattered information in various quotations. Thus, until 2007, other species had been published too by Mocsari (1897), Müller (1927), Lăcătușu-Duțu (1962), Lăcătușu (1967, 1974), Lăcătușu & Drăghia (1977), Filipescu & Lăcătușu (1970, 1975), Lăcătușu & Filipescu (1989), and after 2007, Ailenei (2008, 2011a, 2011b).

Therefore, in the present paper, we have proposed to gather information regarding the citations of the species of the genus *Agathis* in Romania. In the "Fauna Europaea" is reported only the species *Agathis breviseta* Nees. But, in the same situation is also the knowledge of the species of the genus *Agathis* in the neighbouring country, the Republic of Moldova, which, ecologically, is an extension of the Eastern Carpathians to the East.

In this case, too, in the "Fauna Europaea" it is mentioned only one species of *Agathis semiaciculata* (Iv.), while Talitzkii, Kuslitzkii & Tobias (1990), mention another 7 species from the Republic of Moldova. In what concerns the species found in Romania and the Republic of Moldova, treated in the present paper, the data come from the references mentioned above. In this connection, it should be specified the fact that for the identification of species, the authors Filipescu & Lăcătușu used Telenga's paper (1955) and Ailenei (2008; 2011) also used the papers of Nixon (1986) and Tobias (1986).

Finally, for the Republic of Moldova, the synthesis made by Talitzkii & Kuslitzkii (1990) had Tobias' contribution as co-author. In this way, it was realized the synopsis of those 11 species in Romania and of those 8 species in the Republic of Moldova, of which only one, *Agathis montana* Shest., is not found again in Romania (Table 1). It is possible that there are one or two synonymies due to the studies on the species of the genus in the last years.

Material and Methods

In what concerns the biology of the species *Agathis nigra* Nees., the study was based on proper observations on the dead stems of *Tanacetum vulgare* (L.), that wintered in nature and the next spring were kept in "Schmitz" photo-selector with the help of which there were obtained both the parasitoid species of the larvae and pupae of *Dichomeris marginella, A. nigra,* and the host butterflies that were not parasitized. The observations were completed with test-dissections, collectings with the entomological net and with water traps in the vegetation season, on the groups of *T. vulgare* (L.). In order to establish the biogeographical and climatic affinities of the species recorded in Romania and the Republic of Moldova, those 58 zones and countries where the species have been reported, were divided from south to north (with some inevitable relativity) in southern zones between 28° and 44° northern Latitude, souther-middle zones between 41° and 44° northern Latitude, middle zones 41°-55° northern Latitude and northern zones between 54° and 80° northern Latitude. In Table 1, there are mentioned the areas with the adjusted latitudes to the south and north in accordance with the faunal quotes from the consulted bibliography: Simbolotti & Achterberg (1999); Talitzkii *et al*., (1990); Ailenei (2008, 2011a, 2011b); Chiriliuc

(2015); Filipescu & Lăcătușu (1970); Lăcătușu (1962, 1967, 1974); Lăcătușu & Drăghia (1977); Lăcătușu & Filipescu (1975, 1989); Moldovan *et al*. (2007); Müller (1927); Nixon (1986); Tobias (1971, 1986). On the penultimate row of Table 1 - Total no. of zones and countries, there are specified the areas and the countries where the species was mentioned, according to the data from bibliography and in the last row - Total countries, zones % it is specified the percentage in comparison with the number of countries and areas of collecting in the penultimate row of Table 1, to the total number of the zones and countries considered by “Fauna Europaea” that is 79 countries and areas. Example: *Agathis anglica* was identified in 24 countries and areas, representing 30.38% of the total of 79. In Table 2 the species are listed according to their climate affinities from those with predominant southern affinities *(Agathis umbellatarum*, no. 1), to those with predominant northern affinities (*Agathis griseifrons*, no. 12). In Table 2, there is thus recorded the number of countries (areas) in which there were recorded as well as the number and the percentage of specimens of these species for each of the four areas considered.

Results

Agathis nigra Nees (Sin: *Agathis testaceipes* Fischer, *Agathis kazakhstanica* Tobias; *Agathis* nixoni Belokobylskij & Jervis), biological and ecological aspects

In Figure 1 there are presented some aspects of the morphology of the species, both for female and male. Our material consists of 14 specimens (10 ♀♀ and 4 ♂♂) from Vicovu de Jos (Suceava County) and 2♂♂ from Cotu Copalău (Botoșani County). These specimens were obtained from dead hibernating stems, with the larvae of *Dichomeris marginella* (F) (= *Isophrictis striatella* Den & Schiff.) kept in the tubes of “Schmitz” photo-selector. Another specimen 1♂ was captured at the water traps placed in groups of *T. vulgare* (L.) on the 29th July 2009 at Vicovu de Jos (Suceava County), and on the 27th July 2010, in the same place, 1♀ was captured with the entomological net on *T. vulgare* (L.). Previously in our country, the species was cited by Lăcătușu & Filipescu (1975) at Orșova (Mehedinți County).

According to the “Fauna Europaea” and to Simbolotti & Achterberg (1999), the distribution of species is very wide (Table 1), with tends of preference for middle and northern zones, approximately between 41° and 71° northern Latitude. Thus, among those 58 countries and zones considered for those 12 species of the genus *Agathis* treated in the present paper, *A. nigra* was reported in 32, that is 55% of these zones. According to Tables 1 and 2, among those 25 areas – considered “southern”, between 28° and 44° northern Latitude, *A. nigra* was reported in 9 zones that is in 28.12% of the zones from which the species was reported. In succession, the species was present in three intermediate zones (9.37%), 13 middle zones (40.63%) and 7 northern zones (21.87%).

Ecological affinities of the species *Agathis nigra* are presented in Table 3. In Romania, the species was found at Vicovu de Jos (Suceava County) (47°52' northern Latitude and 25°37' eastern Longitude), where *Tanacetum vulgare* (L.) is on vacant fields with ruderal vegetation and spontaneous trees, at an altitude of 484 m and at Cotu-Copalău (Botoșani County) (47°62' northern Latitude and 26°82' east Longitude.), in the forest-steppe zone, with groups of *Tanacetum vulgare* (L.) within forest nurseries with saplings of ash tree (*Fraxinus* spp.), willow (*Salix* spp.), sycamore maple (*Acer* spp.) evergreen oak (*Querqus petraea*), lime tree (*Tilia* spp.), sweet cherry (*Cerasus* spp.), at an altitude of 170 m. In the Republic of Moldova (Talitzkii *et al*., 1990), the species is reported in the steppe

zone with feather grass (*Stipa* spp.) in the South-East of the country, near the Dniester River (approximately 46°64' northern Latitude and 29°74' eastern Longitude).


1


2


7


3


4


8


5


9


6

Figure 1. Morphology of *Agathis nigra Ness*: 1 and 3 – ♀, lateral aspect; 2 – anterior part of the thorax, and lateral aspect; 4 – ♂, lateral aspect; 5 and 6 - wings; 7 – ♀ antenna; 8 – ♂ antenna; 9 – posterior leg.

Table 1. Geographical distribution of species of the genus *Agathis* Latreille (Hymenoptera, Braconidae).

No.	Areas, zones	The countries and areas from which the species of *Agathis* were reported	*Agathis anglica* Marsh.	*Agathis assimilis* Kok.	*Agathis breviseta* Nees	*Agathis glaucoptera* Neses	*Agathis griseifrons* Thoms (=*latiptera* Tel.)	*Agathis malvacearum* Latr.	*Agathis montana* Shest.	*Agathis nigra* Nees	*Agathis rufipalpis* Nees	*Agathis semiaciculata* Ivan	*Agathis tibialis* Nees (=*genualis* Marsh.)	*Agathis umbellatarum* Nees	no. spp. *Agathis*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Northern Zones 54 °-80 ° Northern Latitude	Norway		+			+				+				3
2		Finland	+		+		+			+	+				5
3		Sweden	+		+		+			+					4
4		Russia de NW		+			+			+			+		4
5		Russia Kaliningrad		+											1
6		England	+	+	+		+		+	+	+				7
7		Ireland			+		+				+				3
8		Latvia			+					+					2
9		Lithuania		+	+		+	+		+			+		6
10		Danmark								+					1
11	Middle Zones 41°-55° Northern Latitude	Germany	+	+	+		+	+		+	+	+	+	+	10
12		Netherlands	+	+	+		+	+		+	+		+		8
13		Belgium			+					+	+				3
14		Ukraine					+					+			2
15		Poland	+	+	+		+	+	+	+	+	+			9
16		Czech			+										1
17		Moldova		*	*			*	*	*		*	*	*	8
18		Romania	+	+	+	+	+	+		+	+	+	+	+	11
19		Hungary	+	+	+	+	+	+	+	+	+		+	+	11
20		Slovakia			+			+		+	+				4
21		Austria	+	+			+			+					4
22		Slovenia					+								1
23		Switzerland	+	+	+		+	+		+	+	+		+	9
24		Croatia	+					+		+					3
25		Serbia	+	+	+		+	+	0		+			+	8
26		Central Russia		+	+	+		+	+	+			+		7
27		Eastern Russia		0		0		+		0					4
28		Mongolia	0	0											2
29	Intermediate southern 41°-	Bulgaria	+	+	+		+	+	+	+	+	+		+	10
30		Muntenegro							+	+	+				3
31		Macedonia				+		+						+	3
32		Albania	+				+	+							3
33		Continental France	+	+	+	+	+	+	+	+	+	+		+	11
34	Southern Zones 28°-44° Northern Latitude	Canary Islands											+		1
35		Marocco	0							0					2
36		Algeria												0	1
37		Continental Portugal									+			+	2
38		Continental Spain	+		+	+		+		0	+		?	0	8
39		Andorra					+		+		+				3
40		Balearic Islands				+								+	2
41		Sicily												+	1
42		Italy	+			+	+	+		+	+			+	7

No.	Areas, zones	The countries and areas from which the species of *Agathis* were reported	*Agathis anglica* Marsh.	*Agathis assimilis* Kok.	*Agathis breviseta* Nees	*Agathis glaucoptera* Neses	*Agathis griseifrons* Thoms *(=latiptera* Tel.)	*Agathis malvacearum* Latr.	*Agathis montana* Shest.	*Agathis nigra* Nees	*Agathis rufipalpis* Nees	*Agathis semiaciculata* Ivan	*Agathis tibialis* Nees *(=genualis* Marsh.)	*Agathis umbellatarum* Nees	no. spp. *Agathis*
43		Corsica												+	1
44		Malta												+	1
45		Continental Greece	+		+		+	+	+			+	+	+	8
46		Cyclades Islands												+	1
47		Dodecanese Islands								+					1
48		Aegean North Island	+												1
49		Crete	+					+	+	+			+	+	6
50		Cyprus	+											+	2
51		Caucasus										0		0	2
52		European Turkey	+	+	+	0	0	+		+	+			+	9
53		Southern Russia		+	+	+	+	+	+	+	+	+	+	+	11
54		Iran								0					1
55		Tajikistan		0										0	2
56		Uzbekistan		0											1
57		Kirgistan							0						1
58		Kazakhstan		0		0				0		0			4
Total no. zones and countries			24	24	24	12	25	23	14	32	20	12	12	25	
Total countries, zones % (•)			30.38	30.38	30.38	15.19	31.65	29.11	17.72	40.51	25.32	15.19	15.19	31.65	

+ Data come from "Fauna Europaea", Simbolotti & Achterberg (1999); * Data come from Talitzkii *et al*., (1990); 0 Data come only from Simbolotti & Achterberg (1999); + Data come from personal research. (•) Percentages are calculated in relation to the total number of countries and zones, 79, from "Fauna Europaea".

Biology of the species *Agathis nigra* (Tables 4 and 5) – as to the hosts of the species, according to the extensive review of the genus belonging to the authors Simbolotti & Achterberg (1999), based on a vast material from the main museums and European collections, *A. nigra* was collected either from the plant inflorescences of *T. vulgare* (L.) or obtained from *Dichomeris marginella* (F) (=*Isophrictis striatella* Den & Schiff.) (Lepidoptera, Gelechiidae), a small butterfly known as associated with *T. vulgare* (L.). Both the host *Dichomeris marginella* (F.) and *A. nigra* fly from the stems of *T. vulgar*e (L.) where they wintered and, in spring, they were kept in special installations, such as "Schmitz" photo-selector. The species *A. nigra* was collected from various species of plants too and their inflorescences. Thus, Tobias (1986) collected *A. nigra* Nees (=*kasachstanica* Tobias 1963) from the following plants: *Ferula tatarica*, *Ferula songorica*, *Palimbia rediviva*, *Serratula cardunculus*, *Pyrethrum kasachstanicum*, *Lepidium* sp. In Spain, *A. nigra* (=*Agathis nixoni* Belokobylsky & Jervis) was collected from *Anacyclus clavatu*s (Asteraceae). In what concerns the species of host lepidopterans, reported by Tobias, they were not discussed in the review of the authors Simbolotti & Achterberg (1999) – *Cochylis roseana* Hw., *Ptycholoma lecheana* L. *Aclerys quercinana* Z. (Tortricidae); *Coleophora argentula* Z., *Coleophora vestianella* L. *Coleophora meridionella* Rbl. (Coleophoridae); *Pyrausta sambucalis* Den & Schiff., *Pyrausta aurata* Sc. (Pyraustidae); *Apodia bifractella* Dup., *Dichomeris marginella* (F) (=*Isophrictis*

striatella Den & Schiff.) *Scrobipalpa atriplicella* (Fr.), *Metzneria metzneriella* (Stt.) (Gelechiidae).

Table 2. Frequency of species of the genus *Agathis* Latreille found in Romania and the Republic of Moldova in geographical areas from which there were reported up to the present.

No.	*Agathis* spp.	No. zones, countries	Southern Zones 28° - 44° Lat. N		Intermediate Zones 41° - 44° Lat. N		Middle Zones 41° - 55° Lat. N		Northern Zones 54° - 71° Lat. N	
		no.	no. Specimens	%	no. specimens	%	no. specimens	%	no. specimens	%
1	*Agathis umbellatarum*	25	16	64.0	3	12.0	6	24.0	-	-
2	*Agathis glaucoptera*	12	6	50.0	2	16.66	4	33.33	-	-
3	*Agathis tibialis*	12	5	41.0	-	-	5	41.0	2	16.66
4	*Agathis montana*	14	5	35.71	3	21.43	5	35.71	1	7.14
5	*Agathis anglica*	24	8	33.33	3	12.5	10	40.0	3	12.5
6	*Agathis semiaciculata*	12	4	33.33	2	16.66	6	50.0	-	-
7	*Agathis malvacearum*	23	6	20.08	4	17.39	12	52.17	1	4.35
8	*Agathis assimilis*	24	5	20.83	2	8.33	12	50.0	5	20.08
9	*Agathis nigra*	32	9	28.12	3	9.37	13	40.63	7	21.87
10	*Agathis rufipalpis*	20	4	20.0	3	15.0	8	40.0	5	25.0
11	*Agathis breviseta*	24	4	16.66	2	8.33	12	50.0	6	25.0
12	*Agathis griseifrons*	25	5	20.08	3	12.0	10	40.0	7	28.0

The flight period (Tables 4 and 6) in Europe, resulting from the data of the authors Simbolotti & Achterberg (1999), lasts from April 15th in Spain and May 4th in Greece until September 22nd (1986) in Holland and the collectings from its host *Dichomeris marginella* (=*Isophrictis striatella* Den & Schiff.), from May 13th to August 15th in Holland and Germany (Tables 4 and 6). From the hibernating stems of *T. vulgare* (L.) collected at Vicovu de Jos (Suceava County) in April 28th 2010, 3♀♀ and two ♂♂ flew until June 17th 2010 and 7 ♀♀ and two ♂♂ flew between June 17th and July 15th. At Cotu-Copalău (Botoșani County) 2♂♂ between August 12th and September 15th 2011 flew from the hibernating stems of *T. vulgare* (L.) collected on February 19th 2011. Besides these specimens obtained from the host by “Schmitz” photo-selector, there was collected, with the entomological net, 1♀ on the 27th of July 2010 and 1♂ on the 29th of July 2009 at the water traps at Vicovu de Jos (Suceava County). In what concerns the flight periods for different sectors of the West Palaearctic zone (Tables 4 and 6), it is observed the early flights in the southern zone and increasingly later in the northern parts. Thus, the flight of females in Spain was recorded from April 15th, but in Greece and even in North of Germany, from the 4th and from the 14th of May respectively, until the 22nd of September in Holland. It can be found from the same tables that, in Bulgaria, the majority of specimens flies in June (25%) and July (75%). In Rep. of Moldova, in Iuly, the data are somewhat similar, 29.41% in June, 58.82% in July, but 11.76% in September too. In France, the majority of specimens flies in July (62.5%), in August 25% but in September too (12.5%).

In Germany, the flight seems more spaced out with 5.55% in May, 11.11% in June, 38.89% in July and 44.44% in August, but in Holland and Belgium, the flight takes place in August (72.72%) and September (27.27%). We have less data from Spain where it seems that the main flight occurs in May. A special case is the situation in Kazakhstan, outside the western Palaearctic zone. There, in the steppe zones of the Central Asia, with a cold continental climate and with little collectings of materials (Tobias 1963, 1966, in Simbolotti & Achterberg, 1999), the main flight takes place in June (70.27%) and July (21.62%).

Table 3. Ecological affinities of species of the genus *Agathis* Latreille reported in Romania and the Republic of Moldova.

No.	The species of genus *Agathis* Latreille	Republic of Moldova				Romania				
		Arid forests of the North, with cherry	Dry meadow on the left shore of the Dniester River	Subarid forests in South, with pubescent oak	Steppe with *Stipa* spp. and forests in South at the Dniester	Mountain mesophytous Hayfields (A)	Mesophytous Forest steppe vegetation (B)	Steppe hayfields (C)	South plus Transylvania, mesophytous vegetation (D)	Arid zones of Dobrogea (E)
1	*Agathis umbellatarum*	-	+	+	-	-	-	-	+	-
2	*Agathis glaucoptera*	-	-	-	-	-	-	+	-	-
3	*Agathis tibialis*	-	+	-	+	-	-	-	+	-
4	*Agathis montana*	-	+	-	+	only in the Republic of Moldova				
5	*Agathis anglica*	-	-	-	-	+	-	-	+	-
6	*Agathis semiaciculata*	-	+	-	-	+	-	-	-	-
7	*Agathis malvacearum*	-	+	-	+	-	-	-	-	+
8	*Agathis assimilis*	+	+	-	+	-	-	+	+	+
9	*Agathis nigra*	-	-	-	+	-	+	-	+	-
10	*Agathis rufipalpis*	-	-	-	-	-	-	-	+	-
11	*Agathis breviseta*	-	+	-	+	+	-	+	-	-
12	*Agathis griseifrons*	-	-	-	-	+	-	-	-	+
Total no. specimens		1	7	1	6	4	1	3	6	3

A. Mountain hayfields – Rarău, 1536 m altitude; B. Forest steppe – Vicovu de Jos (Suceava County); Cotu-Copalău (Botoșani County); C. Steppe hayfields – Valea lui David; Mârzești (Iași County); D. Mesophytous vegetation – south (București, Porțile de Fier, Orșova, Ieșelnița, Ogradena) and Transylvania; E. Arid zones of Dobrogea: Sulina, Agigea – maritime dunes, nature reserve; arid forests of south, Canaraua Fetii.

The number of generations of the species *A. nigra* is difficult to establish for the whole region of distribution, especially because of less material collected from nature or obtained from rearings. However, some estimates are possible for some sectors of the West Palaearctic zone as there have been gathered more data. The presence of males, whose life is generally shorter than that of females, can also help. Thus, based on these latter indications for the northern zones – Holland, Belgium there could develop a generation. As for Germany and France, with vast territories on latitude and more numerous data, evidencing a more spaced out flight (flights), one can estimate the existence of 2-3 generations. For Spain, the territory and climate of which (or the Iberian Peninsula, in

general) could allow the development of three generations, we have not enough data for more than 2 generations. As for Romania, the first flight from the host *Dichomeris marginella* existing in the stems of *T. vulgare* (L.) hibernating in nature, extended at Vicovu de Jos (Suceava County) from spring until July 15th (2 ♂♂ until June 17th and 2 ♂♂ until July 15th) but another male was collected from nature on July 29th and 2 males were obtained between August 12th and September 15th 2011. These data can suggest the existence of at least two generations in North-Eastern of Romania.

Numerical ratio of sexes (Sex-Ratio) (Table 7) – taking into account the data offered especially by the authors Simbolotti & Achterberg for the West-Palaearctic zone, those 70 females and 39 males, represent a sex-ratio of 35.78% males. On this background, however, there is a great variability of this value namely 9.09% in Holland, 27.8% in Germany, 37.5% in France, 25% in Bulgaria and 42.11% in Spain. In North-Eastern Romania, the value of sex-value ratio of 38.9% is close to the average for the West Palaearctic zone, 35.78% presented above and to a great extent, to the situation in France 37.5%.

Faunal data on the species of the genus *Agathis* Latreille reported in Romania and the Republic of Moldova

Agathis anglica Marsh (Tables 1 and 2). Geographical distribution – the species was reported in 24 of those 59 countries and zones considered that is 30.38%. According to Table 2, the species was more frequent in southern (33.33%) and middle zones (40%) and less in the northern ones (12.5%). In Romania, it is mentioned by Filipescu & Lăcătușu (1970) on the meadows of Rarău 1536 m altitude. 3 ♀♀ in June-July. Biology (Table 5) – according to Simbolotti & Achterberg (1999), the species was obtained in England from *Syncopacma taeniolella* Zell. (Gelechiidae) on *Lotus corniculatus* and *Agonopterix pallorella* Zell. (Oecophoridae) (on *Centaurea scabiosa)* and Nixon (1986) mentioned it from *Epinotia mercuriana* (Fröl) (Tortricidae). In Holland, Simbolotti & Achterberg (1999) mention it from the *Aproaerema anthyllidella* (Hübn.) (Gelechiidae) in seeds of *Anthyllis*. In Romania, Lăcătușu & Drăghia (1977) obtained the species from *Chrysoesthia sexgutella* Thbg. (Gelechiidae) on *Chenopodium album* (L.) in the zone of Bucharest.

Agathis assimilis Kok. (= *A. propinqua* Kok., *A. jakovlevi* Kok., *A. anchisiades* Nix.). Geographical distribution – the species is reported in 24 of those 79 countries and zones that is 30.38%. The species was reported in 24 of those 79 countries and zones considered that is 30.38%. According to Table 2, the species is common in all the geographical zones, especially in the middle ones (41° - 55° North Latitude). In Romania, it is mentioned by Ailenei (2011a, 2011b) within the maritime Dune Nature Reserve from Agigea (Constanța). Biology – according to Simbolotti & Achterberg (1999), the hosts of the species are unknown, those of the species *A. sibirica* Telenga 1933 (*Coleophora astragalella* Zell. *Coleophora lugdunella* Zell., *Hypsiphilus marginellus* F. (Lepidoptera), as synonymous, were not retained by these authors. In the Republic of Moldova, there was reported in arid places: cherry woods, dry meadows, steppe with feather grass (*Stipa* spp.) (Talitzkii *et al*., 1990) (Table 3).

Agathis breviseta Nees (= *achterbergi* Nixon). Geographical distribution – the species is reported in 24 of the 79 zones considered that is 30,38%, According to Table 2, the species is common especially in the middle and northern ones (50% and 25%). In Romania, *A. breviseta* is the only species of the genus *Agathis* mentioned in "Fauna

Europaea" by Moldovan *et al*., (2007) too. Lăcătușu mentions it in Romania in 1962; Filipescu & Lăcătușu (1970) collected seven ♂♂ in Rarău (1536 m) in the month of August and Ailenei (2008) collected eight specimens from the grassland steppe of David's Valley (Iași County), during May-July and Ailenei (2011) also mentions the species at Mârzești (Iași County), Sulina and Canaraua Fetii (Dobrogea), grassland steppe and arid meadow as well. In the Republic of Moldova, it was mentioned in arid meadows and steppe with feather grass (*Stipa* spp.) (Talitzkii *et al*., 1990) (Table 3). Biology – the hosts are not known, considering that those mentioned by Tobias (1986) (10 species belonging to Tortricidae, Gelechiidae, Oecophoridae, Coleophoridae and Pyraustidae), belong, at least, partially, to *Agathis fuscipennis* (Zetterstedt).

Agathis glaucoptera Nees. Geographical distribution – the species is known from 12 of those 79 countries and zones considered, that is 15.19% of the zones (Table 1). The species presents a special affinity firstly for the southern zones with 50% and less for the middle ones (33.33%) (Table 2). In Romania, the species was reported by Ailenei (2008; 2011), who collected 11 specimens in the June-September period 2006 from the steppe grasslands of David's Valley (Iași). Biology unknown.

Agathis griseifrons Thomas (= *laticarpa* Telega). Geographical distribution – the species was reported in 25 countries and zones of those 79 considered, ie 31.65% (Table 1). The species has a general distribution in the considered territory, with a presence of 20.08% in the southern zones, but with a special presence in the middle (40%) and northern (28%) ones (Table 2). In Romania, the species was reported by Filipescu & Lăcătușu (1970), 20 ♀♀ in June-August on the Rarău meadows (1536 m altitude). Biology – according to Nixon (1986), the species was obtained from *Pyrausta aurata* (Scop.) (Pyralidae) in France and Great Britain (Table 5).

Agathis malvacearum Latr. Geographical distribution – the species was reported in 23 of those 79 countries and zones considered, ie 29.11% (Table 1). It is present in all the climate zones, from the southern (20.08%) to the northern ones (4.35%), but with a strong preference for the middle ones (52.17%) (Table 2). In Romania, the species was reported in the South of Dobrogea and of Bessarabia (The Republic of Moldova) (Müller, 1927) and Lăcătușu (1967) reported it in the forests from the South of Dobrogea. In the Republic of Moldova, the species is reported in arid meadows and steppe with feather grass (*Stipa* spp). Biology – according to Nixon (1986) it is the parasitoid of the mallow moth *Pexicopia malvella* (Hübn.) (Gelechiidae) in flowers of Malvaceae, and according to Simbolotti & Achterberg (1999), the host species reported by Tobias (1986) might refer to *A. varipes* Thoms. Also, *A. malvacearum* was collected in France, on flowers of *Althea rosea* L. and *Malva* sp and in Holland on flowers of *Althea officinalis* L. (Table 5).

Agathis montana Sheet. Geographical distribution – the species was reported in 14 of those 79 countries and zones considered representing 14.72% (Table 1). It is present in all the climate zones: 38.71% southern zones; 21.43% intermediate zones; 38.71% middle zones and only 7.14% northern ones (Table 2). In Romania, it was not reported but it is reported in the Republic of Moldova in areas with arid meadows and steppe with feather grass (*Stipa* spp.) (Talitzkii *et al*., 1990). In what concerns the ecological affinities of the species, according to the same authors, it prefers the dry meadows from the left bank of the Dniester River as well as the steppe with feather grass (*Stipa* spp.) in the south-east of the Republic of Moldova near the Dniester. It has to be noted, however, that Simbootti & Acterberg (1999) do not mention its presence in Russia (The Republic of Moldova

inclusively and probably Hungary) or the proposed host by Tobias (1986), *Pyrausta aurata* Scop., reporting it sooner to *Agathis griseifrons*.

Agathis nigra Nees (see the description above).

Agathis rufipalpis Nees. Geographical distribution – the species was reported in 20 of those 79 countries and zones considered, that is 25.32% (Table 1). It is present in all climate zones, but especially in the middle zones (40%) and in the northern ones (25%); however, it also registers an obvious presence in the south (20%) (Table 2). In Romania, the species was reported by Lăcătușu & Filipescu (1975) in the area of Iron Gates (Mehedinți County) on August 27th 1968. Biology unknown. The hosts presented by revision of Simbolotti & Achterberg (1999). Sex-ratio (Table 7) – the value of this index can be estimated on the basis of the known material from Bulgaria, which is quite rich (69 ♂♂ and 40 ♀♀) and was collected between 1972 and 1994 (Fig. 2). Thus, this value is of 36.7% ♂♂. In Spain, on the basis of a poorer material (9 ♀ and 2 ♂), the sex-ratio was of 18.18%, and on the whole for the Western Palearctic zone the studied material consisted of 137 specimens (93 ♀♀ and 44 ♂♂), with a sex ratio of 32.12% ♂♂. This material was collected in the 1941 to 1994 period. The Flight period – on the whole, in the western Palearctic zone, the flight of the species occurred between April 20th 1983 in Spain and April 27th 1968 in Romania (Lăcătușu & Filipescu, 1975) and April 29th 1984 - September 23rd 1977 in Bulgaria (Fig. 2). To the north, it takes place toward July-August (Finland, Switzerland and partly France) and to South the flight is earlier, beginning with the month of April (Spain, Romania, Bulgaria). On the basis of the rich material available from Bulgaria, one can observe that here the flight is concentrated between May 20th and July 20th, with the peak between the 11th and the 25th of July (Table 1 and 2).

Agathis semiaciculata Ivan (= *striolata* Shest.). Geographical distribution – the species was reported in 12 of the 79 countries and zones considered that is 15.19% (Table 1) and especially in the southern zones (33.33%) and middle ones (50%) (Table 2). In Romania, the species was reported by Filipescu & Lăcătușu (1970) in Rarău hayfields (Suceava County) (1536 m altitude), 3 ♀♀ in August. In the Republic of Moldova, it is reported in an arid meadow by Talitzkii et al., (1990). Biology unknown.

Agathis tibialis Nees (= *genualis* Marsh.). Geographical distribution – the species was reported in 12 of the 79 zones and countries considered (15.19%) (Table 1); it is mainly present in the southern (41%) and middle (41%) zones and less in the northern ones (16.66%) (Table 2). In Romania, it was reported by Mocsary (1897). In the Republic of Moldova, it is mentioned in arid meadows and steppe with feather grass (*Stipa* spp.) by Talitzkii *et al*., (1990). Biology – according to Simbolotti & Achterberg (1999) it is unknown. The flight would happen especially by the end of the season. According to Nixon (1986), the species would parasitize two species of Gelechiidae, but Simbolotti & Achterberg believe that most of the specimens obtained from these hosts would belong to the species *Agathis varipes* Thoms.

Agathis umbellatarum Nees (=? *A. thoracica* Lucas; ? *A. brullaei* Lucas; ? *A. aurantiaca* Fahringer, *A. kolazy*i Fishcher; *A. gussakovskyi* Tobias). Geographical Distribution – the species was reported in 25 of the 79 countries and zones considered (31.65%) (Table 1) and it is present mainly in southern zones (64%) and middle ones (24%) (Table 2). In Romania, the species was reported by Lăcătușu & Filipescu (1975) in the area of Iron Gates (Ogradena) – Eșelnița (Ieșelnița) (Mehedinți County) (approximately 44°67' northern Latitude), 1 ♀ on April 27th, 1968. In the Republic of Moldova, it is reported in

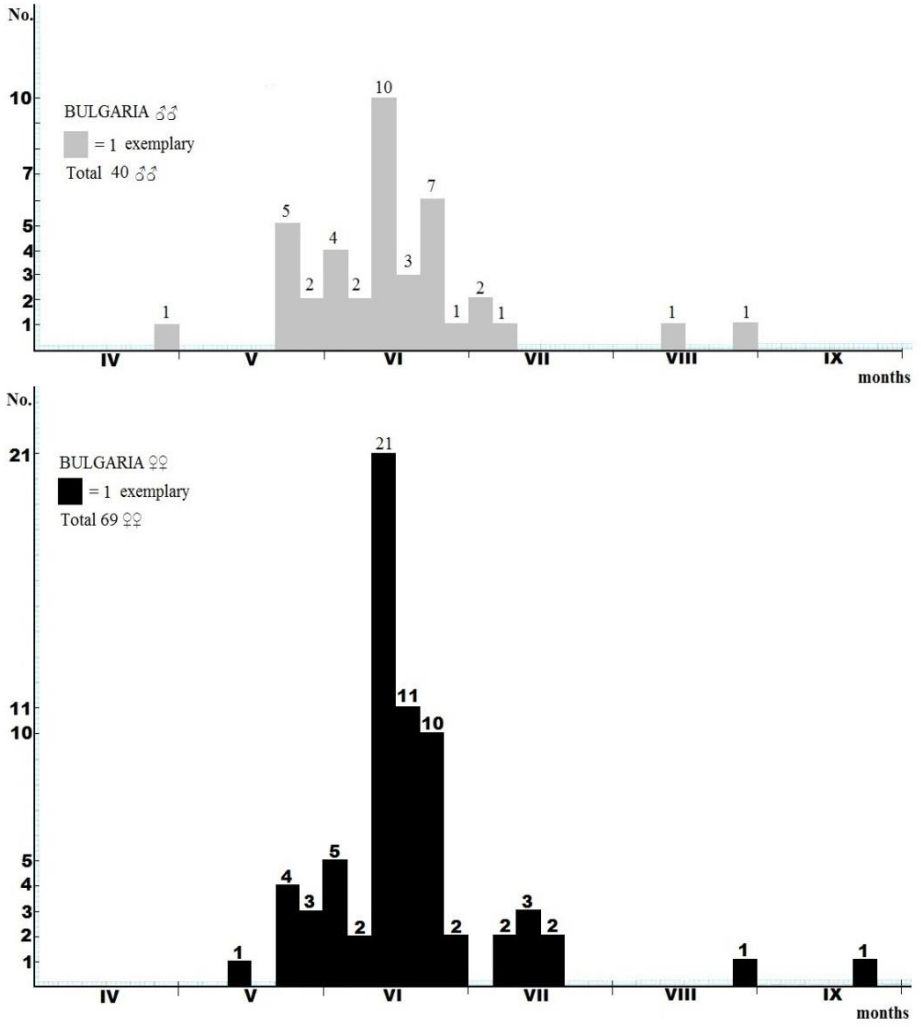

Figure 2: Flight periods of females and males of the species *Agahtis rufipalpis* Nees in Bulgaria.

Table 4. Data of collecting of ♀♀ and ♂♂ of the species *Agathis nigra* Nees in the study area, conformable to Simbolotti & Achterberg (1996), Tobias (1963), with the completions of authors and Chiriliuc (2015).

No.	Country	species of plants and hosts	IV	V (May)			VI (June)			VII (July)			VIII (August)			IX (September)		
			♀	Date	♀♀	♂♂	Date	♀♀	♂♂	Date	♀♀	♂♂	Date	♀♀	♂♂	Date	♀♀	♂♂
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Netherlands	*Tanacetum vulgare*											10.08.1991	1		4.09.1975	1	
													14.08.1950	1		4.09.1989	1	
													15.08.1947	1		22.09.1986	1	
													15-30.08 1975	1				
		Tanacetum vulgare / Isophrictis striatella											15.08.1985	1				
													20.08.1989	1				
													26.08.1893		1			
		T. vulgare flower											28.08.1984	1				
2	Belgium															11.09.1966	1	
3	Germany	*Isophrictis striatella*		13.05.1970	1								2.08.1990		1			
		Isophrictis striatella					29.06.1990		1				2.08.1990	1				
		Isophrictis striatella					29.06.1990		1				3.08.1990	1				
		Isophrictis striatella/ Tanacetum vulgare								28.07.1990	1		10.08.1990	2	1			
		Isophrictis striatella								29.07.1990		1	14.08.1990	1				
										30.07.1990	2		1982	1				
		Isophrictis striatella								31.07.1990		1	1989	1				
		Isophrictis striatella								31.07.1990		1						
4	Romania	*Dichomeris marginella /Tanacetum vulgare*					28.04-17.06 2010	3	2	17.06-15.07 2010	7	2				12.08-15.09 2011		2
										27.07.2010	1							
										29.07.2009	1							

Table 4. continuation.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
5	Bulgaria						21.06.1976	1		8.07.1978	1							
							27.06.1978		1	12.07.1976	2							
										23.07.1978		1						
										29.07.1977	2							
6	France									7.07.1951	1		10.08	1		2.09.1961		1
										19.07.1969	2		15.08.1891		1			
										22.07.1065	1	1						
										27.07.1958								
7	Greece			4.05.1976	1													
8	Spain		1	15.04.1997														
		Anacyclus clavatus-flower	1	15.04.1968														
		Anacyclus clavatus-flower		19.05.1992	17	15												
				19.05.1992		1												
				21.05.1958	1													
				25.05.1983	1													
				31.05.1979	1													
9	Marocco			05.1895	2													
10	Kazakhstan						11.06.1957	3		1.07.1957	1							
		Pyrethrum kasakhsanicum								11.07.1957	4		1.08.1958	3				
		Serratula carduncules					13.06.1957	1										
		Ferula songorica					15.06.1957	4										
		Ferula tatarica					7-16.06.1957	17										
		Ferula tatarica					24.06.1957	1										
		Lepidium sp.								3.07.1957	1							
		Palimbia rediviva								2.07.1957	2							
TOTAL			2		24	16		30	5		30	7		18	4		4	3

Table 5. Species of the genus *Agathis* Latr. present in Romania and the Republic of Moldova, whose hosts are known together with the associated host plants as well as the plants from which there were collected these species.

No	The species of *Agathis*	HOSTS		ASSOCIATED PLANTS		Country
		Host species	The family	Species of plants	The family	
1	*Agathis anglica*	*Syncopacma taeniolella*	Gelechiidae	*Lotus corniculatus* L.	Papilionaceae	England
	Agathis anglica	*Agonopterix pallorella*	Oecophoridae	*Centaurea scabiosa* L.	Asteraceae	England
	Agathis anglica	without the host	-	*Lotus corniculatus* L.	Papilionaceae	England
	Agathis anglica	*Aproaerema anthyllidella*	Gelechiidae	*Anthyllis* sp.	Papilionaceae	Netherlands
	Agathis anglica	*Epinotia mercuriana* (Frölich)	Tortricidae	-	-	Austria
	Agathis anglica	*Chrysoesthia sexgutella* Thbg.	Gelechiidae	*Chenopodium album* L.	Chenopodiaceae	Romania
2	*Agathis griseifrons* Thoms (= *laticarpa* Telenga)	*Pyrausta aurata* (Scop.)	Pyralidae	*Mentha aquatica* L.	Labiatae	France
		Pyrausta aurata (Scop.)	Pyralidae	*Mentha aquatica* L.	Labiatae	England
3	*Agathis malvacearum*	*Pexicopia malvella* (Hübn.)	Gelechiidae	*Malva sp*. flower	Malvaceae	France
	Agathis malvacearum	*Pexicopia malvella* (Hübn.)	Gelechiidae	? *Althaea rosea* (L.) Cav.	Malvaceae	France
	Agathis malvacearum	*Pexicopia malvella* (Hübn.)	Gelechiidae	*Althaea officinalis* L.	Malvaceae	Netherlands
	Agathis malvacearum	*Pexicopia malvella* (Hübn.)	Gelechiidae	*Malva* sp.	Malvaceae	Armenia
4	*Agathis nigra*	*Dichomeris marginella* (F.) (=*Isophrictis striatella* Den & Schiff)	Gelechiidae	*Tanacetum vulgare* (L.)	Asteraceae	Germany
	Agathis nigra		Gelechiidae	*Tanacetum vulgare* (L.)	Asteraceae	Netherlands
	Agathis nigra		Gelechiidae	*Tanacetum vulgare* (L.) flower	Asteraceae	Netherlands
	Agathis nigra		Gelechiidae	*Tanacetum vulgare* (L.)	Asteraceae	Romania
	Agathis nigra		Gelechiidae	*Anacyclus clavatus*	Asteraceae	Spain
	Agathis nigra	-	-	*Pyrethrum kasakhstanicum*	Asteraceae	Kazakhstan
	Agathis nigra	-	-	*Serratula carduncul*us Pall.	Asteraceae	Kazakhstan
	Agathis nigra	-	-	*Ferula songorica* Pall. ex. Schult.	Asteraceae	Kazakhstan
	Agathis nigra	-	-	*Ferula tatarica* Fisch. ex. Sppreng	Asteraceae	Kazakhstan
	Agathis nigra	-	-	*Palimbia rediviva*	Apiaceae	Kazakhstan
	Agathis nigra	-	-	*Lepidium* sp.	Cruciferae	Kazakhstan
5	*Agathis umbellatarum* Nees. (=? *thoracica* Lucas)	*Epinotia thapsiana* Zell.	Tortricidae	*Thapsia villosa* L.	Apiaceae	Portugal
		Agonopterix thapsiella Zell.	Oecophoridae	*Thapsia villosa* L.	Apiaceae	Portugal
		Agonopterix thapsiella Zell	Oecophoridae	*Centhaurea caleitrapa* L.	Asteraceae	France
		Agonopterix thapsiella Zell	Oecophoridae	*Centhaurea spinosa* L.	Asteraceae	Greece
		Agonopterix thapsiella Zell	Oecophoridae	*Atractylus gummifera* L.	Asteraceae	Algeria

arid meadows and semi-arid forests with downy oak (*Querqus pubescens*) from the south. Biology – according to Simbolotti & Achterberg (1999) the safe hosts would be *Epinotia thapsiana* Zell (Tortricidae) or *Agonopterix thapsiella* Zell. (Oecophoridae) in flowers of *Thapsia villosa*, from which there was obtained 1♂ between April 21st and May 22nd 1972 in Portugal. The hosts mentioned by Telenga (1955) were not retained. The species was obtained from the flowers of Asteraceae: *Carduus* sp. and *Centaurea calcitrapa* L. in France, *Centaurea spinosa* (L.) in Greece, and *Atractylis gummifera* L. in Algeria. It was also collected from the flowers of other plants: *Asphodellus ramosus* and *Thapsia garganica* in Algeria, on xerophytic vegetation in Crete, and on *Medicago sativa* L. (Papilionaceae) (Table 5). With regard to the hosts mentioned by Telenga (1955) and Tobias (1986), these were not retained by Simbolotti & Achterberg (1999). Sex-ratio (Table 7) – based on the analysed area and the material considered (Simbolotti & Achterberg (1999) there were collected 58 ♀♀ and 13 ♂♂ from where it results 18.31% males. The sex-ratio index values varied greatly, however, depending on the place and the available material. Thus, for the zones from where the material was collected more, for the 11 specimens collected in Algeria the sex-ratio was zero, for Bulgaria from where 16 specimens were collected (15 ♀ 1 ♂), sex-ratio was 6.67% for males and for France (12 ♀ and 3 ♂), and Spain (4 ♀ and 1 ♂) the value is of 20% males. For the zones from where fewer individuals came, the sex-ratio values were from zero for Italy, Yugoslavia, Greece, Malta, Cyprus, Morocco, Romania, to 25% males for Portugal (3 ♀ and 1 ♂) and 77.77% ♂, in Turkey (2 ♀ and 7 ♂♂). The flight period – being a species with predominantly southern affinity (Table 2), the periods of flight are more precocious in the south: April 3rd in Cyprus, April 7th in Algeria, the flight being concentrated in the month of June. In Spain, the flight of spring starts in April 10-14th. In France, where the material is something richer, the flight of females begins in May and lasts till November, as the flight of males. This dynamic could plead for 3 flights and at least 2 generations per year. And the situation in Bulgaria pleads for two or three generations (May-June, the first and the second in July) (?).

Discussion

Abundance and frequency. The value of these parameters for the species recorded in Romania, due to few and sporadic collectings, presents a certain relativity. Thus, for some species, there were collected during the time, only 1-5 specimens (*A. anglica*, *A. assimilis*, *A. rufipalpis*, *A. umbellatarum*, *A. malvacearum*, *A. semiaciculata*, *A. tibialis*), although their distribution in the area is considerable, with values of 15.19 % - 31.65% (Table 1), in accordance with the data of collecting provided by Simbolotti & Achterberg (1999). Other species, with higher values of abundance, were *A. glaucoptera* with 11 specimens and a frequency of 15.19%, *A. breviseta* with 18 specimens and 30.38% frequency, *A. nigra* with 19 specimens and 40.51% frequency and *A. griseifrons* with 20 specimens and 31.65% frequency (Table 1). In case of these species, the greater abundance is due to either more ample collectings at Rarău (Filipescu & Lăcătușu, 1970), for *A. griseifrons* or higher number obtained through rearings from the hosts collected in nature, in big quantity, as in *A. nigra* (Chiriliuc, 2015). If we refer to the random collectings, the majority of species were found only in 1-4 localities from Romania, with the exception of the species *A. breviseta* which was collected in 1-8 specimens from 5 localities. One can still notice that, in case of random collectings, the greatest number of species and abundance was registered at Rarău, with 4 species and 33 specimens *(A. anglica*, *A.*

semiaciculata, A. griseifrons and A. breviseta) and at David's Valley (Iași County) with 2 species and 19 specimens (*A. glaucoptera and A. breviseta).*

Ecological affinities (Tables 2 and 3). In terms of the climate affinities of those 12 species treated by us in Table 2 one can find that, in case of the species *A. umbellatarum* and *A. glaucoptera*, 64% and respectively 50% of the number of specimens were collected from southern zones of the area and 36%, respectively 50% in the intermediate and middle zones. The following five species are more uniformly distributed from the southern to the northern ones, but with a preference increasingly accentuated for middle zones, from *A. tibialis* with 41% in the south, 41% in the middle zones and 16.66% in the north, up to *A. malvacearum* with 20.08% respectively in the south, 17.39% in intermediary areas, 52.17% in those middle ones and 4.35% in the north. The rest of the species, 5 from *A. assimilis* to *A. griseifrons* present several affinities for the middle zones to northern ones. Thus, if *A. assimilis* preferred in proportion of 20.83% the southern zones, those intermediary and middle 58.33% and those northern 20.08%, *A. griseifron*s preferred the southern zones respectively with 20.08%, those intermediary plus middle 52% and those northern in proportion of 28%. Another aspect of ecological affinities refers to the favourable, particular environmental conditions. Thus, Tobias (1971) believes that the species of the genus *Agathis* are more common in the arid zones, and especially in those steppe ones. Tobias (1971) motivates this aspect with the fact that numerous described species come from Central Asian steppe zones, especially. On the other hand, of the 30-described species from Central Asia, 13 were synonymized with European species that populate an area up to the Central Asia (Simbolotti & Achterberg, 1999). On the other hand, at least, 14 described species from Central Asia (especially by Tobias) are valid, some with extension in the Western Palaearctic zone, and 8 species are known only in the Central Asia. In what concern the species from Romania and the Republic of Moldova, especially those from the Republic of Moldova fit with the opinions of Tobias (1971). Thus, 7 of those 8 species reported in the Republic of Moldova (Table 3) are especially associated with the dry meadows on the left bank of the Dniester River and with the steppes with feather grass *(Stipa* spp.) from the south of the country near the Dniester. Six of these species were also reported in the arid and steppe zones: arid cherry forests from the north, sub arid forests from the south with downy oak (*Querqus pubescens*) and steppes with feather grass (*Stipa* spp.). As the species in Romania (Table 3), 4 species were collected from mountain meadows on the Rarău Mountains in the north of the Eastern Carpathians, at 1536 m altitude (*A. anglica, A. semiaciculata, A. breviseta* and *A. griseifrons).* These species, according to Table 2, prefer the zones of middle latitude and to a great extent northern zones, which explains their presence in the mesophytous meadows from Rarău. Of these, *A. anglica, A. breviseta, A. griseifrons*, as one can notice in Table 2, are met to a great extent in southern zones too, from the mesophilic vegetation in the south and from Transylvania, to the steppe grasslands and arid zones from the South of Dobrogea. In the steppe zones and those arid ones in Dobrogea, there were found *A. glaucoptera, A. malvacearum, A. assimilis, A. breviseta* and *A. griseifrons* (Table 3). Finally, in warmer zones in the South and in Transylvania, from the biotopes with mesophytous vegetation, there were collected *A. umbellatarum, A. tibialis, A. anglica, A. assimilis, A. nigra* and *A. rufipalpis*. Taking into account the fact that the territory of the Republic of Moldova, as a continuation to the east of the territory of Romania, is, in general, more arid than the Romanian one, except for some zones in the Romanian extreme Southeast, Dobrogea, the association of species of the

genus *Agathis* with the arid steppe zones is more evident. This is the case of the species (in Romania and the Republic of Moldova): *A. tibialis, A. malvacearu*m. *A. assimilis* and *A. breviseta*; *A. assimilis* proving to be the most widespread species in the zones of Romania and the Republic of Moldova.

Data on the biology of species of the genus Agathis Latr. reported in Romania and the Republic of Moldova (Table 5)

Hosts – as Shaw & Huddleston (1991) show in Simbolotti & Achterberg (1999), the species of the genus *Agathis* are solitary endoparasitoids, koinobionts of the concealed larvae in the tissues of plants, belonging to some families of Lepidopterans. In our case, it is about the families Gelechiidae, Oecophoridae, Pyralidae and Tortricidae whose larvae are parasitized in general in the capitula of different species of Asteraceae. According to Nixon (1986) they can parasitize either in the species of genera within a family of hosts or in the host species belonging to several families, hosts that are found in the same microhabitat with the parasitoid species. In what concerns the hosts of the species of *Agathis* treated by us, these are known for five of these species (Table 5), adding to the known data *Dichomeris marginella* for *Agathis nigra* in Romania and also from Romania, a new host, *Chrysoesthia sexgutella* Thbg. (Gelechiidae) for *A. anglica* (Lăcătușu & Draghia 1977) obtained from *Chaenopodium album* L. (will nevertheless revised).

The Plants to which there are associated the species of the genus *Agathis* reported in Romania and to which the hosts are shown, are presented in table 5 and for *A. nigra* in table 4. It is about the plants on which the hosts of the species of *Agathis* develop and the plants on whose flowers there were found the species of *Agathis* without being obtained from hosts that might develop in these plants. In these cases, it might be the case about the feeding of the species of *Agathis* with nectar of the flowers of these plants. Thus, those five species in the fauna of Romania have hosts that grow on plants belonging to the families Chenopodiaceae, Papilionaceae and Asteraceae) (for *A. anglica*), to Malvaceae (for *A. malvacearum),* to Labiatae (for *A. griseifrons*), to Asteraceae (for *A. nigra* and for *A. umbellatarum*). In what concerns the presence of the species of the genus *Agathis* on plants, in general, they were captured usually on the plants in which their hosts develop, as shown in Table 5 and from above. However, besides these, *Agathis* spp. were also collected from other plant species, usually flowering ones: *A. nigra*, in its vast area from Mongolia and Central Asia (Kazakhstan) to Spain, was collected (Table 5) from two species of Asteraceae in Europe; on a species of Cruciferae on a species of Apiaceae and on four species of Asteraceae in Kazakhstan (Tobias, 1986); and *A. umbellatarum* was collected again on flowers of two species of Asteraceae in Europe and on a species in Algeria.

Periods of flight. For *A. nigra*, there were established the best flight periods in different zones of the area (Tables 4 and 6). Taking into account the dynamics of the flight of this species in its area with northern affinities (Table 2), we can assume that the species with preponderantly southern affinities will present the main flight especially in these areas (*A. umbellatarum* and *A. glaucoptera*). In the same time, the species with middle but also with sufficient southern and northern affinities will have the flight spread throughout the whole period of the spring-autumn season. Thus, one can observe that *A. umbellatarum*, with a middle and southern distribution in the West-Palaearctic zone, has a more spaced out flight (flights) during the season, from April to November in Romania, Bulgaria, Ex-Yugoslavia, France and more grouped ones in the southern zones, from April to June, usually, in countries like Portugal, Spain, Malta, Greece, Crete, Cyprus, Mediterranean

Table 6. Frequency of the flight of the species *Agathis nigra* Nees in zones of the area.

Country-Zone	Total No.	IV April		V May		VI June		VII Iuly		VIII August		IX September	
		nr.	%	nr.	%	nr.	%	nr.	%	nr.	%	nr.	%
Netherlands	11	-	-	-	-	-	-	-	-	8	72.72	3	27.27
Belgium	1	-	-	-	-	-	-	-	-	1	100.0	-	-
Germany	19	-	-	1	5.26	2	10.53	7	36.84	9	47.37	-	-
Romania	18	28.04.....17.06.2010				5	27,77	11	61,11	-	-	2	11.11
Bulgaria	8	-	-	-	-	2	25.0	6	75.0	-	-	-	-
France	8	-	-	-	-	-	-	5	62.5	2	25.0	1	12.5
Greece	1	-	-	-	-	-	-	-	-	-	-	-	-
Spain	38	2	5.26	36	94.74	-	-	-	-	-	-	-	-
Marocco	2	-	-	2	-	-	-	-	-	-	-	-	-
Kazakhstan	37	-	-	-	-	26	70.27	8	21.62	3	8.11	-	-
TOTAL	143	-	-	-	-	39	24.48	37	25.87	23	16.08	6	4.20

Table 7. Sex-ratio values registered for some species of the genus *Agathis* Latreille in different countries and zones.

No.	Zones and countries	*Agathis nigra*		*Agathis rufipalpis*		*Agathis anglica*		*Agathis umbellatarum*	
		no. ♀♀/♂♂	% ♂♂	no. ♀♀/♂♂	% ♂♂	no. ♀♀/♂♂	% ♂♂	no. ♀♀/♂♂	% ♂♂
1	West Palearctic	70/39	35.78	91/44	32.59	83/5	5.68	58/13	18.31
2	Finland	-	-	1/1	50.0	-	-	-	-
3	England	-	-	-	-	2/1	33.33	-	-
4	Germany	13/5	27.8	-	-	2/1	33.3	-	-
5	Netherlands	10/1	9.09	-	-	-	-	-	-
6	Romania	11/7	38.9	-	-	-	-	1/-	-
7	Bulgaria	6/2	25.0	69/40	36.7	34/3	8.11	15/1	6.67
8	France	5/3	37.5	-	-	-	-	12/3	20.0
9	Northen Algeria	-	-	-	-	-	-	1/-	-
10	Portugal	-	-	-	-	-	-	3/1	25.0
11	Spain	22/16	42.11	9/2	22.22	-	-	4/1	20.0
12	Turkey	-	-	-	-	3/1	25.0	2/7	77.0

Algeria, Morocco, etc. It must also be revealed the fact that the later flights in southern zones of these species occur at higher altitudes: 800 m in Yugoslavia for the month of September, 1000 m, in Spain for the month of July, 2200 m for the same month in Turkey, etc. For *A. umbellatarum*, there are data available for nearly 150 years, from 1849 to 1998 (the data were processed/offered by Simbolotti & Achterberg in their revision from 1999).

Another case, of the species *Agathis rufipalpis* is also interesting. Although there are less data from the whole area, instead, there are more numerous faunal data from Bulgaria, which displays a climatic zone similar to the southern part of Romania. Being a species with middle and northern affinities (Table 2), it has nevertheless southern sufficient affinity too, being distributed from Spain and Portugal up to Finland.

Thus, in Spain and Portugal, the flight of males and females occurs mostly in the month of May. In Finland, in the month of July, in France, as in case of other species too, due to the climate variation from the South to the North the flight is more spaced out, from May till August. And in case of this species in southern zones, it can be detected later flights too at higher altitudes. Thus, in Andorra, there was captured 1 ♀ at 1500 m altitude, but also in countries with harsher climate, such as Switzerland, the species was found at 1500 m altitude in August. In Bulgaria, (Fig. 2) however, from where we have several detailed faunal data represented by 44 ♂♂ and 69 ♀♀ collected in the 1975-1994 period, one can find that the main flight occurs in the first days of the month of May until the first days of the month of July, with maximum at mid-June. Taking into account the flight of the males, one can assume the existence of at least three flights with two generations during the season.

The numerical ratio of sexes (sex-ratio) (Table 7). The primary data come from Simbolotti & Achterberg (1999), with our additions. The specification of this parameter, its validity, depends primarily on the ampleness of the collectings and faunal data at our disposal provided by the existing collections in different museums. Thus, among those 12 species treated by us, there are data just for four on the basis of which one can estimate the value of sex ratio. Thus, for some countries or zones, either there is only one sex, or there are very few specimens, which cannot be taken into consideration. Therefore, in Table 7 we present the cases of four species with the number of males and females known for some countries or zones for which one can estimate the value of sex ratio. Thus, for *A. nigra*, the value of sex-ratio oscillated between 9.09% males, in Holland and 42.11%, in Spain, the general value for the West Palaearctic being 35.78% (for 70 ♀♀ and 39 ♂♂ collected in this area). In Romania, based on the specimens obtained mostly through rearings (11 ♀♀ and 7 ♂♂), sex-ratio was 38.9% ♂♂, a value close to that found in France (37.5% ♂♂) and to the average for the Western Palaearctic zone (35.78% ♂♂). In what concerns the species *A. rufipalpis*, the value of the sex-ratio oscillated between 22.22% (9 ♀ and 2 ♂) in Spain and 50% in Finland (only 1 ♀ and 1 ♂) the mark being given by the situation in Bulgaria 36.7%, from where they were collected a great number of specimens (69 ♀ and 40 ♂), these dictating the value of sex-ratio too for the West Palaearctic zone – 32.59% ♂♂. Also, for *Agathis anglica*, we have, in general, few specimens coming from a few countries, except a greater number of specimens from Bulgaria and 33.33% from England and Germany. For the West Palearctic zone, the low value of only 5.68% ♂ is still attested by the increased number of specimens collected 83 ♀♀ and 5 ♂♂. Finally, in case of the species *Agathis umbellatarum*, sex ratio oscillated between 6.67% for Bulgaria (15 ♂ and 1♀), and 77% in Turkey (2 ♀ and 7 ♀), the global value for the West Palaearctic zone

being 18.31% (58 ♀♀ and 13 ♂♂). One can also find that, in case of these four species, for the West Palearctic zone, sex-ratio oscillated between 5.68% ♂♂ for *Agathis anglica* (83 ♀♀ and 5 ♂♂) and 35.78% ♂♂ for *Agathis nigra* (70 ♀♀ and 39 ♂♂) (Table 7).

Conclusions

The parasitoid – host relationship (*Agathis nigra – Dichomeris marginella*) is reported for the first time in Romania .

In what concerns the biogeographical and climatic affinities of the species, it prefers zones with northern and middle latitude and in to lesser extent those southern – *A. nigra* preferred in Romania forest-steppe zones, sometimes with ruderal vegetation and in the Republic of Moldova, steppe zones with feather grass (*Stipa* spp.)

If we refer to the biology of species, in our researches, it was obtained from the small butterfly *Dichomeris marginella* (= *Isophrictis striatella)* that develops in the stems of *T. vulgare*, the flight period lasted until the end of the month of August, with a maximum flight between June 17th and July 15th, the flight being similar to that from Bulgaria. Taking into account the flight of males, we can estimate at 2-3 the number of generations that develop in Romania.

The value of sex-ratio in Romania was 38.9% males close to the known value for the West Palearctic zone, of 35.78% males.

Because in the “Fauna Europaea” it is reported only the species of *A. breviseta*, in the fauna of Romania, due to the fact that faunal data referring to the territory of Romania and the Republic of Moldova are distributed in publications often secondary, we have made a synthesis of these data making evident the existence of 11 species in Romania, although it might as 2-3 species to represent synonymies according to current bibliography. According to the current revision bibliography of the genus *Agathis* Latreille, with faunal data distributed in our bibliography (Romanian and in the Republic of Moldova) as well as to our observations especially for *A. nigra*, for each species it is presented the general geographical distribution and the ecological affinities as well as the known biological data: hosts, frequented plants, periods of flight, sex-ratio, etc.

Within the chapter “Discussions” there are presented comparatively the abundance and frequency of the species in the known area (West Palearctic zone), ecological affinities, biology of the species (hosts, associated plants, flight periods, the numerical ratio of the sexes, etc.).

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DIVERSITY OF HARMFUL ENTOMOFAUNA (ARTHROPODA; INSECTA) FROM THE RYE CROP IN THE NORTHERN PART OF MOLDOVA

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Abstract. Rye cultures’s material collections and observations were made in 4 localities from Suceava county (Rădăuți, Horodnic de Jos, Marginea and Poieni-Solca) and one from Botoșani county-Mihăileni. One with another, there were collected 6419 of harmful insects and there were identified 65 taxons which belong to orders Orthoptera, Hemiptera, Thysanoptera, Diptera, Hymenoptera and Coleoptera. Among pests from straw cereals, there were identified the following species: *Eurygaster maura*, *E. integriceps*, *Aelia acuminata*, *Schizaphis graminum*, *Sitobion avenae*, *Cicadella viridis*, *Limothrips denticornis*, *L. angulicornis*, *Frankliniella pallida*, *Haplothrips aculeatus*, Chloropidae and *Cephus* sp. In all cultures, there were clearly dominant *Haplothrips aculeatus*, *Sitobion avenae* and *Schizaphis graminum.*

Keywords*:* rye crop, Suceava County, harmful entomofauna, abundance, dominance.

Rezumat. Diversitatea entomofaunei dăunătoare (Arthropoda; Insecta) din cultura de secară din zona de nord a Moldovei. Colectările de material entomofaunistic și observațiile s-au făcut în cultura de secară din 4 localități din jud. Suceava (Rădăuți, Horodnic de Jos, Marginea și Poieni-Solca) și dintr-o localitate din jud. Botoșani – Mihăileni. În total, s-au colectat 6419 exemplare de insecte dăunătoare și s-au identificat 65 de taxoni care au aparținut ordinelor Orthoptera, Hemiptera, Thysanoptera, Diptera, Hymenoptera și Coleoptera. Dintre dăunătorii specifici cerealelor păioase, în această cultură s-au identificat speciile: *Eurygaster maura*, *E. integriceps*, *Aelia acuminata*, *Schizaphis graminum*, *Sitobion avenae*, *Cicadella viridis*, *Limothrips denticornis*, *L. angulicornis*, *Frankliniella pallida*, *Haplothrips aculeatus*, Chloropidae și *Cephus* sp. În toate culturile, net dominante au fost *Haplothrips aculeatus*, *Sitobion avenae* și *Schizaphis graminum.*

Cuvinte cheie: cultura de secară, jud. Suceava, entomofauna dăunătoare, abundență, dominanță.

Introduction

Rye is a plant important to humans and to domestic animals. It is raw material in making bread, used in the process of making beverages, animal feeding, so on and so forth. Lately the culture of this plant came to a vast expansion especially on low productive soils. In Romania, research on harmful entomofauna in cereal cultures were done systematically and consistently in various units of agricultural research only for wheat, barley, oats and triticale. In some works, some authors mention various groups of harmful entomofauna for the rye crop (Baniță, 1969; Malschi, 2005; Malschi & Mustea, 1992, 1999; Malschi *et al*., 2003; Manolache *et al*., 1963; Popv & Bărbulescu, 2007; Bărbulescu, 2001; Bărbulescu *et al*., 1999; Săpunaru, 1992). Identification of Homoptera, Heteroptera and Coleoptera Tizanopterelor was made based on the papers signed by Knechtel (1951), Bei-Bienko (1964), Choppin de Janvry & Leclant (1979), Gîdei & Popescu (2012). Statistical calculation was performed based on the work developed by Zamfirescu & Zamfirescu (2008).

Material and Methods

The entomological material collections were made with entomological net from the upper part of the rye threads, during April-July 2014, in 5 villages from Northern part of Moldova - 4 villages from Suceava County (Rădăuți, Horodnic de Jos, Marginea and Poieni-Solca) and one village from Botosani County (Mihăileni). In April and July there was made a single sampling for each month and in May and June, two sampling for each month. The collections were made within 14 days, for each village 50 mowings from the outer part of the rye crop and another 50 mowings from the inner side of it. The material was preserved in ethylic alcohol 80%. The constancy of the species, the dominance and the index of ecological significance are calculated with the mathematical formulaes:

$C_A = n_pA/N_p.100$;

$D_A = nA/N.100$;

$W_A = C_A.D_A/100$;

C_A= the constancy of the species; D_A = the dominance of the species; W_A = index of ecological significance

n_pA = number of samples where can be found species A; N_p = total number of samples;

nA – total number of individuals from species A; N = total number of individuals from all species.

Results and Discussion

From the rye crop, there were collected 6419 samples of phytophagus insects and there were identified 65 taxons from orders: Orthoptera, Hemiptera – Subord. Heteroptera and Subord. Homoptera, Thysanoptera, Diptera, Hymenoptera and Coleoptera. The specific diversity with the highest value was found at the order Coleoptera (36 taxons) and the lowest value at Orthoptera (one taxon) (Table 1).

From the specific pests of straw cereals in Romania, in the investigated culture there were identified the following taxons: *Eurygaster maura, E. integriceps, Aelia acuminata, Sitobion avenae, Schizaphis graminum, Cicadella viridis, Limothrips denticornis, L. angulicornis, Chirothrips manicatus, Frankliniella pallida, Haplothrips aculeatus*, Chloropidae and *Cephus* sp..

In what insects are concerned, Thysanoptera were dominant in Rădăuți and Mihăileni (43.54% of total individuals from harmful entomofauna in Rădăuți and 44.82% in Mihăileni), Hemiptera were dominant in the rye crop from Marginea and Poieni-Solca (40.06% from the total individuals in Marginea and 35.72% in the rye crop Poieni-Solca) and Diptera were dominant in the rye crop from Horodnic de Jos (Tables 2-6).

In all localities, among Thysanopera, the most samples belonged to *Haplothrips aculeatus* species, which owned 69.15% from all the Thysanoptera in the rye culture from Rădăuți and 91.66% in Mihăileni (Tables 2-6).

In all localities, among Hemiptera, dominant were Homoptera and from them *Sitobion avenae* species owned 44.46% from the total Hemiptera individuals in the culture from Marginea. The percentage for the culture from Rădăuți was 62.72. Among Diptera, Chloropidae were dominant in all localities (Tables 2-6).

Table 1. Diversity of harmful entomofauna in the rye crop from the Northern part of Moldova.

No	TAXON	Locality				
		RĂDĂUȚI (SV)	HORODNIC DE JOS (SV)	MARGINEA (SV)	POIENI SOLCA (SV)	MIHĂILENI (BT)
1.	**ORD. ORTHOPTERA**					
	Subord. Caelifera					
	Acrididae	-	-	+	-	-
2.	**ORD.HEMIPTERA**					
	Subord. HETEROPTERA					
	Fam. Cydnidae					
	Sehirus bicolor (Linné)	-	-	-	+	-
3.	*Piezodorus lituratus* (Fabricius)	-	+	-	+	-
	Fam. Scutelleridae					
4.	*Eurygaster maura* (Linné)	+	+	+	+	+
5.	*Eurygaster integriceps* (Schr.)	-	+	-	-	-
	Fam. Pentatomidae					
6.	*Aelia acuminata* (Linné)	+	-	+	+	+
7.	*Dolycoris baccarum* (Linné)	+	-	-	-	-
	Fam. Coreidae					
8.	*Syromastes rhombeus* (Linné)	-	-	+	-	-
9.	Miridae	+	+	+	+	-
	Subord. HOMOPTERA					
	Seria Sternorrhyncha					
	Fam. Aphididae					
10.	*Schizaphis graminum* Rond.	-	-	+	+	+
11.	*Sitobion avenae* F.	+	+	+	+	+
12.	Psyllidae	+	-	-	+	+
	Seria Auchenorrhyncha					
	Fam. Cercopidae					
13.	*Cercopis vulnerata* Rossi	-	-	-	+	-
14.	Cicadidae	-	+	+	-	+
	Fam. Cicadellidae					
15.	*Cicadella viridis* (Linné)	+	+	+	+	+
16.	Cicadellidae	+	+	+	+	+
	ORD. THYSANOPTERA					
	Fam. Aeolothripidae					
	Fam. Thripidae					
17.	*Limothrips denticornis* Haliday	+	+	+	+	+
18.	*Limothrips angulicornis* Jablonowski	+	+	-	+	+
19.	*Chirothrips manicatus* Haliday	+	+	+	+	-
20.	*Frankliniella pallida* Uzel					
	Fam. Phloeothripidae					
21.	*Haplothrips aculeatus* Fabricius	+	+	+	+	+
	ORD. DIPTERA					
	Subord. NEMATOCERA					
22.	Tipulidae	+	-	-	-	+
23.	Cecidomyiidae	+	-	-	+	+
	Subord. BRACHYCERA					
24.	Tephritidae	-	+	-	+	+
25.	Chloropidae	+	+	+	+	+
26.	Agromyzidae	+	-	-	-	-

No	TAXON	Locality				
		RĂ-DĂUȚI (SV)	HORODNIC DE JOS (SV)	MAR-GINEA (SV)	POIENI SOLCA (SV)	MIHĂILENI (BT)
	ORD. HYMENOPTERA					
	Subord. SYMPHITA					
27.	Tenthredinidae	+	-	-	-	-
28.	Cephidae	-	-	-	-	+
29.	*Cephus sp.*	-	-	-	+	-
	ORD. COLEOPTERA					
	Subord. Adephaga					
	Fam. Carabidae					
30.	*Amara familiaris* Duft.	-	+	-	+	-
	Fam. Scarabaeidae					
31.	*Amphimallon solstitialis* Linné	-	-	+	-	-
	Fam. Elateridae					
32.	*Elater elongatulus* F.	-	-	+	-	-
33.	*Corymbites affinis*	-	-	+	-	-
34.	*Athous hirtus* Hbst.	-	-	+	-	-
35.	*Athous haemorrhoidalis* F.	-	-	-	-	+
36.	*Agriotes lineatus* L.	-	+	-	-	-
37.	*Sericus brunneus* L.	-	+	-	-	-
38.	*Lacon murinus*	-	-	+	-	+
39.	Elateridae	-	+	-	-	-
	Fam. Chrysomelidae					
40.	*Meligethes* sp.	+	-	-	+	-
41.	*Lema melanopa* (Linné)	-	+	-	+	-
42.	*Lema erichsoni* Sffr.	+	-	-	-	-
43.	*Phyllotreta atra* Fabricius	+	+	+	+	+
44.	*Phyllotreta nemorum* (Linné)	+	+	+	+	+
45.	*Phyllotreta undulata* (Kutsch.)	-	-	-	+	-
46.	*Phyllotreta christianae*	+	+	-	-	+
47.	*Phyllotreta paralella*	-	-	-	-	+
48.	*Podagrica malvae* Ill.	+	-	-	-	-
49.	*Cassida viridis*	-	-	-	-	+
50.	*Longitarsus ballotae* Marsh.	+	-	-	+	-
51.	Altica *sp.*	+	-	+	+	-
52.	Crepidodera *sp.*	+	-	-	-	-
53.	*Aphtona nigriceps*	-	+	-	-	-
54.	*Chaetocnema tibialis* Ill.	+	-	-	+	+
55.	*Chaetocnema hortensis*	-	+	-	-	-
56.	*Chaetocnema concinna* Marsh.	-	-	-	+	-
57.	*Chaetocnema semicoerulea* Koch.	-	-	-	-	+
58.	Epithrix sp.	-	-	-	-	+
59.	Dibolia sp.	+	+	-	-	-
	Fam. Nitidulidae					
	Fam. Curculionidae					
60.	*Apion apricans* (Herbst)	+	+	+	+	+
61.	*Apion seniculus* Kirby	+	-	-	-	-
62.	*Chlorophanus viridis* L.	-	-	-	-	+
63.	*Eusomus ovulum* Germ.	-	-	-	+	-
64.	*Cleonus piger* Scop.	-	-	+	-	-
65.	Curculionidae	+	+	+	+	+

Table 2. Abundance (A) and dominance (D) of phytophagus entomofauna in the rye crop from Rădăuți, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
	HEMIPTERA	**51**	**147**	**175**	**6**	**8**	**10**	**397**	**32.92**
	HETEROPTERA	20	2	4		2	4	32	2.66
1	*Eurygaster maura*	2	2			1	1	6	0.50
2	*Aelia acuminata*			1				1	0.09
3	*Dolycoris baccarum*					1		1	0.09
4	Miridae	18		3			3	24	1.99
	HOMOPTERA	31	145	171	6	6	6	365	30.27
5	*Sitobion avenae*	16	99	126	5	2	1	249	20.65
6	*Schizaphis graminum*	6	20	41	1	2		70	5.81
7	Psyllidae			1				1	0.09
8	Cicadidae		3			1	2	6	0.49
9	*Cicadella viridis*	4	4				1	9	0.75
10	Cicadellidae	5	19	3		1	2	30	2.49
	THYSANOPTERA	**20**	**155**	**249**	**96**	**3**	**2**	**525**	**43.54**
11	*Haplothrips aculeatus*	19	118	153	69	3	1	363	30.10
12	*Limothrips denticornis*	1	27	77	26		1	132	10.95
13	*L. angulicornis*		1					1	0.09
14	*Chirothrips manicatus*			2	1			3	0.25
15	*Frankliniella pallida*		9	17				26	2.16
	DIPTERA		**84**	**82**	**1**	**25**	**2**	**194**	**16.09**
16	Tipulidae			1			1	2	0.17
17	Cecidomyiidae			49				49	4.06
18	Chloropidae		84	32	1	24		141	11.70
19	Agromyzidae					1	1	2	0.17
	HYMENOPTERA		**2**		**1**			**3**	**0.25**
20	Tenthredinidae		2		1			3	0.25
	COLEOPTERA	**43**	**25**	**4**		**9**	**6**	**87**	**7.22**
21	*Phyllotreta atra*	8	4				1	13	1.08
22	*Ph. nemorum*	3	2	1				6	0.50
23	*Ph. christianae*		1					1	0.09
24	*Lema melanopa*	11		2				13	1.08
25	*L. erichsoni*		2					2	0.17
26	*Altica* sp.	5	3			1		9	0.75
27	Meligethes					4		4	0.34
28	*Podagrica malvae*	3					1	4	0.34
29	*Longitarsus ballotae*	3	1				1	5	0.42
30	*Crepidodera* sp.	1					1	2	0.17
31	*Chaetocnema tibialis*		3				2	5	0.42
32	*Dibolia* sp.		1			2		3	0.25
33	*Apion seniculus*		1					1	0.09
34	*Apion apricans*	4						4	0.34
35	Curculionidae	5	7	1		2		15	1.25
Total		**114**	**413**	**510**	**104**	**45**	**20**	**1206**	

Table 3. Abundance (A) and dominance (D) of phytophagus entomofauna in the rye crop from Horodnic de Jos, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
	HEMIPTERA	**41**	**75**	**84**	**104**	**41**	**4**	**349**	**34.15**
	HETEROPTERA	8		2	2			12	1.18
1	*Eurygaster maura*	3		1				4	0.40
2	*E. integriceps*				2			2	0.20
3	*Piezodorus lituratus*			1				1	0.10
4	Miridae	5						5	0.49
	HOMOPTERA	33	75	82	102	41	4	337	32.98
5	*Sitobion avenae*	18	40	39	56	29	1	183	17.91
6	*Schizaphis graminum*	9	15	41	43	7	1	116	11.35
7	*Cicadella viridis*		1					1	0.10
8	Cicadellidae	6	19	2	3	5	2	37	3.62
	THYSANOPTERA	**12**	**76**	**128**	**33**	**36**	**2**	**287**	**28.09**
9	*Haplothrips aculeatus*	11	67	92	17	28		215	21.04
10	*Limothrips denticornis*	1	7	32	11	6	2	59	5.78
11	*L. angulicornis*		1		1			2	0.20
12	*Chirothrips manicatus*			2		1		3	0.30
13	*Frankliniella pallida*		1	2	4	1		8	0.79
	DIPTERA	**87**	**93**	**28**	**36**	**108**	**2**	**354**	**34.64**
14	Tephritidae					2		2	0.20
15	Chloropidae	87	93	28	36	106	2	352	34.45
	COLEOPTERA	**4**	**19**	**3**	**2**	**1**	**3**	**32**	**3.14**
16	*Amara familiaris*		1					2	0.20
17	*Agriotes lineatus*		1					1	0.10
18	*Sericus brunneus*		1					1	0.10
19	Elateridae		2	1				3	0.30
20	*Phyllotreta atra*	1	1			1	1	4	0.40
21	*Ph. nemorum*		2				1	3	0.30
22	*Ph. christianae*						1	1	0.10
23	*Chaetocnema hortensis*	1	2					3	0.30
24	*Aphtona nigriceps*	2	4					6	0.59
25	*Dibolia* sp.			1				1	0.10
26	*Apion apricans*		3					3	0.30
27	Curculionidae		2	1	1			4	0.40
Total		**144**	**263**	**243**	**175**	**186**	**11**	**1022**	

Table 4. Abundance (A) and dominance (D) of phytophagus entomofauna in the rye crop from Marginea, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		18 April	12 May	26 May	12 June	28 June	11 July	A	D
	ORTHOPTERA					**1**		**1**	**0.15**
1	Acrididae					1		1	0.15
	HEMIPTERA	**31**	**73**	**92**	**7**	**62**	**5**	**270**	**40.06**
	HETEROPTERA	13	1	4	2	29	1	50	7.42
2	*Eurygaster maura*	4	1	4		1	1	11	1.64
3	*Aelia acuminata*	1			1			2	0.30
4	*Syromastes rhombeus*				1			1	0.15
5	Miridae	8				28		36	5.35
	HOMOPTERA	18	72	88	5	33	4	220	32.64
6	*Sitobion avenae*	15	37	61	1	6		120	17.81
7	*Schizaphis graminum*	3	31	27	3	23	1	88	13.06
8	Cicadidae				1		1	2	0.30
9	*Cicadella viridis*		1			1		2	0.30
10	Cicadellidae		3			3	2	8	1.19
	THYSANOPTERA	**10**	**67**	**117**	**13**	**21**	**3**	**231**	**34.28**
11	*Haplothrips aculeatus*	8	53	83	11	13	3	171	25.37
12	*Limothrips denticornis*	2	11	26	2	3		44	6.53
13	*Chirothrips manicatus*			2				2	0.30
14	*Frankliniella pallida*		3	6		5		14	2.08
	DIPTERA		**2**	**61**	**26**	**58**	**1**	**148**	**21.96**
15	Chloropidae		2	61	26	58	1	148	21.96
	COLEOPTERA	**4**	**3**	**6**		**9**	**2**	**24**	**3.56**
16	*Amphimalon solstitialis*					1		1	0.15
17	*Lacon murinus*		1					1	0.15
18	*Elater elongatulus*			1				1	0.15
19	*Corymbites affinis*			1				1	0.15
20	*Athous hirtus*			1				1	0.15
21	*Phyllotreta atra*	1		1		2		4	0.60
22	*Ph. nemorum*					1	1	2	0.30
23	*Lema melanopa*	1	2	1			1	5	0.75
24	*Altica* sp.					2		2	0.30
25	*Cleonus piger*			1				1	0.15
26	*Apion apricans*	2				1		3	0.45
27	Curculionidae					2		2	0.30
Total		**45**	**145**	**276**	**46**	**151**	**11**	**674**	

Table 5. Abundance (A) and dominance (D) of phytophagus entomofauna in the rye crop from Poieni-Solca, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		19 April	13 May	27 May	11 June	27 June	14 July	A	D
	HEMIPTERA	**14**	**53**	**426**	**118**	**42**	**11**	**664**	**35.72**
	HETEROPTERA	7	4	25	6	6	2	50	2.69
1	*Eurygaster maura*	3		3	2			8	0.43
2	*Aelia acuminata*	1	2	6	3			12	0.65
3	*Sehirus bicolor*			1				1	0.06
4	*Piezodorus lituratus*		1					1	0.06
5	Miridae	3	1	15	1	6	2	28	1.51
	HOMOPTERA	7	49	401	112	36	9	614	33.03
6	*Sitobion avenae*	3	11	294	25	28	2	363	19.53
7	*Schizaphis graminum*	3	5	59	23	8	1	99	5.33
8	*Cercopis vulnerata*	1	3	2	4			10	0.54
9	*Cicadella viridis*		2	2			4	8	0.43
10	Cicadellidae		28	44	60		2	134	7.21
	THYSANOPTERA	**4**	**84**	**360**	**152**	**38**	**1**	**639**	**34.38**
11	*Haplothrips aculeatus*	3	46	271	127	29		476	25.61
12	*Limothrips denticornis*	1	29	73	22	6	1	132	7.10
13	*L. angulicornis*			1				1	0.06
14	*Chirothrips manicatus*			5				5	0.27
15	*Frankliniella pallida*		9	10	3	3		25	1.35
	DIPTERA	**16**	**203**	**190**		**69**	**8**	**486**	**26.15**
16	Cecidomyiidae					3		3	0.17
17	Tephritidae	1		2		2	3	8	0.43
18	Chloropidae	15	203	188		64	5	475	25.56
	HYMENOPTERA		**1**					**1**	**0.06**
19	*Cephus* sp.		1					1	0.06
	COLEOPTERA	**6**	**9**	**19**	**11**	**16**	**8**	**69**	**3.72**
20	*Amara familiaris*				1			1	0.06
21	*Phyllotreta atra*	2		1		1		4	0.22
22	*Ph. nemorum*		2	5	3	1		11	0.6
23	*Ph. undulata*			2		6		8	0.43
24	*Lema melanopa*	1			1		1	3	0.17
25	*Altica* sp.	1	2	5				8	0.43
26	Meligethes		2	2				4	0.22
27	*Longitarsus ballotae*					3		3	0.17
28	*Chaetocnema concinna*		1				4	5	0.27
29	*Chaetocnema tibialis*		1				2	3	0.17
30	*Apion apricans*	2		2	2	4	1	11	0.6
31	*Eusomus ovulum*			1				1	0.06
32	Curculionidae		1	1	4	1		7	0.38
Total		**40**	**350**	**995**	**281**	**165**	**28**	**1859**	

Table 6. Abundance (A) and dominance (D) of phytophagus entomofauna in the rye crop from Mihăileni, Botoşani County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		18 April	12 May	26 May	12 June	28 June	11 July	A	D
	HEMIPTERA	**8**	**76**	**214**	**138**	**6**	**10**	**452**	**27.27**
	HETEROPTERA	8	8	7	1		4	28	1.69
1	*Eurygaster maura*	2	1				1	4	0.25
2	*Aelia acuminata*	2	4					6	0.37
3	Miridae	4	3	7	1		3	18	1.09
	HOMOPTERA		68	207	137	6	6	424	25.58
4	*Sitobion avenae*		22	114	73	4	2	215	12.97
5	*Schizaphis graminum*		24	60	55	2	2	143	8.63
6	*Cicadella viridis*			3				3	0.18
7	Cicadellidae		22	30	9		2	63	3.80
	THYSANOPTERA	**9**	**55**	**642**	**23**	**5**	**9**	**743**	**44.82**
8	*Haplothrips aculeatus*	6	39	609	15	5	7	681	41.08
9	*Limothrips denticornis*	3	14	19	5		2	43	2.60
10	*L. angulicornis*			2				2	0.12
11	*Frankliniella pallida*		2	12	3			17	1.03
	DIPTERA	**12**	**313**	**73**	**6**		**8**	**412**	**24.85**
12	Tipulidae	1	1					2	0.12
13	Cecidomyiidae	2		13				15	0.91
14	Chloropidae	9	312	57	6		6	390	23.53
15	Tephritidae			3			2	5	0.31
	HYMENOPTERA			**2**				**2**	**0.12**
16	Cephidae			2				2	0.12
	COLEOPTERA	**11**	**14**	**10**	**3**	**5**	**6**	**49**	**2.96**
17	*Amara familiaris*			1				1	0.06
18	*Lacon murinus*	1	1					2	0.12
19	*Athous haemorrhoidalis*		2					2	0.12
20	*Phyllotreta atra*	4	2		1		3	10	0.61
21	*Ph. nemorum*	2	3	1			1	7	0.43
22	*Ph. paralella*					1		1	0.06
23	*Ph. christianae*		2					2	0.12
24	*Cassida viridis*					1		1	0.06
25	*Chaetocnema tibialis*	4	1				1	6	0.37
26	*Chaetocnema semicoeruleus*			1				1	0.06
27	*Epithrix* sp.			2				2	0.12
28	*Apion apricans*		1	2	1		1	5	0.31
29	*Chlorophanus viridis*		1					1	0.06
30	Curculionidae		1	3	1	3		8	0.49
Total		**40**	**458**	**941**	**170**	**16**	**33**	**1658**	

The applied statistical calculation of harmful entomofauna specific to straw cereals in Romania which was identified in the investigated rye culture from the Northern part of Moldova shows that taxons *Haplothrips aculeatus*, Chloropidae, *Sitobion avenae*, *Schizaphis graminum* and *Limothrips denticornis* are euconstat, constant, eudominant and dominant, characteristic to this type of agroecosystem and best adapted to its ecological factors. The rest of the taxons are accessories and accidental (Table 7).

Table 7. Abundance (A), constance (C), dominance (D) and ecological significance index (W) of harmful insects, specific to Romanian straw cereals identified in the rye crop from the Northern part of Moldova, 2014.

No.	Species	A	C		D		W	
			%	Cls.	%	Cls.	%	Cls.
1	*Haplothrips aculeatus*	1906	96.67	C_4	33.68	D_5	32.56	W_5
2	Chloropidae	1506	83.34	C_4	26.62	D_5	22.19	W_5
3	*Sitobion avenae*	1130	93.34	C_4	19.97	D_5	18.64	W_5
4	*Schizaphis graminum*	516	93.34	C_4	9.12	D_4	8.51	W_4
5	*Limothrips denticornis*	410	80.00	C_4	7.25	D_4	5.80	W_4
6	*Frankliniella pallida*	90	53.34	C_3	1.59	D_2	0.85	W_2
7	*Eurygaster maura*	33	53.34	C_3	0.59	D_1	0.31	W_2
8	*Cicadella viridis*	23	30.10	C_2	0.41	D_1	0.12	W_2
9	*Aelia acuminata*	21	30.10	C_2	0.38	D_1	0.11	W_2
10	*Chirothrips manicatus*	13	20.00	C_1	0.23	D_1	0.05	W_1
11	*Limothrips angulicornis*	6	20.00	C_1	0.11	D_1	0.02	W_1
12	*Cephus* sp.	3	3.34	C_1	0.06	D_1	0.02	W_1
13	*Eurygaster integriceps*	2	3.34	C_1	0.04	D_1	0.01	W_1
TOTAL		**5659**	-	-	-	-	-	-

Conclusions

In the rye crops, from 5 villages (Rădăuți, Horodnic de Jos, Marginea, Poieni-Solca, Mihăileni) there were collected 6419 samples of phytophagus insects and there were identified 65 taxons from orders: Orthoptera, Hemiptera – Subord. Heteroptera and Subord. Homoptera, Thysanoptera, Diptera, Hymenoptera and Coleoptera.

From the specific pests of straw cereals in Romania, in the investigated culture there were identified the following taxons: *Eurygaster maura, E. integriceps, Aelia acuminata, Sitobion avenae, Schizaphis graminum, Cicadella viridis, Limothrips denticornis, L. angulicornis, Chirothrips manicatus, Frankliniella pallida, Haplothrips aculeatus*, Chloropidae and *Cephus* sp.

The taxons *Haplothrips aculeatus*, Chloropidae, *Sitobion avenae, Schizaphis graminum* and *Limothrips denticornis* are euconstat, constant, eudominant and dominant, characteristic to this type of agroecosystem and best adapted to its ecological factors.

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USEFUL ENTOMOFAUNA FROM RYE CROP IN THE NORTHERN PART OF MOLDOVA

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Abstract. Material collections and observations were made in the rye culture from 5 localities, 4 of them from Suceava County (Rădăuți, Horodnic de Jos, Marginea and Poieni-Solca) and one from Botoșani (Mihăileni). These collections were made using entomological net during April-July 2014. One with another, there were collected 1609 samples of useful insects and there were identified 69 taxons in orders Odonata, Dermaptera, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera. The widest diversity was presented by the order Hymenoptera (37 taxons) followed by the order Coleoptera. Considering the number of useful insects, in all localities the dominance was represented by Hymenopteres. According to the targeted area, there was a relevant number of Thysanoptera and Coleoptera.

Keywords: rye crop, auxiliary entomofauna, abundance, dominance.

Rezumat. Entomofauna utilă din cultura de secară din zona de nord a Moldovei. Colectările de material și observațiile s-au făcut în cultura de secară din 5 localități, 4 localități din jud. Suceava (Rădăuți, Horodnic de Jos, Marginea și Poieni-Solca) și o localitate din jud. Botoșani (Mihăileni). Colectările s-au făcut cu ajutorul fileului entomologic în perioada aprilie – iulie 2014. În total, s-au colectat 1609 exemplare de insecte utile și s-au identificat 69 de taxoni din ordinele Odonata, Dermaptera, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera și Coleoptera. Diversitatea cea mai amplă a prezentat-o ordinul Hymenoptera (37 de taxoni) urmat de ordinul Coleoptera. La nivel de ordin de insecte utile, în toate localitățile dominante au fost Himenopterele, urmate, în funcție de localitate de Tizanoptere și Coleoptere.

Cuvinte cheie: cultura de secară, entomofauna auxiliară, abundență, dominanță.

Introduction

In any kind of agroecosistem, with the number of pests that cause damage, certain organisms install themselves and are designed to limit the destructive action of pests. Among these, predator and parasitoid insects have a relevant importance in protection of plants and environment. Together they form the so-called auxiliary entomofauna. In Romania, research on auxiliary entomofauna in cereal cultures were done systematically and consistently in various agricultural research units, just for wheat, barley, oats and triticale cultures. In some papers, some authors mention various auxiliary entomofauna groups for rye culture (Baniță *et al*., 1997, 1999; Malschi & Mustea, 1993, 1995, 1997, 1998, 1999; Popov *et al*., 2007; Voicu *et al*., 1993).

Material and Methods

Observations and entomological material collections were made during April- July 2014. The collections were made using entomological net from the plants in the 5 regions from the Northern part of Moldova – 4 localities from Suceava County (Rădăuți, Horodnic de Jos, Marginea and Poieni-Solca) and one from Botoșani County (Mihăileni). In April and July there was made a single sampling for each month and in May and June, two

sampling for each month. The collections were made within 14 days, 100 mowings with entomological net per each sampling, for each village 50 mowings from the outer part of the rye culture and another 50 mowings from the inner side of it.

Results

From the investigated rye culture from all of the 5 localities there were collected assembled 1609 insects and were identified 69 taxons of useful insects which belong to orders: Odonata, Dermaptera, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera (Table1). The highest value of specific diversity was presented by the order Hymenoptera (37 taxons), followed by Coleoptera (18 taxons) and the lowest value was represented by the orders Odonata, Dermaptera, Thysanoptera and Neuroptera, (one species for each order). Most of Hymenoptera taxons belong to Eulophidae family. From the order Coleoptera, Coccinellidae family presented the highest value of specific diversity (Table 1).

Table 1. Diversity of auxiliary entomofauna in the rye crop from the Northern part of Moldova.

No.	TAXON	LOCALITY				
		RĂ-DĂUȚI (SV)	HO-RODNIC DE JOS (SV)	MAR-GINEA (SV)	POIENI SOLCA (SV)	MI-HĂILENI (BT)
1	**ORD. ODONATA**					
	Subord. ZYGOPTERA					
	Fam. Coenagrionidae					
	Coenagrion puella (Linné)	+	-	-	-	-
2	**ORD. DERMAPTERA**					
	Fam. Forficulidae					
	Forficula auricularia (Linné)	-	-	-	+	-
	ORD.HEMIPTERA					
	Fam. Pyrrhocoridae					
3	*Pyrrhocoris apterus* (Linné)	+	-	-	-	-
4	Nabidae	+	+	+	+	+
	Fam. Anthocoridae					
5	*Orius niger* (Wolff.)	+	+	+	+	+
	ORD. THYSANOPTERA					
	Fam. Aeolothripidae					
6	*Aeolothrips intermedius* Bagnall	+	+	+	+	+
7	**ORD. NEUROPTERA**					
	Fam. Chrysopidae					
	Chrysopa carnea (Stephens)	+	+	-	+	+
	ORD. DIPTERA					
8	Syrphidae	+	+	-	+	+
9	Asilidae	+	-	+	+	-
10	Dolichopodidae	-	+	+	+	+
11	Micropezidae	+	-	-	-	+
12	Tachinidae	+	-	-	-	-
13	Sarcophagidae	+	+	-	+	-
14	Anthomyiidae	+	+	+	+	+
	ORD. HYMENOPTERA					
	Subord. APOCRITA					
15	Ichneumonidae	+	+	+	+	+

No.	TAXON	LOCALITY				
		RĂ-DĂUȚI (SV)	HO-RODNIC DE JOS (SV)	MAR-GINEA (SV)	POIENI SOLCA (SV)	MI-HĂILENI (BT)
16	Braconidae	+	+	+	+	+
	Fam. Aphidiidae					
17	*Tryoxis brevicornis* Hal.	+	+	+	+	+
18	Gasteruptiidae	+	-	-	-	-
19	Cynipidae	+	+	+	+	+
	Fam. Pteromalidae					
	Subfam. Asaphinae					
20	*Asaphes* sp.	-	+	+	+	+
	Subfam. Miscogasterinae					
	Trib Sphegigasterini					
21	*Cyrtogaster* sp.	+	-	-	-	-
	Trib Miscogasterini					
22	*Thinodytes cyzicus* Walker	-	-	+	-	-
	Trib Ormocerini					
23	*Gastrancistrus* sp.	-	-	-	+	-
	Subfam. Pteromalinae					
24	Pteromalinae	+	+	-	+	-
25	*Callitula* sp.	+	+	-	-	+
26	*Pachyneuron* sp.	+	+	-	+	+
27	*Trichomalus* sp.	+	-	-	-	-
28	*Merisus* sp.	-	-	-	-	+
29	*Mesopolobus* sp.	+	+	+	+	+
30	*Pteromalus* sp.	+	-	+	+	-
31	Fam. Encyrtidae	-	+	-	+	-
32	Eulophidae	+	+	+	+	+
	Fam. Aphelinidae					
33	*Aphelinus* sp.	-	-	-	+	+
	Fam. Mymaridae					
34	Polynema sp.	-	+	+	+	-
35	*Anagrus sp.*	-	-	-	-	+
36	Diapriidae	+	+	-	+	+
37	Scelionidae	+	+	+	+	+
38	*Trissolcus* sp.	-	+	-	+	+
39	*Telenomus* sp.	-	+	-	+	+
40	*Trimorus* sp.	+	-	-	-	-
41	Platygastridae	-	+	-	-	-
42	*Inostemma* sp.	+	+	+	+	-
43	*Synopeas* sp.	+	+	+	+	+
44	*Leptacis* sp.	-	-	+	-	-
45	*Platygaster* sp.	+	+	+	+	+
46	Proctotrupidae	-	-	+	-	-
47	Ceraphronidae	-	-	-	+	-
48	Megaspilidae	+	+	+	+	+
	Fam. Formicidae					
49	*Formica rufa* Linné	-	-	-	+	-
50	Formicidae	+	+	+	+	+
51	Cimbicidae	-	-	+	-	-
	ORD. COLEOPTERA					
	Subord. Polyphaga					
	Fam. Staphylinidae					

No.	TAXON	LOCALITY				
		RĂDĂUȚI (SV)	HORODNIC DE JOS (SV)	MARGINEA (SV)	POIENI SOLCA (SV)	MIHĂILENI (BT)
52	*Tachyporus* sp.	+	+	+	-	-
	Fam. Cantharidae					
53	*Cantharis rustica* Fallen	+	+	+	+	-
54	*C. livida* Linné	+	-	-	-	-
55	*C. annularis* Men.	-	-	+	-	-
	Fam. Melyridae					
56	*Malachius bipustulatus* (Linné)	+	-	+	+	-
57	*M. aeneus* (Linné)	-	-	-	+	-
58	*Dolichosoma lineare* Rossi	-	+	+	+	+
	Fam. Coccinellidae					
59	*Coccinella 7-punctata* (Linné)	+	+	+	+	+
60	*C. undecimpunctata* (Linné)					
61	*C. 14-punctata* (Linné)	-	-	-	-	+
62	*Adonia variegata* (Goeze)	-	+	+	+	+
63	*Adalia bipunctata* (Linné)	+	-	-	+	+
64	*Hippodamia tredecimpunctata* (Deg)	+	-	-	+	-
65	*Propylea 14-punctata* (Linné)	-	+	+	+	+
66	*Anatis ocellata* (Linne)	-	-	-	-	+
67	*Thea virgintiduopunctata* (Linné)	+	-	-	-	-
68	Cleridae	+	-	-	-	-
69	Histeridae	+	-	-	-	-

In 6 collections from the rye crop from Rădăuți there were analysed 379 useful insects and there were identified 49 taxons from orders Odonata, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera. In what quality is concerned, Hymenoptera presented the highest value of abundance (201 samples of useful insects) owning 53.04% from the total amount of auxiliary insects, followed by Thysanoptera (30.61%) and Coleoptera (8.18%), (Table 2).

Table 2. The abundance (A) and dominance (D) of entomofauna useful in the rye crop from Rădăuți, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
	ODONATA			**1**				**1**	**0.27**
1	*Coenagrion puella*			1				1	0.27
	HEMIPTERA	4	1	2	1		2	10	2.64
	HETEROPTERA	**4**	**1**	**2**	**1**		**2**	**10**	**2.64**
2	Nabidae	3	1					4	1.07
3	*Pyrrhocoris apterus*	1					1	2	0.53
4	*Orius niger*			2	1		1	4	1.07
	THYSANOPTERA	**1**	**28**	**77**	**8**		**2**	**116**	**30.61**
5	*Aeolothrips intermedius*	1	28	77	8		2	116	30.61
	NEUROPTERA	**4**						**4**	**1.07**

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
6	*Chrysopa carnea*	4						4	1.07
	DIPTERA		**4**	**2**	**1**	**4**	**3**	**14**	**3.70**
7	Syrphidae		2			1	2	5	1.33
8	Asilidae			1	1		1	3	0.8
9	Micropezidae			1				1	0.27
10	Tachinidae		1					1	0.27
11	Sarcophagidae					2		2	0.53
12	Anthomyiidae		1			1		2	0.53
	HYMENOPTERA	**17**	**43**	**125**	**1**	**1**	**14**	**201**	**53.04**
13	Ichneumonidae		5	1				6	1.6
14	Braconidae		3				1	4	1.07
15	*Tryoxis brevicornis*	1	4				2	7	1.86
16	Gasteruptiidae		1					1	0.27
17	Cynipidae		1	8				9	2.39
18	*Trichomalus* sp.						1	1	0.27
19	*Pteromalus* sp.		2				1	3	0.8
20	*Mesopolobus* sp.	2	1	2		1	2	8	2.13
21	*Cyrtogaster* sp.	1						1	0.27
22	*Callitula* sp.	1						1	0.27
23	Pteromalinae	1						1	0.27
24	*Pachyneuron* sp.		1					1	0.27
25	Eulophidae		18	108	1		4	131	34.57
26	Diapriidae	6		1				7	1.86
27	*Trimorus* sp.	1	1				1	3	0.8
28	*Platygaster* sp.		1	2			2	5	1.33
29	*Inostemma* sp.			1				1	0.27
30	*Synopeas* sp.		2					2	0.53
31	Ceraphronidae		2					2	0.53
32	Megaspilidae	2		2				4	1.07
33	Formicidae	2	1					3	0.8
	COLEOPTERA	**7**	**10**	**7**	**1**	**4**	**2**	**31**	**8.18**
34	*Tachyporus* sp.		2	1				3	0.8
35	Cleridae					1		1	0.27
36	Histeridae					1		1	0.27
37	*Cantharis rustica*		1				1	2	0.53
38	*C. livida*		1					1	0.27
39	*Malachius bipustulatus*			2				2	0.53
40	*Dolichosoma lineare*		1					1	0.27
41	*Coccinella 7 - punctata*	5	2	2	1	1	1	12	3.17
42	*Coccinella 11 - punctata*	1						1	0.27
43	*Adalia bipunctata*		1					1	0.27
44	*Hippodamia 13 - punctata*		1					1	0.27
45	*Adonia variegata*	1						1	0.27
46	*Thea 22 - punctata*			1				1	0.27
47	*Propylea 14 - punctata*		1	1		1		3	0.8
48	Cleridae						1	1	0.27
49	Histeridae						1	1	0.27
	TOTAL	**33**	**86**	**214**	**12**	**11**	**23**	**379**	

Among Hymenoptera, Eulofidae were dominant owning 65.18% from the total individuals while the rest of the taxons were represented by few individuals. Thysanoptera was represented by a single species (*Aeolothrips intermedius* – predator of thrips and aphids) and from the dominant Coleoptera, Coccinellidae owned 64.52% from the total sum of Coleoptera individuals (Table 2).

From Horodnic de Jos rye's culture, there were collected and analysed 243 samples of useful insects and there were identified 38 taxons from the orders Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera. Hymenoptera was dominant, owning 48.98% individuals from the total sum of useful insects, followed by Thysanoptera (18.11%) and Diptera (15.64%) (Table 3).

Table 3. Abundance (A) and dominance (D) of entomofauna useful in the rye crop from Horodnic de Jos, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
	HEMIPTERA	1	1	1	2	11	2	18	7.41
	HETEROPTERA	**1**	**1**	**1**	**2**	**11**	**2**	**18**	**7.41**
1	Nabidae	1	1			11	1	14	5.77
2	*Orius niger*			1	2		1	4	1.65
	THYSANOPTERA	**2**	**10**	**11**	**16**	**3**	**2**	**44**	**18.11**
3	*Aeolothrips intermedius*	2	10	11	16	3	2	44	18.11
	NEUROPTERA	**1**				**1**	**1**	**3**	**1.24**
4	*Chrysopa carnea*	1				1	1	3	1.24
	DIPTERA		**2**	**2**	**4**	**22**	**8**	**38**	**15.64**
5	Syrphidae				3	11	2	16	6.59
6	Dolichopodidae		1				2	3	1.24
7	Sarcophagidae		1			2		3	1.24
8	Anthomyiidae			1		9	4	14	5.77
9	Anthocoridae			1	1			2	0.83
	HYMENOPTERA	**15**	**11**	**19**	**31**	**27**	**15**	**119**	**48.98**
10	Ichneumonidae	1		1	1		2	5	2.06
11	Braconidae		1			1		2	0.83
12	*Tryoxis brevicornis*		2			4	3	9	3.71
13	Cynipidae	4	2	4				10	4.12
14	Pteromalinae	1						1	0.42
15	*Mesopolobus* sp.	3		1	17	4	2	27	11.12
16	*Pachyneuron* sp.			1	1			2	0.83
17	*Callitula* sp.				2	4		6	2.47
18	*Asaphes* sp.				1		1	2	0.83
19	Encyrtidae					1		1	0.42
20	Eulophidae	5	3	10	2	4	4	28	11.53
21	*Polynema* sp.		1					1	0.42
22	Diapriidae				1	1		2	0.83
23	Scelionidae		1		1			2	0.83
24	*Trissolcus* sp.			1				1	0.42
25	*Telenomus* sp.					1		1	0.42
26	*Platygastridae*		1		2			3	1.24
27	*Platygaster* sp.			1		2	1	4	1.65
28	*Inostemma* sp.				1		1	2	0.83
29	*Synopeas* sp.				1	1	1	3	1.24

No.	Taxon	Collecting dates in 2014						Total	
		17 April	11 May	25 May	10 June	26 June	12 July	A	D
30	Ceraphronidae				1	1		2	0.83
31	Megaspilidae	1				2		3	1.24
32	Formicidae					1		1	0.42
	COLEOPTERA	**4**	**3**	**6**	**6**	**2**	**2**	**23**	**9.47**
33	*Tachyporus* sp.			1	2			3	1.24
34	*Cantharis rustica*	2				1	1	4	1.65
35	*Dolichosoma lineare*				2			2	0.83
36	*Coccinella 7 - punctata*	1	1	3	1	1		7	2.88
37	*Adonia variegata*		1	1			1	3	1.24
38	*Propylea 14 - punctata*	1	1	1	1			4	1.65
	TOTAL	**23**	**27**	**33**	**58**	**66**	**30**	**243**	

In the rye crop from Marginea, there were collected 228 samples of useful insects and were identified 33 taxons from orders Hemiptera, Thysanoptera, Diptera, Hymenoptera and Coleoptera. Hymenoptera was dominant owning 62.38% from the total useful insects followed by Coleoptera and Diptera (Table 4). Most individuals from Hymenoptera belong to Eulophidae which represented 30.34%; from Coleoptera, *Coccinella 7- punctata* was dominant representing 33.34% from the total individuals belonging to this order and from Diptera, Anthomyiidae was dominant (Table 4).

Table 4. Abundance (A) and dominance (D) of entomofauna useful in the rye crop from Marginea, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		18 April	12 May	26 May	12 June	28 June	11 July	A	D
	HEMIPTERA	1	1	1	2	2		7	3.07
	HETEROPTERA	**1**	**1**	**1**	**2**	**2**		**7**	**3.07**
1	Nabidae	1		1		2		4	1.76
2	*Orius niger*		1		2			3	1.32
	THYSANOPTERA		**5**	**4**	**2**	**3**	**2**	**16**	**7.02**
3	*Aeolothrips intermedius*		5	4	2	3	2	16	7.02
	DIPTERA	**2**	**5**	**14**		**8**		**29**	**12.72**
4	Asilidae	2				2		4	1.76
5	Dolichopodidae					2		2	0.88
6	Anthomyiidae		5	14		4		23	10.09
	HYMENOPTERA	**11**	**6**	**89**	**7**	**13**	**16**	**142**	**62.28**
7	Ichneumonidae	2		1				3	1.32
8	Braconidae	1	1					2	0.88
9	*Tryoxis brevicornis*				2	3	3	8	3.51
10	Cynipidae			7			3	10	4.39
11	*Mesopolobus* sp.	3	3	2		2		10	4.39
12	*Chlorocytus* sp.			2	1		1	4	1.76
13	*Thynodytes cyzicus*			1				1	0.44
14	*Asaphes* sp.	1						1	0.44
15	*Pteromalus* sp.				1			1	0.44
16	Eulophidae	1	1	38	1		2	43	18.86
17	*Polynema* sp.			1				1	0.44

No.	Taxon	Collecting dates in 2014						Total	
		18 April	12 May	26 May	12 June	28 June	11 July	A	D
18	Scelionidae	2		2	1	1		6	2.64
19	*Platygaster* sp.		1	28			2	31	13.6
20	*Synopeas* sp.					4	1	5	2.20
21	*Leptacis* sp.			1			1	2	0.88
22	*Inostemma* sp.			2			1	3	1.32
23	Proctotrupidae	1		4				5	2.20
24	Megaspilidae				1			1	0.44
25	Formicidae					2	2	4	1.76
26	Cimbicidae					1		1	0.44
	COLEOPTERA	**4**	**4**	**9**	**4**	**6**	**6**	**33**	**14.48**
27	*Tachyporus* sp.		1	1	1		1	4	1.76
28	*Cantharis rustica*	2		1		1	1	5	2.20
29	*Dolichosoma lineare*		1	1				2	0.88
30	*Malachius bipustulatus*			1		2	1	4	1.76
31	*Coccinella 7 - punctata*	1	2	2	1	3	2	11	4.83
32	*Adonia variegata*			1	1			2	0.88
33	*Propylea 14 - punctata*	1		2	1		1	5	2.20
	TOTAL	**18**	**21**	**117**	**15**	**33**	**24**	**228**	

In the rye crop from Poieni-Solca, during these 6 collections, there were gathered 402 samples of useful insects and were identified 41 taxons which belong: Dermaptera, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera. Hymenoptera was dominant owning 52.74% from the total useful insects, followed by Thysanoptera (30.35%) and Coleoptera (8.71%) (Table 5).

Table 5. Abundance (A) and dominance (D) of entomofauna useful in the rye culture from Poieni-Solca, Suceava County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		19 April	13 May	27 May	11 June	27 June	14 July	A	D
	DERMAPTERA					1		1	0.25
1	*Forficula auricularia*					1		1	0.25
	HEMIPTERA		1		5		1	7	1.75
	HETEROPTERA		**1**		**5**		**1**	**7**	**1.75**
2	Nabidae				3			3	0.75
3	*Orius niger*		1		2		1	4	1.00
	THYSANOPTERA	**2**	**28**	**60**	**23**	**4**	**5**	**122**	**30.35**
4	*Aeolothrips intermedius*	2	28	60	23	4	5	122	30.35
	NEUROPTERA	1					1	2	0.5
5	*Chrysopa carnea*	1					1	2	0.5
	DIPTERA			**2**		**14**	**3**	**19**	**4.73**
6	Syrphidae					5	2	7	1.75
7	Asilidae			1			1	2	0.5
8	Dolichopodidae			1		4		5	1.25
9	Sarcophagidae					1		1	0.75
10	Anthomyiidae					4		4	1.00
	HYMENOPTERA	**7**	**13**	**96**	**43**	**31**	**26**	**216**	**53.74**
11	Ichneumonidae	1	1		1	2		5	1.25

No.	Taxon	Collecting dates in 2014						Total	
		19 April	13 May	27 May	11 June	27 June	14 July	A	D
12	Braconidae	1		8	2	1		12	2.99
13	*Tryoxis brevicornis*		1	5	2		5	13	3.24
14	Cynipidae		2	23	11	1		37	9.21
15	Pteromalinae			1				1	0.25
16	*Mesopolobus* sp.		1	4	6	2	3	16	3.98
17	*Gastrancistrus* sp.			1		1		2	0.50
18	*Asaphes* sp.			1	2		1	4	1.00
19	*Pteromalus* sp.	1	1		2	3		7	1.75
20	*Pachyneuron* sp.				2		1	3	0.75
21	Encyrtidae					2		2	0.5
22	Eulophidae		3	35	7	6		51	12.69
23	*Aphelinus* sp.			1				1	0.25
24	*Polynema* sp.			1				1	0.25
25	Diapriidae			1				1	0.25
26	*Telenomus* sp.		2	5	5	4	3	19	4.73
27	*Trissolcus* sp.	2		2	1		2	7	1.75
28	*Platygaster* sp.			1			1	2	0.5
29	*Synopeas* sp.			1				1	0.25
30	*Inostemma* sp.			1			1	2	0.5
31	Ceraphronidae			1				1	0.25
32	Megaspilidae			1		2	2	5	1.25
33	*Formica rufa*					3		3	0.75
34	Formicidae	2	2	3	2	4	7	20	4.98
	COLEOPTERA	**8**	**2**	**14**	**5**	**4**	**2**	**35**	**8.71**
35	*Cantharis rustica*	1		1			1	3	0.75
36	*Malachius aeneus*	2	1	3			1	7	1.75
37	*Dolichosoma lineare*		1	3	1	1		6	1.50
38	*Coccinella 7 - punctata*	2		3	1	2		8	1.99
39	*Adonia variegata*			1	1			2	0.5
40	*Adalia bipunctata*	1		2	1	1		5	1.25
41	*Propylea 14 - punctata*	2		1	1			4	1.00
	TOTAL	**18**	**44**	**172**	**76**	**54**	**38**	**402**	

Among Hymenoptera, most of individual belonged to Eulophidae owning 23.62%, from Coleoptera, *Coccinella 7-punctata* species was dominant (22.86%). Thysanoptera was represented by a single species (Table 5).

In the rye crop from Mihăileni, Botoșani county, there were collected and analysed 357 samples of useful insects and there were recognised 34 taxons from orders Hemiptera, Thysanoptera, Diptera, Hymenoptera and Coleoptera. Similar to the other localities, Hymenoptera was dominant as well owning 58.55% from the total useful insects followed by Tysanoptera (27.45%) and Coleoptera (8.69%) (Table 6). Considering quality aspects, Hymenoptera had 20 taxons and among these, there was dominant Eulophidae owning 50.24% from the total Hymenoptera individuals. Coleoptera was represented by 8 taxons and from these taxons, *Coccinella 7-punctata* was dominant (25.81% from the total useful insects) and Thysanoptera was represented by a single species (Table 6).

Table 6. Abundance (A) and dominance (D) of entomofauna useful in the rye crop from Mihăileni, Botoșani County, 2014.

No.	Taxon	Collecting dates in 2014						Total	
		18 April	12 May	26 May	12 June	28 June	11 July	A	D
	HEMIPTERA		1	3		1	1	6	1.68
	HETEROPTERA		**1**	**3**		**1**	**1**	**6**	**1.68**
1	Nabidae			1				1	0.28
2	*Orius niger*		1	2		1	1	5	1.4
	THYSANOPTERA		**17**	**75**	**2**	**1**	**3**	**98**	**27.45**
3	*Aeolothrips intermedius*		17	75	2	1	3	98	27.45
	DIPTERA		**1**		**5**	**2**	**4**	**12**	**3.37**
4	Syrphidae					2	4	6	1.68
5	Dolichopodidae				2			2	0.56
6	Anthomyiidae		1		3			4	1.12
	HYMENOPTERA	**8**	**21**	**137**	**22**	**5**	**16**	**209**	**58.55**
7	Ichneumonidae	2	3		2			7	1.96
8	Braconidae	1	4		1		2	8	2.24
9	*Tryoxis brevicornis*	2		5			2	9	2.53
10	Cynipidae		3	24	3			30	8.41
11	*Mesopolobus* sp.				5		3	8	2.24
12	*Asaphes* sp.			1			1	2	0.56
13	*Pachyneuron* sp.			1		1	1	3	0.84
14	*Calitulla* sp.			1				1	0.28
15	*Merisus* sp.			1	2			3	0.84
16	Encyrtidae			1				1	0.28
17	Eulophidae	1	6	85	6	4	3	105	29.42
18	*Aphelinus* sp		1					1	0.28
19	*Anagrus* sp.			1				1	0.28
20	Diapriidae		1	2				3	0.84
21	*Telenomus* sp.		2	5			1	8	2.24
22	*Trissolcus* sp.						1	1	0.28
23	*Platygaster* sp.			1			2	3	0.84
24	*Synopeas* sp.			1	2			3	0.84
25	Megaspilidae	2		5	1			8	2.24
26	Formicidae		1	3				4	1.12
	COLEOPTERA	**4**	**5**	**8**	**7**	**4**	**3**	**31**	**8.69**
27	*Dolichosoma lineare*			2		1		3	0.84
28	*Malachius bipustulatus*		1	3	1	2	1	8	2.24
29	*Coccinella 7-punctata*	2	1	2	2	1		8	2.24
30	*C. 11-punctata*				1			1	0.28
31	*Propylea 14-punctata*	1	1	1	1			4	1.12
32	*Adonia variegata*		1		1		1	3	0.84
33	*Adalia bipunctata*	1	1				1	3	0.84
34	*Anatis ocellata*				1			1	0.28
	TOTAL	**12**	**45**	**223**	**36**	**13**	**28**	**357**	

Conclusions

From the investigated rye crop, in all of the 5 localities (Rădăuți, Horodnic de Jos, Marginea, Poieni-Solca, Mihăileni) there were collected assembled 1609 insects and were identified 69 taxons of useful insects which belong to orders: Odonata, Dermaptera, Hemiptera, Thysanoptera, Neuroptera, Diptera, Hymenoptera and Coleoptera.

The highest value of specific diversity was presented by the order Hymenoptera.

Most of Hymenoptera taxons belong to Eulophidae family.

From the order Coleoptera, Coccinellidae family presented the highest value of specific diversity.

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HOST-PARASITE INTERACTIONS BETWEEN THE CYPRINID *ALBURNUS ALBURNUS* (LINNAEUS, 1758) AND *LIGULA INTESTINALIS* (LINNAEUS, 1758) RESULTED FROM THE BIOTRANSFER OF HEAVY METALS

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Abstract. The development of new research methods and technologies brought important data in understanding of the parasites’ life and behavior. The heavy metals are not biodegradable in the living bodies and that makes them very stable in tracking their biotransfer in different organisms. They must have a natural circuit without anthropogenic pollution sources in order to track the elements routes within the food webs. The study explains how the cestode interacts with the cyprinid based on the biometric analysis and biotransfer factor of heavy metals in an unpolluted ecosystem. The separation in different size groups, followed by analyzes and interpretation can bring important evidence for the relationship between host and parasite. The aim of the study was to use the biotransfer factor of Cu, Cd, Pb, Ni, Cr in different sized bleaks infected with the cestode *Ligula intestinalis*, in order to understand cestode’s behavior in natural conditions. The observed parasitizing was the same no matter the group infested and the worms growth was correlated with the hosts. There is the possibility of an inhibition mechanism existence for parasitic infection caused by the competition between the plerocercoids inside the fish because resources and the host supporting capacity for parasites are limited.

Keywords: cestode, fish, parasitisation, trace elements

Rezumat. Interacțiuni de tip gazdă-parazit între ciprinidul *Alburnus alburnus* (Linnaeus, 1758) și *Ligula intestinalis* (Linnaeus, 1758) rezultate în urma biotransferului de metale grele.
Dezvoltarea unor noi metode și tehnologii de cercetare au adus date importante în înțelegerea vieții și a comportamentului paraziților. Metalele grele nu sunt biodegradabile în corpurile vii, fapt ce le face foarte stabile în urmărirea biotransferului lor în diferite organisme. Ele trebuie să aibă un circuit natural, în absența surselor de poluare antropice, cu scopul de a permite urmărirea rutelor acestor elemente în cadrul lanțurilor trofice. Studiul explică modul în care cestodul interactioneaza cu ciprinidele, pe baza analizei biometrice și a factorului de biotransfer a metalelor grele într-un ecosistem nepoluat. Separarea pe diferite grupe de mărime, urmate de analize și interpretări, pot aduce dovezi importante în ceea ce privește relația gazdă - parazit. Scopul studiului este acela de a utiliza factorul de biotransfer pentru Cu, Cd, Pb, Ni și Cr, în obleți de diferite dimensiuni infectați cu cestodul *Ligula intestinalis*, pentru a înțelege comportamentul cestodului în condiții naturale. Parazitoza observată a fost aceeași indiferent de grupul infestat și creșterea viermilor a fost corelata cu cea a organismului gazdă. Există posibilitatea existenței unui mecanism de inhibare pentru infecțiile parazitare cauzate de concurența între plerocercoizi în interiorul peștelui gazdă, deoarece resursele și capacitatea de suport a gazdei sunt limitate.

Cuvinte cheie: cestod, pești, parazitare, oligoelemente

Introduction

The relationships between parasites and hosts were well studied during the last two decays. The studies still have many gaps in proving and understanding their interactions. The development of new research methods and technologies brought important

data in understanding the parasitic life and behavior. In general, the fish parasites have their ecological place in the aquatic ecosystems and play an important role in environmental equilibrium (Thompson *et al*., 2010). They are considered to be a major threat because they have negative impact on fish stocks and aquaculture productivity (Marcogliese, 2005). The fishes contaminated with parasites have no commercial value and can be a major threat for the consumer's health. A parasite wide spread in fish is the tape worm *Ligula intestinalis***.** This cestode has a life cycle that involves in the development stages three hosts. Firstly, it infects a common copepod species (Hoole *et al.*, 2001) like *Cyclops* sp. which is consumed by a cyprinid fish (e.g. *Alburnus alburnus*) where the parasite is developing to the second stage and the final host, a piscivorous bird (e.g. *Phalacrocorax pygmeus*). The bleak (*Alburnus alburnus*) is a species wide spread from Europe to Iran (www.fishbase.org). Its total length is 12-19 cm, longevity is from 5 to 7 years and the habitat is composed from rivers, lakes, ponds and light brackish waters. This species can be use in the future studies for understanding the host-parasite interactions because it has a high abundance in freshwater ecosystems, a wide number of parasitic species and they breed very fast.

The heavy metals are not biodegradable in environment (Mendil *et al*., 2005) and this makes them very stable in tracking the biotransfer in different organisms. They must have a natural circuit without anthropogenic pollutions sources in order to track the elements routes in food webs. Metals such copper are essential to biological functions (Meng *et al*., 2016; Frank *et al.*, 2013; Chen *et al*., 2015; Watanabe *et al*., 1997; Hauser-Davis *et al*., 2014; Song *et al*., 2016), while cadmium, lead and chromium are non-essential toxic metals that can produce damages to the fish physiological functions (Cunningham & McGeer, 2016; Chatta *et al*., 2016). Studies presented cestodes as bioindicators of pollution with heavy metals and different compounds (Oyoo-Okoth *et al*., 2010, 2012; Filipović Marijić *et al.*, 2014; Khalil *et al*., 2014). Copper is an element involved in the function of specific proteins, development, neurological functions, respiration (Minghetti *et al*., 2011), co-factor for over 30 different enzymes (Watanabe *et al*., 1997), collagen synthesis (Lall, 2002) and hematopoiesis (Shao *et al*., 2010). Freshwater fish absorbs the highest amount of copper from environment with the gills followed by the skin and intestine (Carvalho & Fernandes, 2008). Thus, the biotransfer of heavy metals can be used to understand the interactions between parasite and host by bringing new results for their ecology.

The aim of the study was to use the biotransfer factor of Cu, Cd, Pb, Ni, Cr for different sized bleaks infected with the parasite *Ligula intestinalis*, in order to understand the cestode's behaviour in an aquatic ecosystem with natural conditions where the anthropogenic pollution is negligible.

Material and Methods

Study area description and sampling

The samples were collected from the reservoir Stanca-Costesti located on the middle course of the Prut River, Romania. Its length is approximately equal with 100 km between the Radauti Prut and Stanca, on the Romanian side. The reservoir is bordering Romania and Republic of Moldova, and has a total surface of 12 000 km^2. The water volume is estimated to be 1-1.5 billions of cubic meters (Report for the study of environmental impact caused by Hydropower Plant Stanca Costesti, Botosani County, 2011). The lake is not natural; it resulted from the construction of a dam between the villages Stanca and Costesti for the hydropower plant that started to produce electricity

since the year 1978. It is the second largest lake from Romania and was considered to be the best fitted for such study because is located in the border area where the anthropogenic activities are controlled and restricted. There is no heavy industry around to pollute the environment with heavy metals and the surrounding agricultural lands have a low influence in the water chemistry balance because of the huge water volume and protected areas. The lake has a rich diversity of fish species with economic importance, this resource is shared by both countries. There are not fish farms located on the lake surface or fish cage aquaculture activities. The reservoir is an important spot for sustaining diversity of wild birds that are in migration during the summer or winter.

The sampling was conducted during August 2014 with the fishing team from the Project Resources pilot center for cross-border preservation of the aquatic biodiversity of Prut River MIS-ETC 1150 Romania – Ukraine – Republic Moldova. The fishing was authorized by the Romanian government only for research purpose in order to preserve the biodiversity and to find possible threats. The fishing with nets, selection and sampling of abundant species like *Alburnus alburnus* was authorized by Romanian Environmental Ministry for Climat Changing and National Agency for Fishing and Aquaculture for research with Authorization Number 13/25.07.2014. For fishing were used nets with different mesh size, located in random places on the entire lake surface. A total number of 75 fish specimens were randomly selected from all fishing captures. These wild organisms were used only for monitoring and observation purpose according to Directive 2010/63/EU on the protection of animals used for scientific purposes. In this study the wild living organisms were not used for experiments in laboratory conditions. They were separated in three groups based on their length and morphological symptoms of parasitic infestation. This separation was done in order to test the level of contamination and parasite-host interaction at different growth size of the bleaks. In each capture, the specimens were careful measured in length and sorted for the specific group in sampling single use PE (polyethylene) bags that were stored in a portable cool box and then in a freezer at -20°C, in the shore area. Because the laboratory was far away from the lake, the frozen samples were transported in the cool boxes for preparation and analysis.

The water parameters were measured with a multi parameter probe HI 9828 produced by Hanna Instruments, calibrated in the field by using certificated reagents. The instrument was immersed at 2 m depth at each sampling site, starting from the shore area to the middle of the lake, to find possible differences in water chemistry presumed to be influenced by sediment suspension, shore erosion and environmental temperature. The bleak may come to feed in the shore area during the night. Parameters measurements were performed for three days at each six hours, at the established sampling sites. Water was sampled in decontaminated PE bottles (200 ml) in replicas (n=6) at each sampling site and preserved using the acidification method (pH close to 2). The samples were transported in the laboratory for microwave digestion and metal quantification (Strungaru *et al*., 2015).

Sample preparation and method optimization

The reagents used were certified by the producer. The water necessary for samples preparation and reagents dilution was ultrapure, by LaboStar ™3/7 TWF (Siemens) purification system from double-distilled water. For the digestion of metals from samples were used pure reagents with insignificant concentrations of trace elements that could contaminate the samples: nitric acid suprapur 65% (Merck, Germany) and hydrogen

peroxide EMSURE 30% stabilized for higher storage temperature (Merck, Germany). The calibration was done for each metal, using certificated standards stock solutions from Merck that were diluted with ultrapure acidified water (0.5% HNO_3). The solution stocks for matrix modifier were: palladium matrix modifier 10±2 g l^{-1} (Merck) and magnesium matrix modifier 10±2 g l^{-1} (Merck). For the validation of the method accuracy we used certificated reference material (ERM-BB422) for fish muscle, which was in the validity interval.

Each group of fish was defrosted in the laboratory and prepared for metal analyses only after the biometric measurements of total length and weight. Before the dissection, each fish was several times washed with ultrapure water to avoid possible metal contaminants, and the water excess was removed with clean paper towels. The dissection table was covered with clean PE foil; for each organism was used a new PE uncontaminated plate with 20 cm diameter. The scalpel blade for the abdominal incision was the only metal dissection tool, cleaned for each fish and changed with a new one for each group. Four types of tissues were carefully separated from each fish: total muscle, total skin, total digestive tract and total bones (without head and fins). From each group resulted a number of ten samples that were prepared for metal digestion. The digestive tract was several times washed to eliminate the nutrients and other contaminants. Samples were chopped with clean PE tools and well homogenized. A biomass of 1 g was weighted and inserted in a TFM vessel for digestion with nitric acid (4 ml) and hydrogen peroxide (1 ml); the mixture needed 25 minutes to react. The vessels were inserted in a Speedwave MWS-2 metal digestion system. The program for samples digestion was in steps: 145°C for 5 min, 190°C for 10 min and 100°C for 10 min. Liquid samples were transferred into 50 ml volumetric (BRAND) flasks that were several times cleaned with acidified ultrapure water. They were filled up with ultrapure water until reached the specified volume. Two types of samples were prepared for testing the accuracy of the method and the possible contamination. The first sample type was the fish muscle certified material that was prepared in a number of six samples using the same digestion protocol as for a normal sample; eight blind samples, each with a volume of 10 ml ultrapure water instead of muscle were prepared using same digestion protocol and dilution volume to test the existence of possible contamination.

The parasites from each infested group were carefully extracted and taxonomically identified as *Ligula intestinalis*. They were counted from each infested fish, weighed and measured for the length. To quantify the parasitisation of each individual bleak was used the parasitisation index (PI) according to Hoole (1994) Eq. (1):

$$\text{PI}(\%) = \frac{\text{weight of parasite}}{\text{weight of parasite+fish weight}} \times 100 \quad (1)$$

For the factor of heavy metals host-parasite biotransfer was used a report according to following Eq. (2):

$$\text{Biotransfer factor} = \frac{\text{metal concentration of parasite}}{\text{metal concentration of host tissue}} \quad (2)$$

The metal digestion for parasite samples followed the same protocol as the other biological samples only after each worm was several times washed with ultrapure water. The water samples were digested using the protocol described by Strungaru *et al*., 2015.

For all metal measurements was used an atomic absorption spectrometer (HR-CS GFAAS) equipped with a high resolution continuum source, a graphite furnace with platform (model ContrAA 600, Analytik Jena, Germany), and MPE 60 autosampler. Argon

5.0 (99.99%) was used as carrier gas. This technique has been proved to be reliable and accurate in metal determination (Gunduz & Akman, 2013), offering the possibility of high quality measurements by analyzing the interference with other elements. The software has multiple evaluation methods for validation of each signal measured for a sample.

Statistical analysis

Firstly, the Shapiro-Wilk normality test was performed for each data set. The One-Way ANOVA and the Tukey HSD tests were performed to demonstrate the significant variance of metal concentration between biological tissues and biometrical measurements for the fish groups. The comparisons for the infected groups were performed with Student t-test. All the statistical analyses were carried out using OriginPro v.9.3 (2016) software created by OriginLab Corporation, USA.

Results and Discussion

The water parameters and metals concentrations confirmed that the ecosystem is not under anthropogenic pressures and follows a natural annual cycle. Table 1 presents the average values for few water parameters that indicated the ecological state of the ecosystem which is in very good conditions (Order 161 from 16/02/2006 and Management Plan for Prut River 2016-2021). From all heavy metals aimed for analysis in the study, only copper was able to be quantified. This is an important microelement for the fish physiological functions and normally occurs in small amounts in the environment. The toxic heavy metals were not detected in the water samples, suggesting that the ecosystem is not polluted or affected.

All the specimens studied were mature, capable for reproduction. The first group, considered the control (without parasites), was differently sized, with specimens similar to larger sized group (group B) and to smaller sized (group b) infested. The normal length of the bleak adults is between 12-19 cm and they start to reproduce after two years when is reached the average weight of 7.5 g and length of 8.3 cm (www.fishbase.org).

The study evaluated the infection and interactions of the parasite in the adult stage of the host because the pleroceicoids are fully developed for the final host. There was a significant variance between the weight and total length of the specimens (Table 2) compared to the large sized fish in group_B. The Tukey test proved that only the small sized infested group_b was different for length and weight compared to the other two. Parasites average number in hosts was not significantly different between the infested groups. The small sized group_b had in average 7.33±2.5 parasites per fish and the large sized group_B had 6.33±1.15 per fish with no significant differences (Table 2). The average weight and length of the parasites from the group_B were significantly higher than those from the group_b. The average weight of a pleroceicoid in a larger adult bleak was 0.66±0.31 g and length of 17.95±5.32 cm, compared to those from a smaller adult bleak that had 0.33±0.06 g and the length of 13.85±4.63 cm. This suggested that worms infested the hosts at early stages of development. Parsitisation index value ($P>0.05$) suggested no significant differences between the infested groups and the averages±SD values were: 24.79±3.96% for the group_B and 27.24±5.15% for the group_b. The total length of worms in a host was in average 112.8±33.9 cm for the specimens of group_B and 102.9±25.12 cm for the group_b.

The index length parasite/host was calculated as the report between the total sum of parasites length and the total host length for a single fish. The averages values were 9.33±2.04 for group_B and 10.52±2.47 for group_b with no significant differences (*P>0.05*) suggesting that parasites length had the same proportion with the host.

Only copper and cadmium were quantified in the biological samples. The rest of the metals (lead, chromium and nickel) were below the limit of detection (LOD) of the method (0.55µg l^{-1} Pb, 1.37 µg l^{-1} Ni, 1.87 µg l^{-1} Cr). Copper concentration in the digestive tract was not significantly different (*P>0.05* ANOVA) between the groups and was the highest, compared to other tissues samples. The averages were 2.7 µg g^{-1} for the group without parasites and 2.26 – 2.30 µg g^{-1} for the infested groups. Same insignificant differences resulted from the comparison (Fig. 1) made for skeleton (0.59 µg g^{-1} for the group the group without parasites and 0.47 – 0.56 µg g^{-1} for the infested groups) and skin (1.2 µg g^{-1} for the group without parasites and 1.06 – 0.97 µg g^{-1} for the infested groups).

The copper concentrations from the muscle samples were significantly different for the studied groups (***P<0.01*, F statistic 18.06 ANOVA) with the highest values in the specimens without parasites (0.57±0.057 µg g^{-1}) and infested group_b (0.57±0.034 µg g^{-1}); the lowest was in group_B with parasites (0.37±0.043 µg g^{-1}). Cadmium concentration had the highest values in the digestive tract samples. The group without parasites had (***P<0.01*, F statistic 12.09 ANOVA) higher cadmium concentration (0.074±0.01 µg g^{-1}) compared with the infested group_B (0.041±0.007 µg g^{-1}) and group_b (0.03±0.01 µg g^{-1}).

Cadmium had not significant differences in the digestive tract between the two infested groups. The results obtained for the muscle, skin and skeleton samples were not significantly different between the groups (*P>0.05* ANOVA). Cadmium concentration in muscle had the average value of 0.0053 µg g^{-1} for the group without parasites and 0.0034 - 0.0152 µg g^{-1} in the infested groups. The averages for skin samples were 0.01 µg g^{-1} in the group without parasites and 0.01 - 0.013 µg g^{-1} in the infested groups. In skeleton, the averages were 0.003 µg g^{-1} for the not infested specimens and 0.003 – 0.002 µg g^{-1} for the infested ones (Fig. 1).

The copper and cadmium concentrations in pleroceicoids collected from the two groups were significantly different. Copper had the average±SD of 0.558±0.036 µg g^{-1} in the worms from group_B, significantly lower (***P<0.01*, t-test) than worms from group_b with a concentration of 0.878±0.112 µg g^{-1}. Cadmium concentration in parasites had same trend as copper. The group_B had lower (***P<0.01*, t-test) cadmium (0.0017±0.001 µg g^{-1}) compared with group_b (0.004±0.003 µg g^{-1}). The biotransfer factor was calculated based on the results for hosts and parasites from the studied groups. There were recorded differences for copper and cadmium. The parasite was competing with the host for copper from muscle, skeleton and skin (Fig. 1). The biotransfer factor for copper had the highest values for muscle samples (1.47 for group_B and 1.52 for group_b), followed by skeleton (1.17 for group_B and 1.55 for group_b) and skin (0.52 for group_B and 0.9 for group_b).

The biotransfer value of this element from the digestive tract was 0.24 for group_B and 0.38 for group_b. Cadmium had the highest values of biotransfer for group_b: 0.15-digestive tract, 0.4-muscle, 0.34-skeleton, 0.37-skin. For group_B it was: 0.01-digestive tract, 0.18-muscles, 0.24-skeleton, 0.06-skin. The parasite was not in competition with the host for cadmium compared with copper which is an essential element. In the large sized group, the biotransfer was lower.

Table 1. The water parameters and metals concentrations in Lake Stanca Costesti during the sampling term in August 2014 (average±standard deviation). The limits of detection (LOD) for this method was: 0.1 µg l^{-1} Cd, 0.55 µg l^{-1} Pb, 1.37 µg l^{-1} Ni, 1.87 µg l^{-1} Cr.

Sampling site	Geographical coordinates	Water temperature (°C)	pH	Dissolved Oxygen (mg l^{-1})	Redox potential	Conductivity (µS cm^{-1})	TDS (mg l^{-1})	Salinity (PSU)	Cu (µg l^{-1})	Cd (µg l^{-1})	Pb (µg l^{-1})	Ni (µg l^{-1})	Cr (µg l^{-1})
S_1	47°53'24.9" N 47°11'40.92" E	26.1±1.5	8.5±0.03	8.27±0.36	-22.66	430.8±5.32	215.4±0.4	0.22	2.241 ± 1.06	<LOD	<LOD	<LOD	<LOD
S_2	47°53'26.81" N 47°11'45.27" E	23.8±0.34	8.42±0.02	7.57±0.14	-20.4	435±3.4	217.3±1.35	0.21	2.31 ± 0.922	<LOD	<LOD	<LOD	<LOD
S_3	47°53'31.36" N 47°11'57.85" E	25.7±0.12	8.68±0.02	10.18±0.21	-21.0167	435.3±1.12	217.8±3.11	0.21	2.133 ± 0.1	<LOD	<LOD	<LOD	<LOD
S_4	47°53'42.46" N 47°11'3.86" E	25±0.23	8.47±0.01	8.21±0.11	-16.7875	443.6±3.2	221.7±0.16	0.21	1.02 ± 0.06	<LOD	<LOD	<LOD	<LOD

Table 2. Biometric measurements for the control and infested groups. The results are reported as average±standard deviation. One way ANOVA test is noticed with “a” and Student t-test with “t”. * *P<0.05*, ** *P<0.01*. *** *P<0.001*.

Group label	Sample size	Fish weight (g)	Fish total length (cm)	Parasite number per host	Parasite weight (g)	Parasite length (cm)
Without_parasites	25	14.15±2.89 ^{a}*	11.64±0.52 ^{a}***	0	0	0
Group_B	25	16.86±5.67 ^{a}*	12.24±0.39 ^{a}***	6.33±1.15 ^{t}	0.66±0.31 ^{t}***	17.95±5.32 ^{t}**
Group_ b	25	8.84±1.89 ^{a}*	9.77±0.21 ^{a}***	7.33±2.5 ^{t}	0.33±0.06 ^{t}***	13.85±4.63 ^{t}**

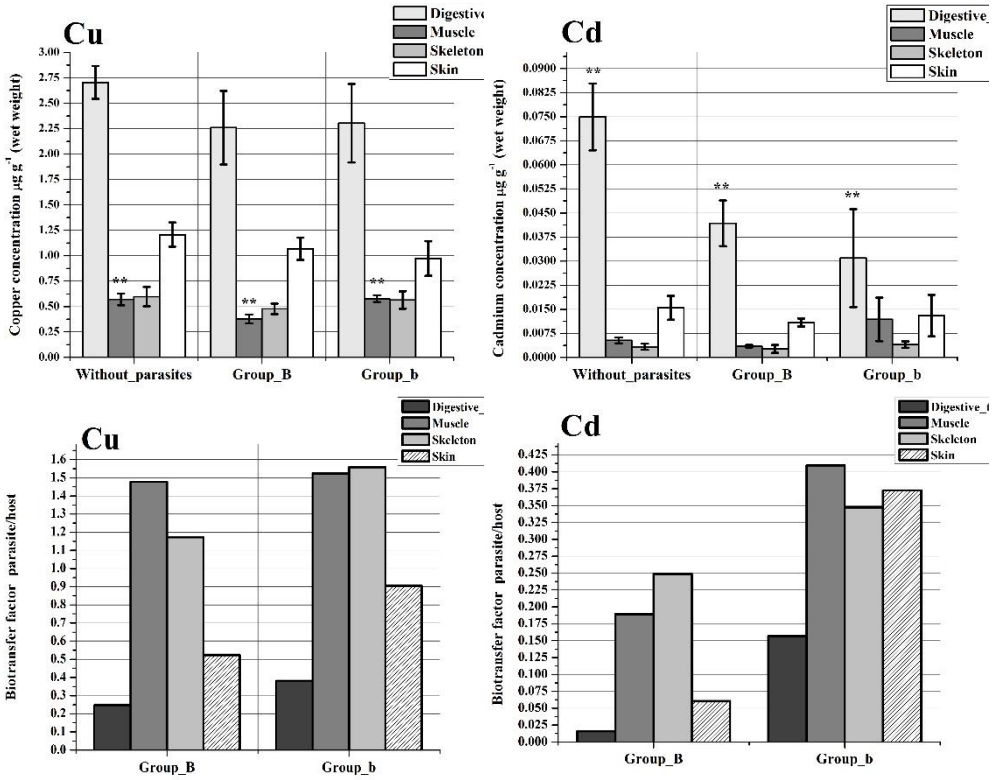

Figure 1. Copper and cadmium concentrations in the biological samples of the studied groups, reported as average±standard deviation for the wet weight (***P<0.01* One way ANOVA test). The biotransfer factor for host-parasite interactions was reported as a nominal value.

Based on the results of this study and discussions from other research papers, were commented the interactions between the cyprinid *Alburnus alburnus* and the parasite tape worm *Ligula intestinalis*. Firstly, were investigated the main hosts species for the parasite lifecycle. In the studied ecosystem, the most abundant fish species is bleak. This resulted from the fishing team reports and local fishermen observations. Because bleak is wide spread across the lake, the probability of getting an infestation with this parasite is high. In all the captures this was the dominant species with the highest number of infestations. In the fishing nets there were other cyprinids with parasitisation symptoms (*Rutilus rutilus* and *Cyprinus carpio*) but their number of infested specimens was too low (total 4 specimens) to be included in this study compared with bleak. Based on the parasitisation index, biometrical results and parasites number in a host, resulted that the bleak had the first contact in larvae stages by consuming infested common copepods like *Cyclops* sp. The fish larvae start to feed with plankton 8 days after hatching. In the adult phase they feed with zooplankton, phytoplankton, terrestrial and aquatic insects; rarely with vegetation. It is

more likely to be infested as larvae because in the adult phase they have a larger food spectrum. This also resulted from the comparison between two different sized infested groups. In the older and larger hosts there were observed larger parasites. There is a zero point in the host life when is exposed to the parasite. After infestation, the parasite grows with same proportion as the host in weight and length. This was observed by Trubiroha *et al*. (2009) at *Rutilus rutilus* (roach) when the parasite mass was correlated with host mass. Few important observations were highlighted in this study: the constant number of parasites and different length in same host. The constant number of parasites in the fish hosts suggested the possibility of a competition between the parasites for the limited nutrients resources provided by the host. It is possible that the first parasite in the host to grow to a specific size and to produce inhibitory compounds that may stop the infestation with new plerocercoids; the immunity system adaptation of the host should not be excluded. This is supported by the different lengths of worms in the host that suggested the possibility of infested copepods ingestion at different periods after the first infestation. The plerocercoid can grow inside the host for years (Bouzid *et al*., 2008) and the same probably happened to the specimens from present study. In such case, the best strategy for the parasites is to let the host to grow until they are fully developed for the final host. This is related with the concentrations of copper and cadmium from the digestive tract, skeleton, muscle and skin that were not different between the control group and infested group. The parasites need a stable nutrient resource to avoid the competition with the host, for preventing the death of the host and the damages of the vital functions. This resource can be taken from the gametogenesis function of the host which can live without it. This was studied in roach (*Rutilus rutilus*) in case of the same parasite by Trubiroha *et al*. (2009), and in bream (*Abramis brama*) by Hecker & Karbe (2005).

Two exceptions were recorded: the different concentrations of copper in muscle and cadmium in digestive tract. Copper concentrations were significantly decreased in the muscle biomass for the group_B with parasites. Several studies explained that the dietary copper deficiency in fish reduced the appetite and caused anemia (Shiau & Ning, 2003; Lin *et al*., 2008; Tan *et al*., 2011). The copper concentrations in the worms from the group_B were lower than those from the group_b. This suggested a deficiency of the element in host muscle and parasites from the largest specimens. The digestive tract, skeleton and skin indicated the presence of copper in the body in sufficient amount. It is known that the reservoir contains copper that as inorganic form can be directly absorbed from water. The organic form is related with food and nutrients. Loot *et al*. (2001) explained that the swimming ability of infected roach is reduced because of phenotypic modification caused by parasite growth in the digestive system. Parasite causes to bleak same phenotypic modification and this leads to reduction of swimming ability. Because of that, the bleak capacity to exploit the food resource is lower. This will reduce the organic form of copper that will lead to deficiency in muscles and parasites. It can also cause anemia in muscles, so the fish will move slower in the water and the risk of predation by birds will increase. Host’s expanded abdomen can represent a stimulus for bird to quickly swallow the infested fish. The group_B from the study is fitted to be consumed and the plerocercoids are fully developed for the final host. Cadmium was in significant lower concentration in the digestive tract of the infested fish. The cestodes are not capable to synthesize their own cholesterols and fatty acids, thus they take them from hosts’ intestinal lumen, thereby host’s capacity of metals absorption is reduced (Oyoo-Okoth *et al*., 2010). More than that, they

can be used as an indicator for metal pollution of the environment (Yen Nhi *et al*., 2013; Marcogliese, 2003). This element was not detected in the lake water. The exposure to cadmium of the studied specimens was from food sources. The comparisons of concentrations in parasites from the two groups proved that this element decreased similarly to copper, suggesting the deficiency caused by a lower food uptake by the host.

Based on reports published by other projects conducted on Lake Stanca-Costesti were identified the bird species that have a fish diet fitted as final hosts of these cestodes: *Gavia stellata, Gavia arctica, Phalacrocorax pygmaeus, Ixobrychus minutus, Ardeola ralloides, Nycticorax nycticorax* and *Egretta garzetta* (Bird Species Report from Lake Stanca Costesti). The most important fact is that they populate the lake during the warm season because in winter season the surface water turns into ice. Some of these species migrate to Africa during the winter (*Ixobrychus minutus, Ardeola ralloides*); other species retreat in warmer areas from Romania and countries from Europe. Because of the final host and the environmental conditions, *Ligula intestinalis* must find strategies to synchronize for the final infestation. This can be triggered by the environmental conditions, development and host metabolic processes.

Conclusions

The study explained how the cestode *Ligula intestinalis* interacts with the cyprinid *Alburnus alburnus*, based on biometric analysis and biotransfer factor of heavy metals observed in an unpolluted ecosystem. The separation in different size groups, followed by analyzes and interpretations brought important evidence of relationships between host and parasite. The parasitisation of the studied groups was constant and the worm growth was correlated with the host. There is the possibility of an inhibitory mechanism for parasitic infection caused by the competition between the plerocercoids inside the host. This may be controlled by the support capacity and the limited body resources of the host. One fact can be sure: the host's growth is not interfering with the parasite until the last one reaches the full development for a third host. The phenotypic modification caused by the parasites in the final stage affects the movement and feeding capacity, resulting the deficiency of copper in muscles. This may also affect the parasite which is rewarded at the end by the third host's infestation. The species *Alburnus alburnus* can be successfully used in future studies for understanding the relations between host and parasites in laboratory conditions. In natural conditions it provided valuable results and hypothesis for future studies.

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DATA CONCERNING THE FISH FAUNA OF THE MOLDOVA RIVER BASED ON SURVEYS OF ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364 NATURA 2000 SITES

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Abstract: The aim of this study was to carry out an ichthyological survey on four Natura 2000 sites (ROSCI0321, ROSCI0365, ROSCI0364, ROSCI0364) which covers the most part of Moldova River and its floodplain in order to elaborate management measures for the fish species of Community interest. Between May and August 2014 we conducted ichthyological surveys on these sites and we captured fish by electro-fishing from Moldova River, its tributaries, backwaters and artificial ponds. A total of 33 fish species were detected from 65 sampling stations in the four Natura 2000 sites (and close vicinity), of which eight were species of Community interest. In every protected area we detected the presence of other fish species of Community interest that were mentioned in the Standard Data Form of the sites, and we recommended one fish species in ROSCI0321, four in ROSCI0365, two in ROSCI0363 and four in ROSCI0364 to be added to the Standard Data Forms of these sites. These proposals were accepted and the list of these Standard Data Forms was extended in 2016. We identified the main threat factors and proposed management measures in order to ensure the long-term survival of the fish species.

Keywords: fish species of Community interes, Natura 2000 site, management measures, Moldova River

Rezumat: **Date privind ihtiofauna râului Moldova obținute în timpul evaluărilor efectuate în siturile Natura 2000 ROSCI0321, ROSCI0365, ROSCI0363 și ROSCI0364.** Scopul studiului a fost evaluarea ihtiofaunei din interiorul a patru situri Natura 2000 aflate de-a lungul râului Moldova în vederea elaborării măsurilor de management pentru conservarea speciilor de pești de importanță comunitară. Evaluările de ihtiofaună au fost efectuate în perioada mai – august 2014 folosind un aparat de electronarcoză. Au fost colectate probe din râul Moldova, afluenții acestuia, brațele moarte aflate de-a lungul râului cât și din câteva lacuri artificiale. În total au fost identificate 33 de specii de pești din cele 65 de stații de colectare aflate în interiorul și în imediata vecinătate a siturilor Natura 2000. Dintre acestea opt specii sunt de importanță comunitară. În interiorul fiecărui sit Natura 2000 am detectat și alte specii de pești Natura 2000 decât cele aflate în formularul standard al siturilor și a fost propusă introducerea acestora în formularul standard al siturilor (o specie pentru ROSCI0321, patru pentru ROSCI0365, două pentru ROSCI0363 și patru pentru ROSCI0364). Aceste propuneri au fost acceptate, astfel în 2016 lista speciilor din formularul standard al acestor situri a fost completată. Totodată am identificat factorii principali care afectează populațiile de pești și au fost propuse măsuri de management în vederea asigurării supraviețuirii lor pe termen lung.

Cuvinte cheie: specii de pești de importanță comunitară, sit Natura 2000, măsuri de management, râul Moldova

Introduction

Moldova River has a length of 205 km, drains a basin of 4326 km^2 and it has a maximum altitude of 1225 m at its spring in Obcina Mestecănișului and minimum 180.9 m at the confluence with Siret River near Roman (Újvári, 1972). The substrate is made up mainly of stone, gravel and sand due to the slope and relatively high speed of the water. The hydrographic basin of Moldova River is symmetrical in the mountains but becomes

asymmetrical from Gura Humorului down due to the loss of tributaries from the left side. The Moldova River receives a total of 41 main tributaries (Davideanu & Davideanu, 2004).

In the literature we find quite a lot of data about fish fauna of the Moldova River (Antipa, 1909; Bănărescu *et al.*, 1960; Bănărescu, 1964, 1969; Apetroaie, 1973, 1975; Davideanu & Davideanu, 2004, Vornicu *et al.*, 2006; Vornicu, 2009). The first data are published by Grigore Antipa (1909), but more accurate data are published in the monumental work of Bănărescu (1964, 1969). Later Apetroaie (1973) publishes data on the zonation of fish fauna from mountain region of the Moldova River. In 1975 she also published data on the spread of cyclostomes in Suceava and Moldova River basins. In 2004, Davideanu & Davideanu published data obtained from the inventories carried out on the Moldova River in 1995. Vornicu *et al.* (2006) published data on the spread of fish species in the Moldova River and later, in his doctoral thesis, Vornicu (2009) published the results of inventories carried out between 2001 and 2008.

There are four Natura 2000 sites along Moldova River designated in 2011 and based on fish species among others: ROSCI0321 (429 ha), the upper part of Moldova River situated between Breaza and Câmpulung Moldovenesc; ROSCI0365 (5303 ha), situated between Păltinoasa and Ruși; ROSCI0363 (3215 ha), between Oniceni and Mitești, and the lower part of Moldova River, the ROSCI0364 (4720 ha), which is situated between Tupilați and Roman. The last site ends before the confluence with the Siret River. Between the last site and the confluence, there is the only dam at a micro hyropower plant built in 2014 on this river, which prevents the fish to swim upwards from the Siret River. In the upper part of the River, in Câmpulung Moldovenesc, is another migration barrier (concrete threshold) close to the confluence with the Sadova River. These Natura 2000 sites cover 76% of the length of Moldova River and every site covers the lower parts of its tributaries and their floodplain on both sides of the river.

Our aim was to carry out an ichthyological survey on the four Natura 2000 sites in order to elaborate management measures for the fish species of Community interest. Therefore our questions before the survey were:

1. Are the fish species of Community interest from the Standard Data Forms present in the sites?

2. What other fish species of Community interest are present in the sites, which can be recommended to be added to the Standard Data Forms of the sites?

3. What other fish species inhabit these sites?

4. What are the main factors that threaten the fish species of Community interest and which are the most appropriate management measures for these species in order to ensure their favourable conservation status in the long term run through an efficient Management Plan?

Material and Methods

Between May and August 2014 we conducted ichthyological surveys on the ROSCI0321, ROSCI0363, ROSCI0364 and ROSC0365 Natura 2000 sites (Fig. 1). We examined all potential habitats in these sites: Moldova River, its tributaries, backwaters and artificial ponds. Fish were captured by electro-fishing (SAMUS-725MP) (Pricope *et al.*, 2004). Samples were taken from 65 sampling stations (Fig. 2, Table 1): 13 stations in and near ROSCI0321, 24 in and near ROSCI0363, 14 in and near ROSCI0364 and 14 in and near ROSC0365. The length of a station was a minimum 100 m and the fishes were

identified based on external morphological characteristics (Bănărescu, 1964; Gyurkó, 1972; Pintér, 1989, 2002). After a few minutes, fishes were recovered and released without injury at a slower section of the water bodies (Keresztessy, 2007). Sampling stations were recorded with a GARMIN GPS and all the data, observations were recorded on data sheets.

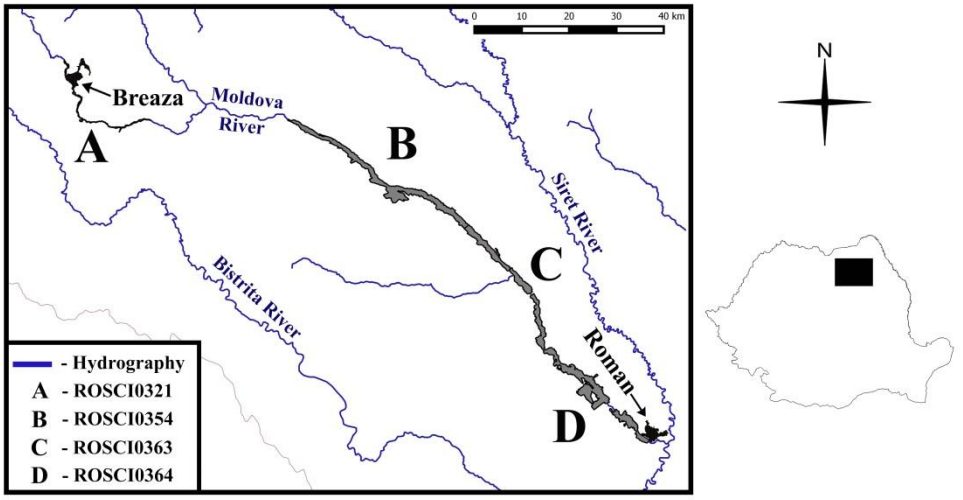

Figure 1. The study area.

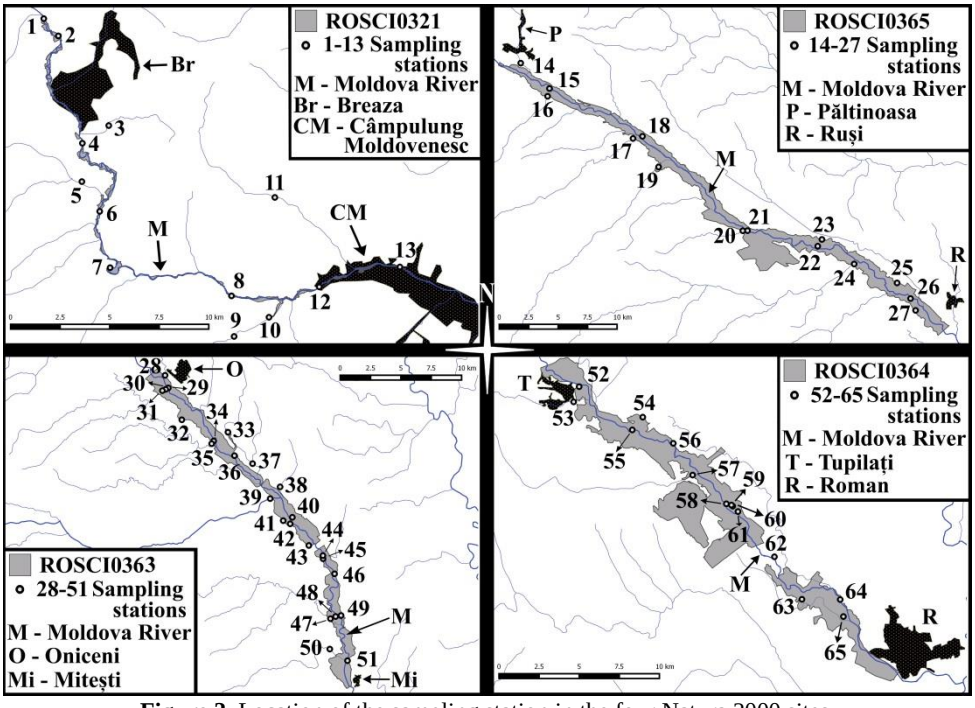

Figure 2. Location of the sampling station in the four Natura 2000 sites.

Table 1. The coordinates of the sampling stations.

Sampling station	X (Longitude)	Y (Latitude)	Sampling station	X (Longitude)	Y (Latitude)
1	25.303902	47.653911	34	26.492518	47.279265
2	25.313632	47.646063	35	26.490293	47.277308
3	25.347225	47.605325	36	26.514863	47.268129
4	25.329472	47.597379	37	26.534434	47.261963
5	25.32903	47.579975	38	26.563881	47.244374
6	25.340908	47.566456	39	26.552843	47.235822
7	25.347723	47.540904	40	26.576554	47.221672
8	25.428978	47.527853	41	26.566528	47.219316
9	25.430564	47.509458	42	26.574061	47.216856
10	25.454002	47.518071	43	26.593866	47.200575
11	25.458405	47.572377	44	26.608943	47.192867
12	25.487826	47.531703	45	26.60902	47.190564
13	25.541956	47.540483	46	26.62121	47.17922
14	25.954691	47.538728	47	26.615717	47.146057
15	25.98678	47.519102	48	26.621371	47.147597
16	25.984563	47.513188	49	26.62734	47.14826
17	26.080157	47.480158	50	26.614362	47.123585
18	26.090809	47.481719	51	26.633321	47.114721
19	26.108506	47.458184	52	26.665127	47.080887
20	26.202223	47.408587	53	26.660344	47.07244
21	26.207516	47.408622	54	26.71682	47.063055
22	26.286235	47.395942	55	26.707991	47.056036
23	26.29105	47.401009	56	26.741403	47.048025
24	26.326836	47.381864	57	26.7567	47.030003
25	26.374715	47.366874	58	26.78381	47.01348
26	26.38955	47.354779	59	26.78794	47.012724
27	26.394994	47.345691	60	26.789006	47.012091
28	26.440924	47.328553	61	26.793187	47.008997
29	26.444198	47.319171	62	26.822237	46.983195
30	26.44133	47.318159	63	26.843965	46.959028
31	26.43769	47.31724	64	26.875309	46.958376
32	26.458295	47.295398	65	26.877603	46.948816
33	26.508276	47.285577			

Results and Discussion

A total of 33 fish species were detected from the 65 sampling stations in the four Natura 2000 sites, of which eight were species of Community interest (Tables 1 and 2). If we compare our data with all the data collected from the literature (Table 3) regarding the fish species of this river, we can see that we could detect 80.5% of the fish species (33 out of 41) ever indicated from Moldova River. The lack of reliable data on either *B. petenyi* or *B. carpathicus* is present in the region made us to mark its name as *B. (meridionalis)* sp. (Kotlík *et al.*, 2002) (Table 2). The same is in the case of *Sabanejewia (aurata)* sp. (Table 2). The situation of the *Sabanejewia* genus is very unclear today. We caught specimens that are very similar to *S. balcanica* (especially in the upper part of the River, and especially in tributaries, but not only) and we caught specimens that are very similar to the *S. vallachica* (especially in the middle and lower part of the River, but not only). We caught both form in the same sampling station too. For clarifying this situation, genetic analysis must be effectuated. In the case of the Community interest species we used their old names in parentheses, the ones are mentioned in the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992) for better understanding. We indicated the presence of two intorduced species (*Onchorhynchus mykiss* and *Salvelinus fontinalis*) for fishing purposes, and three invasive species (*Pseudorasbora parva, Carassius gibelio* and *Perccottus glenii*). *Pseudorasbora parva*, which is native in Asia, was present in 21 sampling station. *Carassius gibelio* once is introduced, became invasive and gradually replaces the native *Carassius carassius* in the whole country (Gavriloaie, 2007). Probably the same scenario took place in the case of Moldova River and its floodplain, because while Bănărescu (1964) describes *Carassius carassius* as a common species in the ponds along the river, we detected its presence from one sampling station only. *Perccottus glenii* was never before indicated from this river. It is a new species for the country which is spread out in China, in the North-West of Korea, in the Amur basin and in Russia. Nalbant *et al.* (2004) collected a few juvenile specimens from the Suceava River, which may have come from Ukraine (Nalbant *et al.*, 2004). Bănărescu (1969) indicated the presence of *Lamperta planeri* from the river, but later, in 2004 after detailed examination of the only preserved specimen based on which *L. planeri* was described; Bănărescu himself indicated that the species is in fact *Eudontomyzon mariae*. During our survey we detected only larvae of *E. mariae*. Out of the eight species undetected by us but indicated in the literature, five species were indicated last time by Bănărescu (1964), which means that during the last 50 years possibly there has been different impacts which induced the disappearance of these species (Table 3), which were all indicated as very rare at the time. On the other hand these new surveys resulted two rare species (*Leucaspius delineatus, Tinca tinca*) and a national interest species (*Carassius carassius* – Government Emergency Ordinance No. 57/2007: Annex 4 B), which were indicated last time by Bănărescu (1964), and a species of Community interest (*Misgurnus fossilis*) which was never indicated from Moldova River and its floodplain in the literature according to our knowledge (Table 3).

Table 2. Occurrence of fish species according to different sampling stations (* species of Community interest).

Species	**Sampling stations**
*Eudontomyzon mariae**	1, 2, 4, 6, 8, 12, 13
Rutilus rutilus	61
Scardinius erythrophthalmus	33, 64
Squalius cephalus	14, 15, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 34, 35, 36, 38, 40, 42, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 56, 57, 58, 59, 61, 62, 63, 65
Phoxinus phoxinus	1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 28, 30, 31, 34, 35, 36, 38, 39, 40, 41, 42, 46, 47, 48, 49, 50, 52, 53
Leucaspius delineatus	25, 38, 30, 53
Alburnus alburnus	14, 18, 21, 24, 29, 35, 40, 48, 51, 55, 58, 61, 62, 65
Alburnoides bipunctatus	18, 21, 22, 40, 46, 48, 51, 52, 55, 58, 65
Vimba vimba	55
Chondrostoma nasus	17, 18, 19, 21, 22, 29, 34, 40, 44, 46, 47, 48, 51, 52, 55, 58, 62, 65
Tinca tinca	64
Barbus barbus	18, 21, 22, 29, 40, 46, 48, 51, 52, 58, 65
Barbus (meridionalis) sp.*	4, 6, 7, 13, 15, 18, 19, 20, 21, 22, 23, 24, 26, 29, 36, 37, 39, 40, 44, 46, 47, 48, 49, 50, 51, 52, 53, 55, 58, 62, 63, 65
Gobio gobio	14, 15, 19, 23, 24, 26, 27, 28, 29, 35, 36, 38, 39, 40, 45, 47, 49, 50, 51, 53, 55, 56, 57, 58, 59, 61, 62, 65
*Romanogobio (Gobio) uranoscopus**	13, 15, 18, 21, 22, 26, 29, 34, 39, 40, 44, 46, 48, 50, 51, 52, 58, 63, 65
*Romanogobio (Gobio) kesslerii**	18, 21, 22, 24, 26, 29, 40, 46, 48, 51, 52, 55, 58, 62, 65
Pseudorasbora parva	14, 22, 26, 27, 28, 29, 30, 34, 36, 38, 39, 40, 44, 45, 48, 49, 53, 55, 58, 59, 61
*Rhodeus (sericeus)amarus**	28, 29, 30, 35, 36, 37, 38, 40, 47, 60, 62, 62
Carassius carassius	64
Carassius gibelio	23, 25, 27, 28, 29, 30, 33, 35, 36, 49, 54, 59, 60, 61
Cyprinus carpio	33
*Misgurnus fossilis**	25, 33, 41, 42, 43, 64
*Cobitis (taenia) elongatoides**	25, 26, 27, 30, 31, 34, 35, 37, 39, 41, 42, 44, 56, 59, 60, 61, 62
Sabanejewia (aurata) sp.*	13, 14, 15, 18, 19, 20, 21, 22, 24, 26, 36, 44, 29, 39, 40, 42, 45, 46, 48, 51, 52, 55, 58, 63, 65
Barbatula barbatula	1, 2, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 31, 34, 36, 39, 40, 41, 42, 43, 46, 48, 50, 58, 61, 62, 63
Esox lucius	27, 33, 43, 64, 56
Thymallus thymallus	1, 7
Salmo trutta	1, 2, 4, 5, 6, 7, 8, 9, 10, 23, 31
Onchorhynchus mykiss	8
Cottus poecilopus	2, 4, 7, 9, 10
Perca fluviatilis	38, 33
Gymnocephalus cernuus	28
Perccottus glenii	64
Sampling station types	
Moldova River	1, 2, 4, 6, 7, 8, 12, 13, 15, 18, 21, 22, 26, 29, 34, 40, 44, 46, 48, 51, 52, 55, 58, 62, 63, 65
Tributaries	3, 5, 9, 10, 11, 14, 16, 17, 19, 20, 23, 24, 27, 30, 31, 32, 35, 37, 38, 39, 41, 42, 43, 47, 50, 53, 57
Backwaters	25, 28, 36, 49, 54, 61, 64
Artificial ponds	33, 45, 56, 59, 60

Table 3. Species from Moldova River basin described from 1909 to date (A - Vornicu, 2009; B - Vornicu *et al.*, 2006; C - Davideanu & Davideanu, 2004; D - Vornicu & Iordache, 2004; E - Apetroaie, 1973; F - Bănărescu, 1964, 1969; G - Antipa, 1909).

Species	Current study	A	B	C	D	E	F	G
Eudontomyzon mariae	X					X	X	
Rutilus rutilus	X					X	X	
Scardinius erythrophthalmus	X	X						
Squalus cephalus	X	X	X	X	X	X	X	X
Phoxinus phoxinus	X	X	X	X	X	X	X	
Aspius aspius							X	
Leucaspius delineatus	X						X	
Alburnus alburnus	X	X	X	X		X	X	
Alburnoides bipunctatus	X	X	X	X		X	X	
Blicca bjoerkna							X	
Vimba vimba	X					X	X	
Chondrostoma nasus	X	X	X	X	X	X	X	
Tinca tinca	X						X	
Barbus barbus	X		X	X	X	X	X	X
Bbarbus (meridionalis) sp.	X	X	X	X		X	X	
Gobio gobio	X	X	X	X	X	X	X	
Romanogobio (Gobio) uranoscopus	X	X	X		X	X	X	
Romanogobio (Gobio) kesslerii	X	X			X	X	X	
Pseudorabora parva	X	X	X	X				
Rhodeus (sericeus) amarus	X	X	X	X		X	X	
Carassius carassius	X						X	
Carassius gibelio	X	X	X		X			
Cyprinus carpio	X						X	
Misgurnus fossilis	X							
Cobitis (taenia) elongatoides	X	X	X			X	X	
Sabanejewia (aurata) sp.	X	X	X	X	X	X	X	
Barbatula barbatula	X	X	X	X	X	X	X	
Silurus glanis							X	
Esox lucius	X					X	X	
Thymallus thymallus	X	X		X		X	X	
Hucho hucho							X	
Salvelinus fontinalis	X	X		X			X	
Salmo trutta	X	X	X	X	X	X	X	
Oncorhynchus mykiss	X	X						
Lota lota						X	X	X
Cottus gobio		X		X		X	X	
Cottus poecilopus	X		X			X	X	
Perca fluviatilis	X	X					X	
Gymnocephalus cernuus	X			X				
Zingel streber							X	
Perccottus glenii	X							

ROSCI0321

A total of 10 fish species were detected from a total of 13 sampling stations (Fig. 3). The *E. mariae*, the only species of Community interest from the Standard Data Form of the site, was indicated by Bănărescu (1969) and Apetroaie (1973), but after that no data was provided about its presence (Table 3). Recently Bănăduc (2008) proposed the designation of Natura 2000 sites on Moldova River based on his own unpublished data from the last 5-

year period. We detected the presence of other 3 species of Community interest – *Romanogobio (Gobio) uranoscopus, Sabanejewia (aurata)* sp. and *Barbus (meridionalis)* sp., of which we recommended *Barbus (meridionalis)* sp. to be added to the Standard Data Form of the site. It was present in four sampling station and the lower part of the site was a suitable habitat for the species, while the other two species were present only at one station (that was located below the protected area) each in a low number, being present probably periodically in the lowest sections of Moldova River in the site. *E. mariae* and *B. (meridionalis)* sp. have both a favorable conservation status in the site. The main threat factors and the management measures proposed for ensuring the long term survival of this species are listed in Table 4.

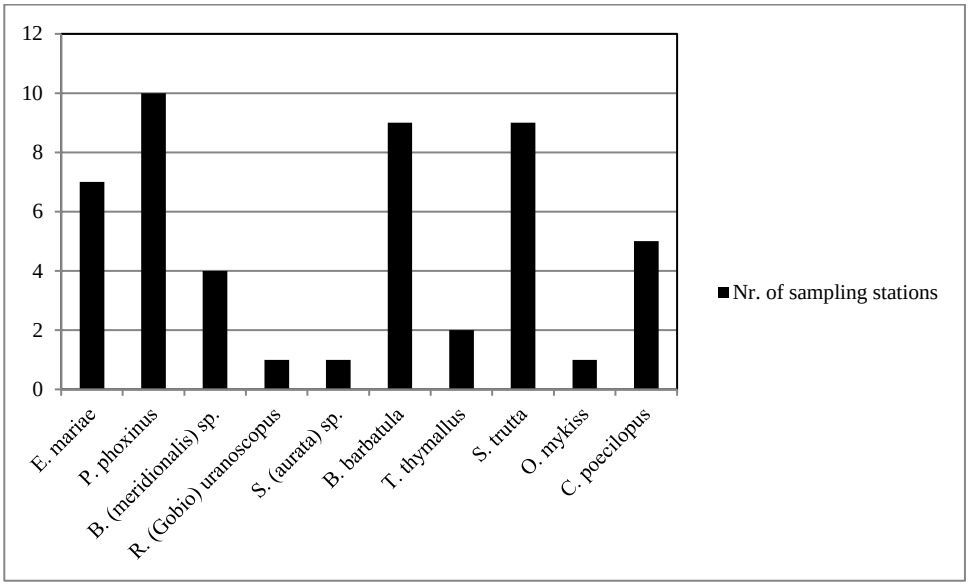

Figure 3. Occurrence of fish species in the ROSCI0321 Natura 2000 site.

ROSCI0365

A total of 19 fish species were detected from a total of 14 sampling stations (Fig. 4). The Community interest species – *Barbus (meridionalis)* sp., *Sabanejewia (aurata)* sp., from the Standard Data Form for the site were detected both from nine sampling stations and both with favourable conservation status within the site. We detected the presence of other four species of Community interest and we recommended all of them to be added to the Standard Data Form of the site: *Cobitis (taenia) elongatoides* – unfavorable-inadequate conservation status, due to its decrease of habitat and the cumulative effect of impacts and threats to the species; *Romanogobio (Gobio) uranoscopus* and *Romanogobio (Gobio) kesslerii* – both favorable conservation status, *Misgurnus fossilis* – unfavorable-bad conservation status, due to its low population size, decrease of habitat and the high cumulative effect of impacts and threats to the species. Although, *M. fossilis* was present at only one sampling station, its presence is important in order to raise awareness of the stakeholders regarding the importance of the species and its habitat. The conservation of its

habitat and other possible habitats is pivotal for this site and in general for the co-species of *M. fossilis* (Müller *et al.*, 2015). At this stage artificial propagation of this species and growth in captivity of juvenile can be a solution in order to repopulate the potential habitats (Imecs *et al.*, 2015). New habitats can also be created for this species based on its habitat requirements (Tatár *et al.*, 2015). The main threat factors and the management measures proposed for ensuring the long term survival of this species are listed in Table 4.

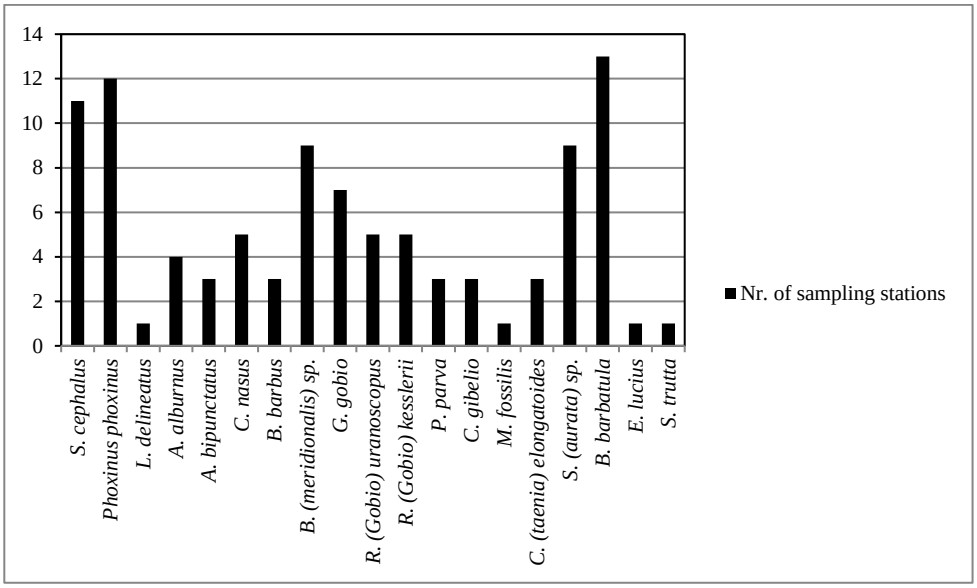

Figure 4. The occurrence of fish species in the ROSCI0365 Natura 2000 site.

ROSCI0363

A total of 24 fish species were detected from a total of 24 sampling stations (Fig. 5). The five Community interest species from the Standard Data Form of the site were all detected. Four of them had favorable conservation status – *Barbus (meridionalis)* sp., *Romanogobio (Gobio) uranoscopus*, *Sabanejewia (aurata)* sp., *Cobitis (taenia) elongatoides*), and *Rhodeus (sericeus) amarus* had unfavorable-inadequate conservation status, due to low population size and habitat loss (caused by sand and gravel extraction) and high cumulative effect of impacts and threats to the species. We detected the presence of other two species of Community interest – *Romanogobio (Gobio) kesslerii*, *Misgurnus fossilis*), both with favourable conservation status, and we recommended both of them to be added to the Standard Data Form of the site. The main threat factors and the management measures proposed for ensuring the long term survival of this species are listed in Table 4.

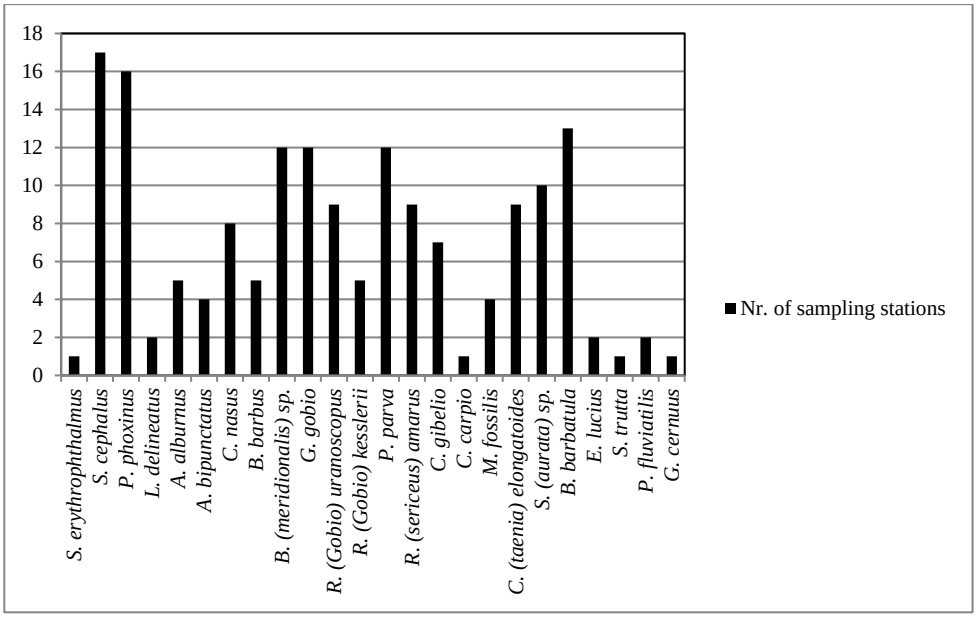

Figure 5. The occurrence of fish species in the ROSCI0363 Natura 2000 site.

ROSCI0364

A total of 25 fish species were detected from 14 sampling stations (Fig. 6). The three Community interest species from the Standard Data Form of the site were all detected. Two of them had favorable conservation status – *Barbus (meridionalis)* sp., *Sabanejewia (aurata)* sp. and *Cobitis (taenia) elongatoides*, had unfavorable-bad conservation status, due to very low population size and increased habitat loss, which is associated with high cumulative effect of impacts and threats to the species. We detected the presence of other four species of Community interest species of which *Romanogobio (Gobio) kesslerii* and *Romanogobio (Gobio) uranoscopus* with favorable conservation status, and *Misgurnus fossilis* and *Rhodeus (sericeus) amarus* with unfavorable-bad conservation status. *R. (sericeus) amarus* had unfavorable-bad conservation status mainly because of the decrease of its habitat. Its habitat is decreased because the increasing sand and gravel extraction from Moldova River results the disappearance of *Unio* and *Anodonta* species to which *R. (sericeus) amarus* is tightly linked through its life cycle. Rigorous measures should be taken in order to stop this process, because if the *Unio* and *Anodonta* species will disappear due to the sand and gravel extraction, *R. (sericeus) amarus* will disappear with them. The status of *M. fossilis* here is similar to its status in ROSCI0365: it was present in only one sampling station and has a unfavorable-bad conservation status, due to its low population size, decrease of habitat and the high cumulative effect of impacts and threats to the species. It was present at only one sampling station along with *Tinca tinca*, *Carassius carassius* and *Perccottus glenii*. We recommended all of them to be added to the Standard Data Form of the site. The main threat factors and the management measures proposed for ensuring the long term survival of this species are listed in Table 4.

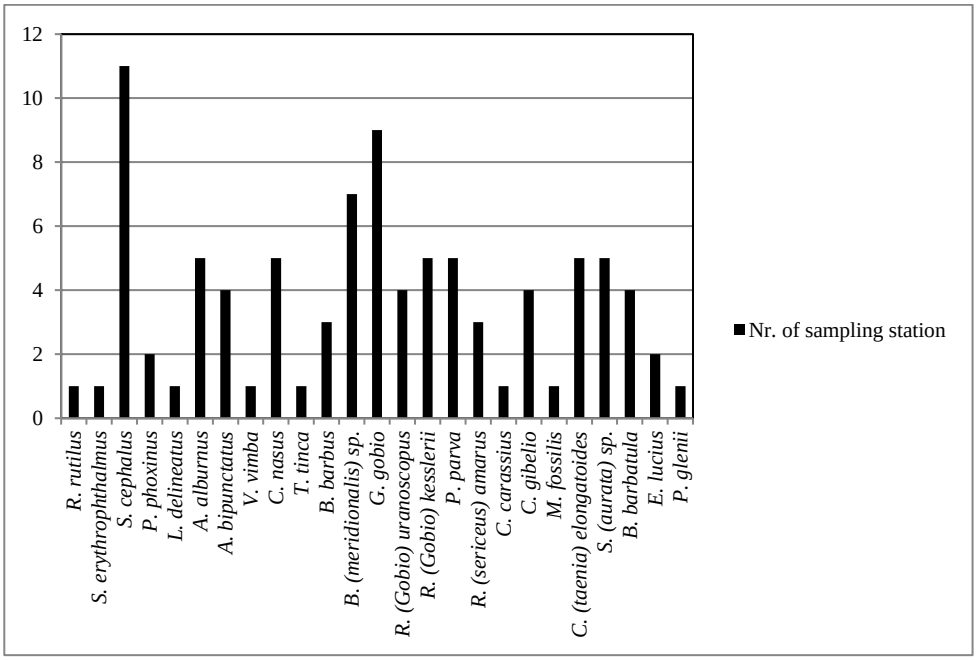

Figure 6. The occurrence of fish species in the ROSCI0364 Natura 2000 site.

Table 4. The main threat factors and management measures for the target species detected.

Species affeted	Threat factor	Management measures	Natura 2000 sites
E. mariae, B. (meridionalis) sp.	The lack of trees on the bank of the river/tributaries: causes the faster heating of the water and the decrease in dissolved oxygen level, also causes lack of the shelter places;	It is necessary planting trees (alder, willow) near river/streams to provide water surface shading. Cutting down trees from the banks of the river/tributaries should be banned.	ROSCI0321
E. mariae, B. (meridionalis) sp.	Expanding settlements along the river bank, building houses right next to them: entails the loss of floodplain, habitats, trees and the need for flood prevention works in the riverbad - barriers.	Human construction should be banned in the floodplaine, existing illegal buildings should be removed/replaced.	ROSCI0321
E. mariae, B. (meridionalis) sp.	Micro hyropower plants: loss of habitat, continuous disturbance, fragmentation.	The construction of new small hydropower plants and any work or interventions that lead to decreased debit (e. g. abstraction) or debit variations should be banned in the protected area and its vicinity.	ROSCI0321

Species affeted	Threat factor	Management measures	Natura 2000 sites
E. mariae, B. (meridionalis) sp., *C. (taenia) elongatoides, M. fossilis, R. (Gobio) kesslerii, R. (Gobio) unanoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Water pollution: settlements along the watercourses discharge wastewater into the river/stream;	The discharge of household wastes/wastewater and/or industrial in rivers/streams will be banned. Purification stations in the area to be repaired/upgraded to meet current standards. Big polluters should be eliminated.	ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364
E. mariae, B. (meridionalis) sp., *C. (taenia) elongatoides, R. (Gobio) kesslerii, R. (Gobio) uranoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Exploitation of sand and gravel from the riverbed: results turbid water, fragmentation, loss of hiding, feeding and breeding habitats;	For gravel pits must be developed an integrated plan of operation (which can be implemented only on the law, regularly inspected by the custodian). It should be prohibited direct extraction of sand and gravel from the riverbed and the water can't be reintroduced in the river without proper decanting. If possible is necessary to designate "quiet areas", where extraction is banned during the implementation of the Management Plan. Areas should have minimum of 5 km length.	ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364
E. mariae, B. (meridionalis) sp., *C. (taenia) elongatoides, M. fossilis, R. (Gobio) kesslerii, R. (Gobio) unanoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Maintenance and flood prevention: loss of hiding, feeding and breeding habitats, also causes the death of the fish specimens.	Consolidation of banks should be regulated by the custodian to prevent the homogenization of habitats. Flood prevention work must be developed without destroying banks, without concreting, without tree cutting and without construction of bottom thresholds. Maintenance should be executed only in autumn.	ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364
B. (meridionalis) sp., *S. (aurata)* sp., *R. (Gobio) kesslerii, R. (Gobio) uranoscopus*	Forest exploitation: clear-cutting results the driving of suspended solids (especially ground, mud from forest roads) in the minor river beds of streams by floods, causing death by clogging gills of fish species and also death of the eggs. Clear-cutted areas can't retain enough water during rainfall and this results also increased floods	Forest exploitation must be monitored and strictly regulated in a way that does not endanger the conservation of fish species: clear-cutting must be banned on the left and right riverside along the river/tributaries. Exploitation upstream the sites should be controlled because it has an effect on the sites fish fauna.	ROSCI0321, ROSCI0365

Species affeted	Threat factor	Management measures	Natura 2000 sites
B. (meridionalis) sp., *Cobitis (taeania) elongatoides, M. fossilis, R. (Gobio) kessleri, R. (Gobio) uranoscopus, R. (sericeus) amarus, S. (aurata)* sp.	The presence of invasive fish species (*P. parva, C. gibelio, P glenii*): habitat, food and reproduction competition for the protected species, which ends for the invasive species benefit.	Controlling the introduction of species in the natural and artificial habitats and prohibiting the introduction of invasive species (e.g. *Carassius gibelio, Lepomis gibbosus, Perccottus glenii, Ictalurus nebulosus, Pseudorasbora parva*)	ROSCI0365, ROSCI0363, ROSCI0364
B. (meridionalis) sp., *C. (taenia) elongatoides, M. fossilis, R. (Gobio) kessleri, R. (Gobio) uranoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Drying up: loss of hiding, feeding and most importantly the reproduction habitats.	In the case of habitats threatened with drying up must be maintained connectivity with the Moldova River or another source of water throughout the year, but especially in spring (during spawning).	ROSCI0365, ROSCI0363, ROSCI0364
M. fossilis	Reducing habitat connectivity due to anthropogenic impacts causes: fragmentation, population decrease and genetic isolation.	Any fragmentation in the habitat of the species that can prevent the movement of the fish should be banned. This is important especially in spring (during spawning). A separate rehabilitation measure is needed for the habitat of this species in order to conserve it. Another important measure: ensuring connectivity of its habitats with Moldova River, in order to ensure spread the larvae and juveniles during and after the spawning period.	ROSCI0365, ROSCI0363, ROSCI0364
E. mariae, B. (meridionalis) sp., *R. (sericeus) amarus, R. (Gobio) kessleri, R. (Gobio) uranoscopus, S. (aurata)* sp.		The micro hydropower plant next to Roman needs to be equipped with a functional fish ladder, the concrete threshold from Câmpulung Moldovenesc also (it has a fish ladder, but is not functional). Other thresholds must be removed (concrete, wood) from the riverbeds; upstream and downstream migration/movement must be ensured through bypass channels and/or functional fish ladders. The construction of dams or other barriers higher than 20 cm should be banned everywhere.	ROSCI0321, ROSCI0363, ROSCI0364

Species affeted	Threat factor	Management measures	Natura 2000 sites
M. fossilis	Transforming the habitat into a fishing lake: standing waters, if transformed into artificial lakes to serve fishermans, becomes a danger for the native species, because alien species will be introduced and the habitat characteristics will be changed.	The transforming of natural habitats into fishing lakes should be banned, all natural habitats conserved and intensive fishing should be excluded.	ROSCI0363, ROSCI0364, ROSCI0365
B. (meridionalis) sp., *Cobitis (taeania) elongatoides, M. fossilis, R. (Gobio) kesslerii, R. (Gobio) uranoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Creating new fishing lakes near the river. These anthropogenic habitats are perfect habitats for the invasive species which can escape in the natural waters.	Creating new fishing lakes near the river (closer than 500 m) should be banned. Connection with the river of the new fishing lakes (which are minimum 500 m away) is prohibited.	ROSCI0363, ROSCI0364, ROSCI0365
E. mariae, B. (meridionalis) sp., *C. (taenia) elongatoides, M. fossilis, R. (Gobio) kesslerii, R. (Gobio) unanoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Poaching: several types is practiced, even with electricity. Electricity kills not only the desired individuals, but all the organisms in the water.	Every type of poaching should be eliminated, the watercourses need to be monitored continuously.	ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364
E. mariae, B. (meridionalis) sp., *C. (taenia) elongatoides, M. fossilis, R. (Gobio) kesslerii, R. (Gobio) unanoscopus, R. (sericeus) amarus, S. (aurata)* sp.	Storage of waste on the waterfront (especially sawdust): sawdust introduces in the water results the clogging gills of fish species and lack of oxigen.	Storage of waste and sawdust should be banned, riversides should be monitored and existing waste should be removed/replaced.	ROSCI0321, ROSCI0365, ROSCI0363, ROSCI0364

Conclusions

1. We could detect the presence of all the fish species of Community interest that were present in the Standard Data Form of the Natura 2000 sites along the River Moldova.

2. A total of 33 fish species were detected from the 65 sampling stations in the four Natura 2000 sites, of which eight were species of Community interest (Table 2; 3). In every protected area we detected the presence of other fish species of Community interest: ROSCI0321 – *Barbus (meridionalis)* sp., *Romanogobio (Gobio) uranoscopus, Sabanejewia (aurata)* sp. (of which we recommended only the *B. (meridionalis)* sp. to be added to the Standard Data Form of the site); ROSCI0365 – *Cobitis (taenia) elongatoides, Misgurnus*

fossilis, Romanogobio (Gobio) kesslerii, Romanogobio (Gobio) uranoscopus (we recommended all of them); ROSCI0363 – *Misgurnus fossilis and Romanogobio (Gobio) kesslerii* (we recommended both); ROSCI0364 – *Misgurnus fossilis, Rhodeus (sericeus) amarus, Romanogobio (Gobio) kesslerii, Romanogobio (Gobio) uranoscopus*. We recommended all of them to be introduced on the Standard Data Forms of the sites, and these recommendations were accepted and the list of the fish species of these sites was completed.

3. We identified the main threat factors and proposed management measures in order to ensure the long-term survival of the fish species of Community interest of the four Natura 2000 site surveyed (Table 4). Theses management measures once implemented, they will ensure the long-term survival of all the fish species detected. The main threat factors are the exploitation of sand and gravel, habitat fragmentation, invasive fish species, water pollution, flood protection works and the drying up of habitats. From the Community interest fish species detected the *Misgurnus fossilis* is in the greatest danger: it is present in only 6 sampling stations and its habitat is mainly isolated, exposed to human impact. The conservation of its remaining habitat and other possible habitats is inevitable and at this stage artificial propagation of this species and its rare co-species (*Carassius carassius, Tinca tinca*) and growth in captivity of juvenile can be a solution in order to repopulate the potential habitats and to displace the invasive species (Imecs *et al.*, 2015). Besides the ex-situ conservation measures new habitats can also be created for these species based on their habitat requirements (Tatár *et al.*, 2015).

Acknowledgements

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HERPETOFAUNA OF THE NATURA 2000 SITE “CHEILE ȘUGĂULUI-MUNTICELU” (ROSCI0033), ROMANIA

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Abstract. In this paper we present the results of a herpetological faunistic study conducted in the Natura 2000 site ROSCI0033 Cheile Șugăului-Munticelu, situated at the western limit of Neamț County, in the Eastern Carpathian Mountains. Based on field surveys conducted during June-August 2015, we report the presence and map the local distribution of four species of amphibians (*Salamandra salamandra, Bombina variegata, Bufo bufo, Rana* temporaria) and seven species of reptiles (*Anguis colchica, Lacerta agilis, Zootoca vivipara, Podarcis murlais, Coronella austriaca, Natrix natrix, Vipera berus*). Two other amphibian species (*Triturus cristatus* and *Lissotriton montandoni*) were also listed in the standard data form of the Natura 2000 site, but were not confirmed by our survey. Overall, our study reveals a greater number of species of herpetofauna than previously listed, and we recommend that the site’s standard data form to be updated in order to reflect the known situation.

Keywords: reptiles, amphibians, Carpathian Mountains, Neamț County, standard data form.

Rezumat. **Herpetofauna sitului Natura 2000 „Cheile Șugăului-Munticelu” (ROSCI0033), România.** În această lucrare prezentăm rezultatele unui studiu herpetologic realizat in situl Natura 2000 ROSCI0033 Cheile Șugăului-Munticelu, localizat la limita vestică a Județului Neamț, în Carpații Orientali. În baza cercetărilor ce au avut loc în perioada Iunie – August 2015, raportăm prezența a patru specii de amfibieni (*Salamandra salamandra, Bombina variegata, Bufo bufo, Rana* temporaria) și a șapte specii de reptile (*Anguis colchica, Lacerta agilis, Zootoca vivipara, Podarcis murlais, Coronella austriaca, Natrix natrix, Vipera berus*). Alte două specii de amfibieni (*Triturus cristatus* și *Lissotriton montandoni*) se regăsesc în formularul standard al sitului, dar noi nu am putut confirma prezența acestora. Studiul nostru evidențiază prezența unui număr mai mare de specii în sit decât cele enumerate anterior, de aceea recomandăm actualizarea formularului standard, pentru a reflecta situația reală.

Cuvinte cheie: reptile, amfibieni, Carpații Orientali, Județul Neamț, formular standard.

Introduction

The Carpathians represents the largest mountain chain of Central Europe, measuring approx. 1400 km in length, the largest part of the mountain chain being in Romania (approx. 52.9%). The Carpathians comprise numerous natural environments rich in habitat types and wildlife (Oszlányi *et al*., 2004; Bălteanu *et al*., 2008). The Carpathians host several endemic amphibian taxa (*Lissotriton montandoni* and *L. vulgaris ampelensis*) as well as large and widespread populations of species that are internationally endangered and facing rapid decline (e.g. *Bombina variegata*) (e.g. Cogălniceanu *et al*. 2013a).

The Natura 2000 site Cheile Șugăului-Munticelu (ROSCI0033) represents a protected natural area located at the western limit of Neamț County, in the Hășmaș Mountains. The importance of this site resides in the abundance of endangered plant species, such as *Cypripedium calceolus, Campanula serata, Iris aphyla* ssp. *hungarica*

(Rugină & Mititiuc, 2003; Chifu *et al*., 2006) However, so far, no reptiles and only three species of amphibians are listed in the Natura 2000 site's standard data form (*Bombina variegata, Triturus cristatus* and *Lissotriton (Triturus) montandoni*), despite the existing records of numerous other species in the immediate vicinity of the area (Gherghel & Ile, 2006; Ghiurcă & Gherghel, 2007; Gherghel *et al*., 2008a, b).

We thus aimed to conduct a more detailed investigation into the composition and distribution of the amphibian and reptile fauna from the studied area.

Material and Methods

The study area comprises the Cheile Șugăului-Munticelu Natura 2000 site and its immediate vicinities, located in the Hășmaș massif of the Eastern Carpathians, on the administrative territory of Bicaz Chei and Bicazu Ardelean communes (Figure 1), with an altitude range between 660 – 1382 m (mean 1020 m). The area is included in the alpine biogeographical region of Romania (Petrișor, 2008).

Field surveys were conducted during June-August 2015 with a frequency of 3 days per month. We made observations along transect surveys as well as active searches in 20 investigation sites (Figure 1). Each individual observed was morphologically identified using adequate literature (Fuhn, 1960; Fuhn & Vancea, 1961; Cogălniceanu *et al*., 2000), located (using Garmin handled GPS devices) and photographed. If individuals required capture for identifications, they were captured by hand and released into their habitat of origin immediately after determination.

Results and Discussion

During our surveys in the Cheile Șugăului-Munticelu Natura 2000 site, we recorded four species of amphibians (*Salamandra salamandra, Bombina variegata, Bufo bufo, Rana temporaria*) and seven species of reptiles (*Anguis colchica, Lacerta agilis, Zootoca vivipara, Podarcis muralis, Coronella austriaca, Natrix natrix, Vipera berus*) (Table 1, Appendix 1).

In some of the investigation sites we found individuals of *Bombina variegata*, one of the species for the site was designated, at the site limit (4, 8) or even outside the site (3, 5, 6, 19) (Figure 1). All the species identified in our field surveys are protected at national level by the OUG 57/2007, but also at international level by Directive 92/43 EEC[1] annexe. Some of the species are also included in the Red list of Vertebrates of Romania (*Salamandra salamandra, Bombina variegata, Bufo bufo, Rana temporaria, Anguis colchica, Coronella austriaca, Vipera berus*) (Iftime, 2005).

Only three species of amphibians are listed (*Bombina variegata, Triturus cristatus, Lissotriton* (*Triturus*) *montandoni*) in the standard data form of the site, but our survey confirms the presence of only one them (*B. variegata*). We suspect that the two newt species are indeed absent or very rare in the area, due to the lack of proper habitats. Both species typically require permanent or temporary clear water bodies with a rich vegetation on the shores (Fuhn, 1960), habitat types which were quite uncommon in our study area, especially due to the general steep relief that doesn't allow the formation of ponds. Nevertheless, the period in which we conducted our survey (June-August) is not ideal for detecting either newt species (Fuhn, 1960) and, as such, additional studies are required in order to confirm/infirm the presence of this two species in the area.

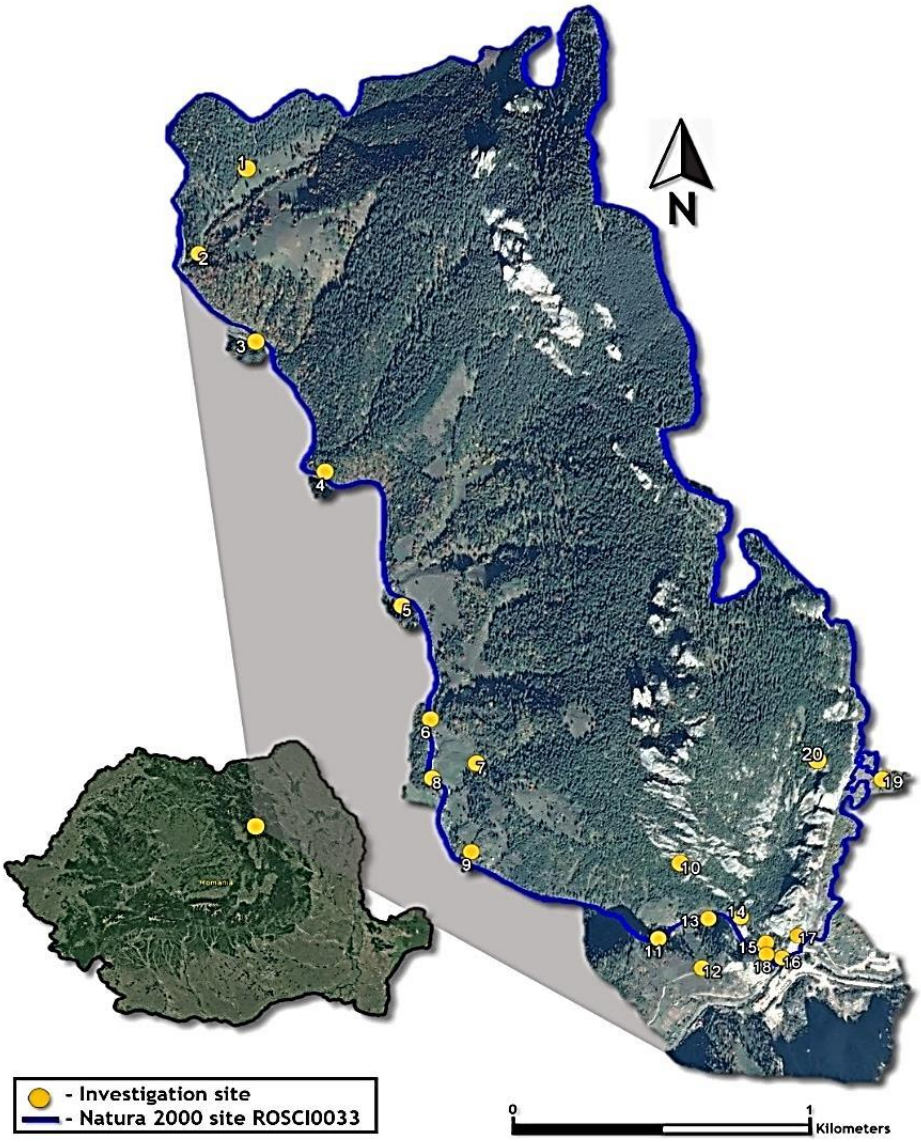

Figure 1. Localisation of the investigation site ROSCI0033 Cheile Șugăului-Munticelu.

Table 1. Geographical coordinates of the investigation sites and the species of amphibians and reptiles identified in ROSCI0033 Cheile Șugăului-Munticelu. The numbers correspond to the ones in Figure 2.

Site	Coordinates	Habitat type	Species found
1	46.849028° 25.828766°	Temporary pounds with clear water	*Bombina variegata* (Linnaeus, 1758)
2	46.846781° 25.826509°	Semi-open area with logs	*Zootoca vivipara* (von Jacquin, 1787)
3	46.844235° 25.828704°	Semi-open area with grassland, temporary ponds, rocks and logs	*Lacerta agilis* (Linnaeus, 1758), *Zootoca vivipara*, *Anguis colchica* (Nordmann, 1840), *Bufo bufo* (Linnaeus, 1758), *Bombina variegata*, *Rana temporaria* (Linnaeus, 1758), *Coronella austriaca* (Laurenti, 1768)
4	46.840346° 25.831446°	Semi-open swampy area with temporary ponds	*Bombina variegata*
5	46.836245° 25.834574°	Forest border with small ponds, rocks and rivulet with clear water	*Rana temporaria*, *Bombina variegata*, *Zootoca vivipara*
6	46.832667° 25.835708°	Semi-open area with grasslands and permanent ponds	*Rana temporaria*, *Bombina variegata*
7	46.831355° 25.837696°	Grasslands in an open area	*Vipera berus* (Linnaeus, 1758)
8	46.830770° 25.835754°	Swampy area with temporary ponds	*Natrix natrix* (Linnaeus, 1758), *Bombina variegata*
9	46.828431° 25.837422°	Open area with grasslands and temporary ponds	*Lacerta agilis*, *Rana temporaria*
10	46.828420° 25.846214°	Coniferous forest border	*Natrix natrix*
11	46.825569° 25.845536°	Temporary pounds with clear water	*Bombina variegata*
12	46.824555° 25.847475°	Open area with scattered rocks	*Anguis colchica Podarcis muralis*
13	46.826061° 25.847803°	Road	*Anguis colchica*
14	46.826211° 25.849152°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis* (Laurenti, 1768), *Natrix natrix*, *Salamandra salamandra* (Linnaeus, 1758)
15	46.825214° 25.850395°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis*
16	46.824530° 25.851259°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis*
17	46.825304° 25.851928°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis*
18	46.824783° 25.850454°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis*
19	46.830954° 25.854670°	Temporary pounds with clear water	*Bombina variegata*
20	46.831948° 25.851238°	Semi-open area with grasslands and scattered rocks	*Podarcis muralis*

Our study represents the first herpetological investigation strictly from Cheile Șugăului-Munticelu area. All the species recorded were reported before by several studies in the surrounding areas (Fuhn, 1960; Fuhn & Vancea, 1961; Ghiurcă *et al*., 2005; Gherghel & Ilie, 2006; Gherghel *et al.*, 2008a, b; Cogălniceanu *et al*., 2013a, b). The two newt species are reported from other sites in Neamț County, such as Cheile Bicazului – Hășmaș (ROSCI0027), which is located in the immediate vicinity of the study area, the Goșmani Mountains (ROSCI0152) and Vânători Neamț Natural Park, both located at about 300 km East (Ghiurcă *et al*., 2005; Gherghel & Ilie, 2006; Gherghel *et al.*, 2008a).

Overall, our study indicates that the Natura 2000 site Cheile Șugăului-Munticelu is inhabited by a greater number of amphibian and reptile species than mentioned in the standard data form. A very similar situation was recently described for another Natura 2000 site from the Eastern Carpathians (ROSCI0212 Rarău-Giumalău; Zamfirescu *et al*., 2016) and similar discrepancies are certainly more widespread throughout Romania (unpublished data). We thus recommend that the standard data form be updated according to the results of our survey. Furthermore, we recommend conducting similar faunistical inventories for all sites for which no recent field data exists, as the standard data forms represent the foundation for all financial efforts towards monitoring and preserving the biodiversity of Natura 2000 sites (Hoffmann & Hoffman-Berei, 2014). For some sites, simply comparing the data available in the relevant literature for that particular area to the information comprised in the standard data form could offer initial insight into possible discrepancies in qualitative data (e.g. Melenciuc 2014 – MSc Thesis).

Conclusions

During our surveys in Natura 2000 site ROSCI0033 Cheile Șugăului-Munticelu, we have identified four species of apmhibians (*Salamadra salamandra, Bufo bufo, Bombina variegata, Rana temporaria*) and seven species of reptiles *(Anguis colchica, Lacerta agilis, Zootoca vivipara, Podarcis muralis, Coronella austriaca, Natrix natrix* and *Vipera berus* (Appendix 1). Except for *Bombina variegata,* none of the aforementioned species are included in the standard data form.

Two other amphibian species (*Lissotriton montandoni* and *Triturus cristatus*) that are mentioned in the standard data form have not been recorded during our survey, and we suspect that they are either absent or particularly rare.

Our study contributes to underlying the trend that information contained in standard data forms for Romanian Natura 2000 sites frequently differ to reports clearly based on field evidence.

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Appendix 1.

Species encountered in the Cheile Şugăului-Munticelu (ROSCI0033) site: a - *Bombina variegata* pond; b - *Bombina variegata*; c - *Anguis colchica*; d - *Lacerta agilis*; e - *Zootoca vivipara*; f - *Podarcis muralis*; g - *Coronella austriaca*; h - *Natrix natrix.*

A HISTORY OF THE BIRDS RESEARCH FROM THE ARGEȘ COUNTY (UNTIL 2015)

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Abstract. This paper presents a history of the birds' research from the Argeș County, from the first known records, from the 19th century, when the authors of that time investigated the Transylvanian avifauna, with references to the Făgăraș birds, until 2015. There are mentioned works about the hunting avifauna, many of them recording the decline and disappearance of species in our country. Other articles have as subject the species distribution, phenology or their protection. Also, major works about the whole Romanian avifauna are passed in review, an important place having here the writings of Dombrowski and Linția. The activity of Mircea Mătieș could not be overlook, too, although many of his observations could not see the print light. Recent publications, regarding mainly the ornitofauna of the dam reservoirs from the Argeș or the avifauna of Râul Doamnei, have also a particular place. Not least, it is worth to mention some works of ethnic folklore, which give an image of the wild birds' presence in the life of the former inhabitants of this area. Certainly, a number of titles have been omitted, the paper wishing to be, from the beginning, a starting point for further and more detailed research of this type.

Keywords: history, ornithological research, Argeș, Romania.

Rezumat. Un istoric al cercetării păsărilor din județul Argeș (până în 2015). În această lucrare, este prezentat un istoric al cercetării păsărilor din Argeș, începând de la primele consemnări cunoscute, din secolul 19, când autorii vremurilor cercetează avifauna transilvăneană, făcând referiri și la păsările Făgărașului, până în 2015. Sunt amintite lucrări care tratează avifauna cinegetică, multe dintre acestea consemnând declinul sau dispariția unor specii din țara noastră. Alte articole au ca subiect distribuția speciilor de păsări, fenologia ori protecția lor. De asemenea, sunt trecute în revistă lucrări de anvergură, care se ocupă de avifauna de ansamblu a României, un loc de seamă având-l, aici, operele lui Dombrowski și Linția. Activitatea regretatului Mircea Mătieș nu a putut fi trecută, nici ea, cu vederea, chiar dacă multe dintre observațiile sale nu au putut vedea lumina tiparului. Aparițiile mai recente, care vizează cu precădere ornitofauna lacurilor artificiale din bazinul Argeșului sau avifauna Râului Doamnei, au, și ele, un loc aparte. Nu în ultimul rand, merită menționate câteva lucrări de etnofolclor, care oferă o imagine a prezenței păsărilor sălbatice în viața de odinioară a locuitorilor acestei zone. Cu siguranță, un număr de titluri au fost omise, lucrarea dorindu-se a fi, încă de la început, un punct de plecare pentru alte cercetări, mai amănunțite, de acest tip.

Cuvinte cheie: istoric, cercetări ornitologice, Argeș, România.

The earliest information about the birds from Argeș County comes from the 19th century. Landbeck, Bielz, Csató and Czynk researched the Transylvanian avifauna and, in this context, they refer to the birds from the peaks of the Făgăraș Massif. For instance, Landbeck (1842), in the work "Säugetiere und Vögel Siebenbürgens", mentions the Rock Ptarmigan (*Lagopus mutus*), Bielz (1888), in "Die Fauna der Wirbelthiere Siebenburgens nach ihrem jetzigen Berstande", treats the vertebrates of Transylvania, Csató (1880), in "Beobachtungen über den Bartgeier (*Gypaetus barbatus* CUV.) in Siebenbürgen" gives some details regarding the observation of the bearded vulture (*Gypaetus barbatus*) at Viștea Mare, in Făgăraș Massif, Czynk (1892), in "Der Herbstzug 1891 in Fogorascher Comitat (Siebenbürgen)", writes about the avifauna of Făgăraș Department. Also, Csató (1877,

1881, 1891, 1894), in a series of papers ("A sascheseliü, *Gypaetos barbatus* Cuv., Erdélyben.", "Beobachtungen über den Schreiadler, *Aquila naevia,* Br.", "*Aquila clanga* Pall. und *A. pennata* Gm., in der Umgebund von Nagyenyed brütend" and "*Tetrao tetrix* in Siebenburgen"), reports about the distribution of the lammergeyer (*Gypaetus barbatus*), eagles (*Aquila* sp.) and black grouse (*Lyrurus tetrix*) in the Făgăraș Mountains. As a matter of fact, the occurrence and the decline of the vultures and eagles in the Carpathians were ones of the popular avifaunistical subjects mainly from the end of the 19th century until the middle of the 20th century. Also, these have been approached by: von Spiess (1898), in "Kammwanderung: Negoi-Bulea, als Schluss-Excursion des IV. Jahrganges 1897 der Infanterie-Kadettenschule in Hermannstadt", Fuhrer (1904), in "Ein Ausflug in das Negoi-Gebiet", Florstedt (1928) in "Den Hochgebirgen Asiens und Siebenburgens", Călinescu (1938), in "Vânatul nostru alpin, de pădure și de stepă", N. P. (1939), in "Din munți și din câmpii – Ied de capră neagră omorât de acvilă", v. Spiess (1941a, b, c, d), in "Acvile și vultani în România". Few works on this theme were issued after 1950, too: "Pe urmele zăganului" (Comșia, 1959), "Istoria vânătorii în România" (Nania, 1977), "Die Adler und Geier Siebenburgens" (Iacobi, 1984).

Another species that benefited of attention because of its decline was the Great Bustard (*Otis tarda*), which has been hunted (legally or illegally) over time almost to extinction in Romania. Its situation in Argeș County was exposed mainly in hunting papers: "Dropia (Struțul de Europa)" (Cornescu, 1925), "Dropia și poleiul" (***, 1952), "Criterii provizorii pentru determinarea bonității fondurilor de vânătoare din R.P. Română" (Popescu *et al*., 1961), "Dropiile în Argeș" (Georgescu, 1961), "Răspândirea speciilor de vânat din R.P.R." (Almășan & Popescu, 1963), "Dropia" (Barbu, 1968), "Dropia" (Barbu, 1976), "Dropia între migrație și dispariție" (Georgescu, 2012). [An excellent analisis on this aspect appeared recently in "Dropia în România. Studiu Biogeografic" (Geacu, 2016)].

Data about the species from the Tetraonidae family were published in magazines about hunting or in synthesis works: "Die Fauna der Wierbelthiere Siebenburgens nach ihrem jetzigen Bestande II Klasse. Aves" (Bielz, 1888), "Premiul I al concursului asupra cocoșului de munte (*Tetrao urogallus*)" (Schneider-Snyder, 1926), "Vânatul în Ardeal, înainte cu 50 de ani" (Olteanu, 1934), "Cocoșul de mesteacăn" (Anonymus, 1936), "Rotitul în 1962", (Georgescu, 1962), "Să cunoaștem mai bine ierunca" (Almășan, 1963), "Contribuții la cunoașterea răspândirii cocoșului de mesteacăn" (Matic, 1965), "Locuri de rotit în Argeș" (Georgescu, 1966), "Despre greutatea cocoșului de munte" (Almășan *et al*., 1969), "Bătăi știute și neștiute" (Georgescu, 1970), "Istoria vânătorii în România" (Nania, 1977), "Cocoșul de câmp, cocoșul de pădure sau cocoșul aldai" (Nania, 2000). Noticeable is also "A hazai vadak tereszetrajza (A vadászati ismeretek Kézikönyve II.)", where Szécsi (1892) refers again to the Rock Ptarmigan (*Lagopus mutus*).

"Ornis Romaniae. Die Vogelwelt Rumanien's systematisch und biologisch-geographisch beschrieben" (Dombrowski, 1912) is the fundamental writing in the Romanian ornithology. It was arranged, completed, and translated in Romanian by Linția (Dombrowski, 1946, Linția, 1954, and Linția, 1955), who published "Păsările României. Ornis Romaniae" and "Păsările din R.P.R.", in two volumes. From Argeș County, there are few accurate notes: ones regarding the lammergeyer (*Gypaetus barbatus*) and one about the sombre tit (*Parus lugubris*), found at Muscel.

In **"**Migrația păsărilor", Rudescu (1958) offered some data on the birds' migration in the Făgăraș Mountains. Other authors discuss this subject, too. Previously, in "Sitarii",

Dumitrescu (1939) presented the situation of the woodcock (*Scolopax rusticola*) in the Carpathians and the southern hills and, subsequently, in “Der Weisstorch-Bestand im Gebiet von Sibiu (Hermannstadt) in Siebenbürgen 1963 u. 1967”, Klemm (1969) mentioned a flock of white storks (*Ciconia ciconia*) observed in flight over the mountain ridge, right next to Bâlea Lake. Theiss (1971), in “Date privind migrația berzelor în România”, gave other information on this last species. Beldi (1968), in “Atvonuló fehérgólyák és gyurgyalagok a Délikárpátok fölött”, mentioned the flight of a flock of bee-eater (*Merops apiaster*) close to the Moldoveanu Peak and Munteanu and Rășinaru (1996), in “Migrația de primăvară a codobaturii albe (*Motacilla alba*) în România”, synthesised the observations from our country about the migration of the white wagtail (*Motacilla alba*).

More issues on the species distribution appear. In “Avifauna alpină a Carpaților românești”, Cătuneanu and Pașcovschi (1960) allude to the avifauna observed in the alpine area of the Carpathians, during 1930-1960, with some references to the species registered in the Făgăraș Massif. Also, Cătuneanu (1964, 1965) published “La nidification d'épervier commun (*Accipiter nisus* L.) dans la R. P. Roumaine” and “Contributions à la connaissance de la répartition et de l'erratisme de la tichodrome échelette (*Tichodroma muraria* (L.)) en Roumanie”. Papadopol (1965), in “Contributions à la connaissance de la systématique, répartition et biologie d'*Alcedo atthis* (L.) en Roumanie”, studying a vast material from Romania, showed the distribution of the common kingfisher (*Alcedo atthis*) in our country. Tălpeanu (1966, 1967) carried out “Les Falconiformes de Roumanie” where he refers to certain individuals of birds of pray, currently preserved at the National Museum of Natural Science “Grigore Antipa” from Bucharest, Brukenthal Museum from Sibiu, Banat Regional Museum from Timișoara, and Museum of the University “Al. I. Cuza” from Iași, or observed by himself, that originated from the Argeș County. In “Cocoșarul cuibărește în Carpații Meridionali”, Radu and Zsiros (1975) cover the fieldfare (*Turdus pilaris*) breeding at Câmpulung, the most southern point of species breeding known at that time. In “Răspândirea ciușului (*Otus scops* L.) în România” (Kalabér, 1975), an observation refers to Argeș ornithofauna: an individual of European scops owl (*Otus scops*) was found at Mihăești. Other similar contributions: “Presura bărboasă și codobatura cu cap negru își extind arealul în România” (Radu, 1972), “Madártani megfigyelések a Fogorasihavasokban” (Solti, 1977), “Contributions à la connaissance de l'espèce *Dryocopus martius* (Aves, Picidae) en Roumanie” (Papadopol & Mândru, 1977), “Contribution à la connaissance de l'avifaune des départements d'Argeș et de Dâmbovița (Roumanie)” (Papadopol, 1979), “Expansion récente de quelques espèces d'oiseaux en Roumanie” (Tălpeanu & Paspaleva, 1979), “New data on the avifauna of the southern slope of the Făgăraș Mountains (Romania)” (Petrescu, 2005).

There are amount of information on the birds' distribution in Argeș County in publications of atlas type, too: “Păsările clocitoare din România” (Ciochia, 1992), “Atlasul provizoriu al păsărilor clocitoare din România” (Munteanu *et al*., 1994), “Atlasul păsărilor clocitoare din România” (Munteanu *et al*., 2002).

“Cartea Roșie a Vertebratelor din România” presents the species of vertebrates from Romania comprised in the National Red List and, here, there is also some data about the presence of the birds in Argeș County (Munteanu, in Botnariuc & Tatole, 2005).

A series of facts regarding the birds from the Argeș County (or Făgăraș Mountains) are found in publications of catalogue type: “Catalogul sistematic al colecției ornitologice a Muzeului de Științele Naturii Aiud” (Lorincz, 1980), “Catalogue des

collections ornithologiques provenant de Roumanie conservées au Muséum d′Histoire Naturelle «Grigore Antipa». Gaviiformes-Gruiformes" (Papadopol & Tălpeanu, 1986), "Catalogue des collections ornithologiques provenant de Roumanie conservées au Muséum d′Histoire Naturelle « Grigore Antipa ». Charadriiformes-Passeriformes" (Papadopol & Tălpeanu, 1987), "Bird nest collection of « Grigore Antipa » National Museum of Natural History (Bucharest)" (Petrescu, 2005), "Catalogus ornithologicus" (Stein & Würdinger, 2005), "Colecția oologică Ion Cătuneanu din Complexul Muzeal de Științele Naturii Galați" (Patriche & Manci, 2006), "Catalogul habitatelor, speciilor și siturilor Natura 2000 în România" (Brânzan *et al*., 2013).

"Păsările din Carpați" (Radu, 1967) treats globally the birds from Romanian Carpathians, but, generally, it did not refer precisely at the distribution of the species in the mountains. Ernst (1977) in "Ornithologische Beobachtungen im Făgăraș Gebirge/Sudkarpaten und im Măcin Gebirge in der S. R. Rumanien" presented his observations regarding the avifauna of the Făgăraș Mountains.

The breeding of the Dotterel (*Charadrius morinellus*) in the Făgăraș Mountains was presumed earlier (Linția, 1955), but the first that confirms that fact is Weber (1970). In "Prundărașul de munte cuibărește în Munții Făgăraș?" he mentioned that the species was observed at Tăul Doamnei and in the upper part of the Vidraru Dam Reservoir.

"La situation des oiseaux rapaces diurnes et le problème de leur protection en Roumanie" (Kalabér, 1982) offers a general view of the distribution and threats on the birds of pray from Romania. The author does not mention places of observations from the Argeș County but gives some indices regarding their distribution and ecology.

"Die Ornis Siebenbürgens" (Klemm & Kohl, 1988) is an ample deed that contains the observations of the authors and other ornitologists regarding the birds from Transylvania. Here, there are some notes on the birds from the heights of the Făgăraș Mountains. Even if many of the observations did not appertain to the Argeș County, they prove the occurrence of those species in the similar habitats from this area.

The birds from Piatra Craiului Mountains were the exclusive subject in more papers: "Preliminary list of the avifauna of Piatra Craiului Massive (Romania)" (Petrescu, 1995), "A pilot bird survey in Piatra Craiului Natural Park, 2001-2002" (Feneru *et al*., 2005), "Ornithological research in Piatra Craiului National Park" (Mestecăneanu & Conete, 2006), "Researches on bird's densities in Piatra Craiului National Park" (Mestecăneanu, 2006).

Mircea Mătieș occupies an important position in the ornithological research from the Argeș County. Individually or in collaboration with other authors, he studied intensely the distribution and the migration of the birds. In "Cercetări biometrice, morfologice și sistematice cu privire la populația de *Lanius excubitor* L. din Republica Socialistă România" (Mătieș, 1968), he made a biological and morphological analysis about the population of the great grey shrike (*Lanius excubitor*) from Romania. He returned to this theme in "Primele date asupra cuibăritului sfrânciocului mare (*Lanius excubitor* L.) în Oltenia și Muntenia", where he presented the distribution of the species in the southern parts of the Carpathians (Ciochia & Mătieș, 1980). In 1969, the same author published "Cercetări avifenologice de-a lungul bazinului mijlociu și superior al Argeșului între 1 ianuarie-31 mai 1968", a valuable work at local and national level on the birds' migration (Mătieș, 1969). Also, in 1971, in "Contribuții la cunoașterea migrației carpatice a păsărilor", he gave new information on the birds' migration over the Carpathians

Mountains (Mătieș, 1971). The migration was a topic in other works, too, many of them elaborated together with Dan Munteanu, currently, member of the Romanian Academy: “Păsări de baltă care au traversat culmea Făgărașului” (Mătieș, 1971), “The seasonal movements of the quail (*Coturnix coturnix* L.) in Romania” (Munteanu & Mătieș, 1974), “Prezența spîrcaciului în Carpații Meridionali și Câmpia Română” (Mătieș & Vulpe, 1975), “Sitarul - migrație, vînătoare, ocrotire” (Mătieș & Munteanu, 1976), “Migrația păsărilor prin defileul Olt” (Mătieș, 1977), “Migrația de primăvară a grangurului” (Munteanu & Mătieș, 1978), “La dinamique saisonnière de la bécasse des bois (*Scolopax rusticola*) en Roumanie” (Mătieș & Munteanu, 1979), “Pasajele timpurii și târzii la sitar” (Mătieș & Munteanu, 1980), “Modificări induse de lacurile de acumulare în structura și dinamica avifaunei” (Munteanu & Mătieș, 1983), and “Les routes de migration des oiseaux en Roumanie” (Mătieș, 1986).

In “Izvoarele «Colcot» de lângă Topoloveni (jud. Argeș) – loc de iernare pentru păsări” (Mătieș *et al*., 1969), observations about the wintering birds on some springs, close to Pitești, are presented. New scientific data regarding four species from the middle and upper hydrographical basin of the Argeș River: the red-breasted goose (*Branta ruficollis*), the capercaillie (*Tetrao urogallus rudolfi*), the black woodpecker (*Dryocopus martius*), and the rock bunting (*Emberiza cia*) were revealed two years later in “Alte exemplare document în colecția ornitologică a Muzeului din Pitești” (Mătieș & Gava, 1971). “Contribuții privind cunoașterea situației actuale a păsărilor răpitoare de zi, ord. Falconiformes, din județul Argeș (perioada 1967 - 1973)” (Mătieș, 1974) is the first work that presents the situation of the rapacious birds from the Argeș County.

In the last years, the avifauna of the Argeș River itself, particularly the one of the dam reservoirs between Vâlcele and Golești, constituted a theme of research and, consequently, a lot of papers were published: “Acumulările hidroenergetice de pe râul Argeș, posibile Arii de Importanță Avifaunistică*”* (Gava, 1997), “Date despre prezența a 12 ordine de păsări (Aves), cu dinamica anseriformelor pe lacul Pitești în iarna 2002 – 2003” (Mestecăneanu *et al*., 2003), “Cercetări privind avifauna zonei lacului de acumulare Budeasa în perioada 2002-2004” (Conete & Mestecăneanu, 2004), “The reservoirs of the Argeș River valley – important bird areas” (Gava *et al*., 2004a), “Recensământul păsărilor de baltă din ianuarie de pe lacurile din bazinul mijlociu al râului Argeș, în perioada 2000 – 2004” (Gava *et al*., 2004b), “Contribuții la cunoașterea păsărilor clocitoare din bazinul mijlociu al râului Argeș” (Mestecăneanu *et al*., 2004a), “Date despre prezența anseriformelor pe lacul Pitești în primăvara anului 2003” (Mestecăneanu *et al*., 2004b), “Date despre prezența păsărilor pe lacul Pitești în toamna anului 2003” (Mestecăneanu *et al*., 2004c), “Cercetări ornitologice pe valea râului Argeș în zona lacului de acumulare Bascov” (Conete *et al*., 2005a), “Observații de tip monitoring asupra păsărilor de baltă de pe lacul de acumulare Bascov – râul Argeș, în perioada 2000 – 2004” (Conete *et al*., 2005b), “Observații de tip monitoring asupra păsărilor de apă de pe lacul Pitești (bazinul Argeșului)” (Gava *et al*., 2005), “Gâsca cu gât roșu pe lacul de acumulare Pitești” (Mestecăneanu, 2005), “Observations of Monitoring Type about the Water Birds from the Golești Accumulation Lake – Argeș River” (Mestecăneanu *et al*., 2005b), “The census of the waterbirds from the Vâlcele Reservoir in January 2000 – 2004” (Conete *et al*., 2006a), “Speciile de păsări din situl AIA „Lacurile de acumulare de pe Argeș” protejate pe plan național și european” (Conete *et al*., 2006b), “Observații de tip monitoring asupra păsărilor de apă de pe lacul Budeasa (bazinul Argeșului)” (Mestecăneanu *et al*., 2006a), “The

avifauna of Basin Goleşti" (Mestecăneanu *et al*., 2006b), "Observaţii avifaunistice pe valea râului Argeş" (Mestecăneanu *et al*., 2006c), "Ornithological observations made in the area of Budeasa basin in hiemal and prevernal aspects (2005 - 2006)" (Mestecăneanu *et al*., 2006d), "The Avifauna of the Middle Basin of Argeş River Artificial Lakes" (Gava *et al*., 2007), "Ornithological observations on the Argeş River in the sector between the Bascov and Piteşti Basins" (Mestecăneanu *et al*., 2007a), "Statutul de protecţie al păsărilor din zona lacurilor de acumulare de pe râul Argeş" (Conete *et al*., 2008a), "Păsările de pe lacul de acumulare Piteşti şi probleme de protecţie a lor" (Conete & Mestecăneanu, 2008), "Ecological researches about avifauna of the Bascov Basin in the hiemal and prevernal aspects (2008 - 2009)" (Conete *et al*., 2008b), "Avifauna din zona lacurilor de acumulare din bazinul mijlociu şi superior al Argeşului şi statutul ei de protecţie" (Gava *et al*., 2008), "Avifauna lacurilor de acumulare de pe râul Argeş dintre Vâlcele şi Goleşti şi statutul ei de protecţie în baza Directivei Păsări" (Mestecăneanu *et al*., 2008a), "Ornithological observation in the zone of the Piteşti Basin between June 2005 and May 2006" (Mestecăneanu *et al*., 2008b), "Ecological research about the avifauna of the Piteşti Basin (Hydrographic Basin of Argeş River)" (Conete *et al*., 2009a), "Ecological researches on the avifauna of the Goleşti basin in the hiemal and prevernal aspects (2008 - 2009)" (Conete *et al*., 2009b), "Data concerning the ornithofauna from the Piteşti Reservoir in the winter 2007 – 2008" (Conete *et al*., 2009c), "Ornithological researches regarding the avifauna from the Piteşti basin in the hiemal and prevernal aspects (2009 - 2010)" (Conete *et al*., 2009d), "Observations regarding the occurrence of the species *Phalacrocorax pygmeus* Pallas, 1773 and *Aythya nyroca* Linnaeus, 1758 on the basins from the Argeş River (Romania)" (Conete *et al*., 2010a), "Ecological researches about the avifauna of the Budeasa Basin (Argeş River, Romania) in the hiemal and prevernal aspects (2008 – 2009)" (Conete *et al*., 2010b), "Ecological research-studies regarding the avifauna during the hiemal period from the basins area of the Argeş River between 2000 and 2010" (Mestecăneanu *et al*., 2010), "The breeding bird species from the middle hydrographichal basin of the Argeş River (Romania" (Conete *et al*., 2011), "Species of birds rarely observed In the Important Bird Area „The Dam lakes of the Argeş River" during of the international waterbird Count (1999 – 2012)" (Gava *et al*., 2011), "Ornithological researches on the Piteşti Basin during 2003 – 2011" (Conete *et al*., 2012a), "Ornithological researches on the Goleşti Dam Lake (Argeş County, Romania) during 2003 – 2010" (Conete *et al*., 2012b), "The mid-winter count of the waterfowls in 2012 on the basins from the Argeş River (IBA – "Lacurile de Acumulare de pe Argeş")" (Gava *et al*., 2012), "Brief historical review of ornithological research on the middle basin of the Argeş River" (Conete, 2013), "The midwinter waterbird census from the basins Vâlcele, Budeasa, Bascov, Piteşti and Goleşti from the Argeş River (January 2013)" (Mestecăneanu *et al*., 2013), "The avifauna from Vâlcele, Budeasa, Bascov, Piteşti and Goleşti basins observed in the prevernal season in 2013" (Mestecăneanu & Gava, 2013), "Contribution to the study of the avifauna from the site Nature 2000 ROSPA0062 – „The reservoirs on the Argeş River" – the wintering quarters from the middle basin of the Argeş River. The hiemal season" (Conete, 2014), "Ornithological observations on the Bascov Basin between February 2013 & January 2014" (Mestecăneanu & Gava, 2014a), "Ornithological observations on the Vâlcele Basin during February 2013 – January 2014" (Mestecăneanu & Gava, 2014b), "Ornithological observations on the Budeasa Basin between February 2013 and January 2014" (Mestecăneanu & Gava, 2014c), "The impact of the anthropogenic pressure on the avifauna

from Bascov dam reservoir (Argeș River) in the recent years (2013-2014)” (Mestecăneanu & Gava, 2014d), “Research study on the breeding avifauna of the Bascov Reservoir” (Conete, 2015), “The avifauna from Vâlcele, Budeasa, Bascov, Pitești, and Goleşti dam reservoirs observed in the autumnal season (2013)” (Mestecăneanu & Gava, 2015a), “The avifauna from Vâlcele, Budeasa, Bascov, Pitești, and Goleşti dam reservoirs observed in the hiemal season (2013 and 2014)” (Mestecăneanu & Gava, 2015b), “The avifauna from Vâlcele, Budeasa, Bascov, Pitești, and Goleşti dam reservoirs observed in the autumnal season (2013)” (Mestecăneanu & Gava, 2015c). Also, a doctoral dissertation, “Cercetări ecologice asupra avifaunei unor lacuri de baraj din zona mijlocie a văii Argeșului” (Conete, 2011), was elaborated and, in the period of study, 207 birds’ species were identified on the basins Vâlcele, Budeasa, Bascov, Pitești and Goleşti. A part of these studies contributed to the declaration of the “ROSPA0062 Lacurile de acumulare de pe Argeș” as area of birds’ protection, included in the Nature 2000 Network.

Concomitantly, the birds from the Râul Doamnei, tributary of the Argeș River, were studied: “Observații ornitologice pe valea Râului Doamnei (bazinul râului Argeș)” (Gava & Mestecăneanu, 2002), “Aspecte din viața păsărilor: hrănirea” (Mestecăneanu, 2002), “Cercetări ornitologice pe cursul inferior al Râului Doamnei (bazinul Argeșului)” (Gava & Mestecăneanu, 2003), “Aspecte din viața păsărilor: stabilirea teritoriului de cuibărit și formarea perechilor” (Mestecăneanu, 2003), “Aspecte din viața păsărilor. Construirea cuiburilor” (Mestecăneanu, 2004), “Situația coloniilor de lăstun de mal (*Riparia riparia*) de pe valea Râului Doamnei și din împrejurimile municipiului Pitești, în perioada 1999 – 2003” (Mestecăneanu *et al*., 2004), “Aspecte din viața păsărilor. Migrația de primăvară” (Mestecăneanu, 2005a), “Cercetări privind avifauna luncii Râului Doamnei din zona agricolă Dârmănești, Argeș” (Mestecăneanu & Gava, 2005), “Observații ornitologice. Pasaj de cocori (*Grus grus*) pe deasupra satului Dârmănești. Acvila țipătoare mică (*Aquila pomarina*) – pasăre cuibăritoare și de pasaj în bazinul Râul Doamnei. Ferăstrașul mare (*Mergus merganser*), oaspete de vară pe lacul de acumulare Râușor” (Mestecăneanu & Mestecăneanu, 2006), “Aspecte din viața păsărilor. Migrația de toamnă” (Mestecăneanu, 2007a), “Ferăstrașul mare cuibărește în bazinul Râul Doamnei” (Mestecăneanu, 2007b), “The avifauna of the alpine and subalpine zones from Iezer-Păpușa Massif between the 20-th of July and 8-th of September 2006” (Mestecăneanu, 2007c), “Ereți de trestie (*Circus aeruginosus*) in migrație prin bazinul hidrografic Râul Doamnei” (Mestecăneanu & Mestecăneanu, 2007), “The impact of the hydroelectric lay-outs on Râușor Lake from the upper basin of Târgului River (Iezer-Păpușa Massif) on the biodiversity of the environment” (Alexiu & Mestecăneanu, 2008), “Avifauna din bazinul Râul Doamnei și statutul ei de protecție” (Mestecăneanu, 2008a), “Ornithological researches in area of the Râușor Basin from the Upper Basin of the Târgului River (Iezer-Păpușa Massif)” (Mestecăneanu, 2008b), “Vulturul pescar (*Pandion haliaetus*) - apariție rară în bazinul Râului Doamnei” (Mestecăneanu, 2008c), “Observații privind migrația păsărilor răpitoare de zi prin bazinul hidrografic Râul Doamnei” (Mestecăneanu & Mestecăneanu, 2008), “Researches upon the avifauna of the pear and apple trees orchard from the Râul Doamnei hydrographical basin” (Mestecăneanu, 2009), “Researches regarding the aerial activity of the raven (*Corvus corax*) in Râul Doamnei River hydrographic Basin” (Mestecăneanu & Mestecăneanu, 2009), “Date privind cuibăritul păsărilor în zonele de jnepeniș din Munții Iezer-Păpușa” (Mestecăneanu, 2010a), “Research about Corbi village ornithofauna (Argeș County, Romania)” (Mestecăneanu, 2010b), “Gaia

neagră (*Milvus migrans*) – pasăre de pasaj prin bazinul hidrografic Râul Doamnei" (Mestecăneanu & Mestecăneanu, 2010a), "Observations regarding the aerial behaviour of the sparrowhawk (*Accipiter nisus*) (Linnaeus, 1958) in the Râul Doamnei hydrographical basin" (Mestecăneanu & Mestecăneanu, 2010b), "Researches upon the influence of the lapse of time on the presence in flight of the sparrowhawk (*Accipiter nisus*) from the Râul Doamnei hydrographical basin" (Mestecăneanu & Mestecăneanu, 2010c), "Some aspects regarding the migratory dynamics of the white stork (*Ciconia ciconia*) in the Doamnei River hydrographical basin (Argeș County, Romania)" (Mestecăneanu & Mestecăneanu, 2010d), "Research about Câmpulung city ornithofauna (Argeș County, Romania)" (Mestecăneanu, 2011a), "Research about Dârmănești village ornithofauna (Argeș County, Romania)" (Mestecăneanu, 2011b), "Research about Mioveni city ornithofauna (Argeș County, Romania)" (Mestecăneanu, 2011c), "Observations regarding the aerial behaviour of the common buzzard (*Buteo buteo*) in the River Doamnei hydrographical basin" (Mestecăneanu & Mestecăneanu, 2011a), "Researches regarding the influence of the weather on the flight of the white storks (*Ciconia ciconia*) in the spring migration across the Doamnei River hydrographical basin (Argeș County, Romania) (I)" (Mestecăneanu & Mestecăneanu, 2011b), "Researches regarding the influence of the weather on the flight of the white storks (*Ciconia ciconia*) in the spring migration across ther Doamnei River hydrographical basin (Argeș County, Romania) (II). Other considerations about the migration over the area" (Mestecăneanu & Mestecăneanu, 2011c), "The synecological analyse of the falconiformes species according to their aerial activity" (Mestecăneanu & Mestecăneanu, 2011d), "A short history of the ornithologic researches performed in the Râul Doamnei hydrographical basin from the first published notes until 2010" (Mestecăneanu, 2012a), "Data regarding the birds' breeding in some Norway spruce forests from the Doamnei River hydrographical basin (Făgăraș and Iezer-Păpușa Mountains)" (Mestecăneanu, 2012b), "Păsări rare observate în anul 2011 în bazinul Râul Doamnei" (Mestecăneanu & Mestecăneanu, 2012a), "Pui de acvilă țipătoare mică salvat în Argeș*"* (Mestecăneanu & Mestecăneanu, 2012b), "Some observations regarding the departure of the tawny owl (*Strix aluco*) from the daytime roost depending on time and certain environmental conditions" (Mestecăneanu & Mestecăneanu, 2012c). The major part of these researches were used for the making of the doctoral dissertation "Studiul complex (sistematic, biologic, ecologic, etologic și de răspândire) privind fauna de păsări (Aves) din bazinul Râul Doamnei – Argeș" (Mestecăneanu, 2011d). As a result, in this area, 197 species of birds were observed.

Other avifaunistical aspects from the Argeș County were presented by the same authors in: "Cercetări ecologice asupra avifaunei agroecosistemelor din zona agricolă Oarja, județul Argeș" (Mestecăneanu *et al*., 2005a), "The birds from the Trivale Forest (Argeș County)" (Mestecăneanu *et al*., 2007b), "Ornithological observations in the Natural Protected Area „Poiana cu Narcise" from Negrași, Argeș" (Mestecăneanu, 2012c), "The census of the white stork (*Ciconia ciconia* L., 1758) in Argeș County, in 2004" (Mestecăneanu *et al*., 2012), "New data regarding the breeding of the Fieldfare (*Turdus pilaris* Linnaeus, 1758) in Argeș County, Romania" (Mestecăneanu & Mestecăneanu, 2013), "The evaluation of the strengths of Long-eared Owl (*Asio otus*) that wintered in the Argeș County (2014-2015). Preliminary study" (Mestecăneanu & Gava, 2015d).

Few works are dedicated to the presence of the birds in the folklore. Băcescu (1961), in his writing, "Păsările în nomenclatura și viața poporului român", mentioned

some popular names collected from diverse localities from the Argeș County. Certain terms have been adopted from “Ornitologia poporană română” (Marian, 1883) and other from “O seamă de cuvinte din Muscel” (Rădulescu Codin, 1901) and a part of them were used later in “Enciclopedie zoocinegetică” (Georgescu & Georgescu, 1996), publication that has a chapter on this material.

Based on these 201 previously works, the list of the species identified over time in the Argeș County contain 257 species (the scientific names, by Bruun *et al*., 1999): *Gavia arctica*, *Gavia stellata*, *Podiceps cristatus*, *Podiceps grisegena*, *Podiceps nigricollis*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Phalacrocorax pygmeus*, *Pelecanus crispus*, *Botaurus stellaris*, *Ixobrychus minutus*, *Egretta garzetta*, *Egretta alba*, *Ardeola ralloides*, *Ardea cinerea*, *Ardea purpurea*, *Platalea leucorodia*, *Nycticorax nycticorax*, *Ciconia ciconia*, *Ciconia nigra*, *Cygnus olor*, *Cygnus cygnus*, *Branta ruficollis*, *Anser anser*, *Anser albifrons*, *Anas platyrhynchos*, *Anas strepera*, *Anas acuta*, *Anas penelope*, *Anas querquedula*, *Anas crecca*, *Anas clypeata*, *Tadorna tadorna*, *Netta rufina*, *Aythya marila*, *Aythya fuligula*, *Aythya ferina*, *Aythya nyroca*, *Bucephala clangula*, *Melanitta fusca*, *Mergus merganser*, *Mergus albellus*, *Neophron percnopterus*, *Gypaetus barbatus*, *Aegypius monachus*, *Gyps fulvus*, *Haliaeetus albicilla*, *Aquila chrysaetos*, *Aquila nipalensis*, *Aquila clanga*, *Aquila pomarina*, *Pandion haliaetus*, *Hieraaetus pennatus*, *Circaetus gallicus*, *Buteo lagopus*, *Buteo buteo*, *Buteo rufinus*, *Pernis apivorus*, *Milvus milvus*, *Milvus migrans*, *Accipiter gentilis*, *Accipiter nisus*, *Accipiter brevipes*, *Circus aeruginosus*, *Circus cyaneus*, *Circus pygargus*, *Circus macrourus*, *Falco peregrinus*, *Falco subbuteo*, *Falco columbarius*, *Falco vespertinus*, *Falco naumanni*, *Falco tinnunculus*, *Lagopus mutus*, *Bonasia bonasia*, *Tetrao urogallus*, *Tetrao tetrix*, *Perdix perdix*, *Phasianus colchicus*, *Coturnix coturnix*, *Grus grus*, *Otis tarda*, *Tetrax tetrax*, *Rallus aquaticus*, *Porzana porzana*, *Crex crex*, *Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus*, *Charadrius dubius*, *Charadrius morinellus*, *Pluvialis apricaria*, *Scolopax rusticola*, *Gallinago media*, *Gallinago gallinago*, *Lymnocryptes minimus*, *Numenius arquata*, *Limosa limosa*, *Calidris alpina*, *Calidris minuta*, *Calidris temminki*, *Actitis hypoleucos*, *Tringa ochropus*, *Tringa glareola*, *Tringa nebularia*, *Tringa totanus*, *Tringa erythropus*, *Tringa stagnatilis*, *Philomachus pugnax*, *Recurvirostra avosetta*, *Himantopus himantopus*, *Larus argentatus*, *Larus canus*, *Larus ridibundus*, *Larus minutus*, *Chlidonias niger*, *Chlidonias leucopterus*, *Chlidonias hybridus*, *Sterna hirundo*, *Columba oenas*, *Columba palumbus*, *Streptopelia turtur*, *Streptopelia decaocto*, *Cuculus canorus*, *Otus scops*, *Bubo bubo*, *Athene noctua*, *Strix uralensis*, *Strix aluco*, *Asio otus*, *Asio flammeus*, *Aegolius funereus*, *Glaucidium passerinum*, *Tyto alba*, *Caprimulgus europaeus*, *Apus apus*, *Apus melba*, *Alcedo atthis*, *Merops apiaster*, *Coracias garrulus*, *Upupa epops*, *Picus viridis*, *Picus canus*, *Dendrocopos major*, *Dendrocopos syriacus*, *Dendrocopos medius*, *Dendrocopos minor*, *Dendrocopos leucotos*, *Dryocopus martius*, *Picoides tridactylus*, *Jynx torquilla*, *Galerida cristata*, *Alauda arvensis*, *Lullula arborea*, *Riparia riparia*, *Ptyonoprogne rupestris*, *Hirundo rustica*, *Delichon urbica*, *Anthus trivialis*, *Anthus pratensis*, *Anthus campestris*, *Anthus cervinus*, *Anthus spinoletta*, *Motacilla flava*, *Motacilla cinerea*, *Motacilla alba*, *Lanius collurio*, *Lanius minor*, *Lanius excubitor*, *Oriolus oriolus*, *Sturnus vulgaris*, *Sturnus roseus*, *Bombycilla garrulus*, *Garrulus glandarius*, *Pica pica*, *Nucifraga caryocatactes*, *Pyrrhocorax graculus*, *Corvus monedula*, *Corvus frugilegus*, *Corvus corone cornix*, *Corvus corax*, *Cinclus cinclus*, *Troglodytes troglodytes*, *Prunella modularis*, *Prunella collaris*, *Locustella luscinioides*, *Locustella fluviatilis*, *Locustella naevia*, *Acrocephalus*

schoenobaenus, *Acrocephalus palustris*, *Acrocephalus scirpaceus*, *Acrocephalus arundinaceus*, *Hippolais icterina*, *Hippolais pallida*, *Sylvia nisoria*, *Sylvia borin*, *Sylvia atricapilla*, *Sylvia communis*, *Sylvia curruca*, *Phylloscopus collybita*, *Phylloscopus sibilatrix*, *Phylloscopus trochilus*, *Regulus regulus*, *Regulus ignicapillus*, *Ficedula hypoleuca*, *Ficedula parva*, *Ficedula albicollis*, *Muscicapa striata*, *Oenanthe oenanthe*, *Saxicola rubetra*, *Saxicola torquata*, *Phoenicurus phoenicurus*, *Phoenicurus ochruros*, *Erithacus rubecula*, *Luscinia megarhynchos*, *Luscinia luscinia*, *Turdus torquatus*, *Turdus merula*, *Turdus iliacus*, *Turdus philomelos*, *Turdus viscivorus*, *Turdus pilaris*, *Monticola saxatilis*, *Parus palustris*, *Parus montanus*, *Parus lugubris*, *Parus cristatus*, *Parus caeruleus*, *Parus ater*, *Parus major*, *Aegithalos caudatus*, *Remiz pendulinus*, *Sitta europaea*, *Tichodroma muraria*, *Certhia familiaris*, *Certhia brachydactyla*, *Passer domesticus*, *Passer montanus*, *Fringilla coelebs*, *Fringilla montifringilla*, *Pyrrhula pyrrhula*, *Coccothraustes coccothraustes*, *Serinus serinus*, *Carduelis chloris*, *Carduelis spinus*, *Carduelis carduelis*, *Carduelis cannabina*, *Carduelis flammea*, *Carpodacus erythrinus*, *Loxia curvirostra*, *Emberiza cia*, *Emberiza schoeniclus*, *Emberiza cirlus*, *Emberiza hortulana*, *Miliaria calandra*, *Emberiza citrinella* and *Plectrophenax nivalis*.

The present essay is founded on the information whereof we have knowledge. The diversity of the reviews, journals and other publications, where it appeared, is vast. Therefore, it is possible that certain data have been omitted, especially some of the oldest and/or of cynegetic interest, which were more difficult to find in the libraries. Hence, the title of the article refers to **a history** of the ornithological research in the Argeș County and, so, we do not pretend to have disclosed all published information from the considered area.

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ETHOLOGICAL ASPECTS REGARDING THE BREEDING OF THE LONG-EARED OWL (*ASIO OTUS* L.)

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Abstract. This study aims to present some breeding aspects in long-eared owl (*Asio otus* L.) based on preliminary ethological observations made on five pairs of long-eared owls established in the Tătărași neighborhood (Iași, Iași County, Romania) during the years 2010-2013. A first aspect taken into consideration concerns the relationship between this species and the corvids at the beginning of the breeding season, respectively in March, when it occupies the latter's nests in order to lay eggs. In spring 2014, we investigated the relations within the family group in the long-eared owl in the Tătărași Park while running an experiment of rehabilitation of a hand-reared juvenile. Separated accidentally from its family (which was nesting in the Copou neighborhood), on the 22th of May 2014, the above mentioned juvenile acquired gradually the begging behaviour at meeting another family of long-eared owls in their nesting territory. The adequacy of the response to the new situation arising after fledging in this species occurred after five days, as the bird had relied on its hand-rearer initially. Our experiment resulted in mediating the adoption of the hand-reared juvenile by the local pair of long-eared owls. Its activity in the nesting area has been noticed for a long time, including the month of August. Once rehabilitated, the hand-reared juvenile followed its foster parents and their offspring in their foraging areas, the group occasionally returning to the Tătărași Park, where it was spotted by the specific calls. Usually the young would stay in the nesting area for 30 days, after which they would follow their parents out of the nesting territory. During the activity period at their nesting territory we recorded the food-begging calls of the fledged young both in Tătărași and in Copou (where the hand-reared juvenile came from).

Keywords: territory, nest, calls, parents, adoption, flight

Rezumat. Aspecte etologice privind reproducerea ciufului de pădure (*Asio otus* L.). Prezentul studiu urmărește să prezinte aspecte ale reproducerii ciufului de pădure (*Asio otus* L.) pornind de la observații etologice preliminare în cartierul Tătărași (Iași). În perioada anilor 2010-2013, am numărat cinci perechi de ciufi de pădure cuibărind în acest cartier. Un prim aspect luat în studiu privește relația ciufului de pădure cu corvidele, la începutul sezonului de reproducere respectiv în luna martie, când le ocupă cuiburile, pentru depunerea propriei ponte. În Parcul Tătărași, în primăvara anului 2014 am analizat comportamentul la ciuful de pădure sub aspectul relațiilor de familie. Totodată am desfășurat un experiment de reabilitare a unui juvenil provenind din cartierul Copou. Separat accidental de familie pe 22/05/2014, după părăsirea cuibului, acesta a fost pus în contact cu o familie de conspecifici din parcul mai sus menționat. Treptat el a ajuns să manifeste comportamentul de solicitare a hranei. Adecvarea răspunsului speciei studiate la situația experimentală s-a produs după cinci zile, cât a durat creșterea la mână. Experimentul nostru a avut ca rezultat adopția juvenilului reabilitat de către perechea de ciufi de pădure locală. Activitatea acesteia în proximitatea locului de cuibărit s-a înregistrat o perioadă îndelungată, luna august inclusiv. Momentul adopției a coincis cu atingerea fazei zborului. Grupul alcătuit din juvenilul reabilitat, părinții săi adoptivi și puii acestora l-am putut repera pe baza strigătelor specifice. Ocazional, păsările reveneau în parcul Tătărași din locurile de hrănire. De regulă, juvenilii stau în preajma cuibului 30 de zile, după care sunt hrăniți de părinți mai departe, pe raza teritoriului. În perioada de activitate în zona de cuibărit, noi am înregistrat strigătele de solicitare a hranei la juvenili în două zone verzi din Iași, cartierele Tătărași și Copou (de unde provenea exemplarul în cauză).

Cuvinte cheie: teritoriu, cuib, vocalizări, părinți, adopție, zbor

Introduction

The study area is located in the proximity of two semi-natural habitats in the eastern part of Iași corresponding to two valleys. One of them is crossed by a chain of five

lakes among which three Ciric lakes and the other one belonging to the Bahlui river. The grasslands on the Bahlui riverside are followed by forest formations situated close to a row of buildings on the southern slope, while the Ciric area is fully forested (both on the eastern and the western slope). The alternation of stands of trees with grasslands corresponds to the ecological preferences of some species of rodents, that are part of the long-eared owl diet. The long-eared owls in our study have established both their winter roosting sites and the nesting territories in Tătărași, due to the availability of food resources in the proximity of the Ciric lakes, respectively the Bahlui river.

Throughout the years 2010-2014, our observations have been focused on the following behavioral aspects in the population of long-eared owls in Tătărași: the pre-incubatory activities at the roosting site, the territoriality at the nesting site, the pair-bonding, the relations within the family group, the movements of the families in the final stage of development in juveniles, and the reuse of the winter foraging routes at the beginning of autumn. The field research took into account particularly the relationship betweeen the long-eared owl and the corvids (Tome, 2003; Hadjisterkotis, 2003) while the former occupied the latter's nests during the breeding season. Data concerning the behavior of long-eared owl after fledging were collected in 2014 in a rook (*Corvus frugilegus* L.) colony in the western limit of the Tătărași Park (Ciurchi street).

Material and Methods

At first, in late February we spotted males of the studied species after their advertising-call on green spaces delimited by Vasile Lupu and Ciurchi streets, where the rooks build their nests in spring. The long-eared owl uses often the nests belonging to this species, which is one of the most representative corvids in town, in regards to its population size. Starting with the onset of the breeding season we also recorded females of the species under study after their calls in deserted rook nests. The alarm-call of the corvids at meeting the long-eared owl guided us to potential nesting territories of the latter.

For the ethological observations we have also used the upper floors of some high buildings in the vicinity of which there are rook colonies used by the long-eared owl in the breeding season. For the illustration of the long-eared owl lifestyle in the nesting territories and of the young development phases (the molt) we used a digital camera Fujifilm FinePix HS20EXR (30 × optical zoom, 16 Mpx effective resolution, 4608 × 3456 maximum resolution, 1920 × 1080 video resolution, SDHC external memory, 46 MB internal memory and image stabilizer).

Some of the recordings at the nest in the spring of 2011 were made by climbing up the trees. This way we obtained data regarding the number of the eggs laid in the nest and the aspects appearing during the development in nestlings. In the case of the high trees with few branches growing from the base of the trunk or lacking branches in this region, we used either the safety climbing technique or the mountaineering equipment, or a pair of tree climbing spikes. The latter considerably increase the stability and the safety while working in the tree crowns. Few data have been collected this way, mostly biometric ones, since disturbing the long-eared owls in their roosting sites (the nesting territories in our case) is illegal. In regards to the clutch and the chicks, we investigated four active nests found in the rook colonies in Tătărași, respectively Copou. We did the majority of our field activities according to the ethological principles involving the familiarisation of the bird with the observer.

The experiment of rehabilitation has been carried out in the long-eared owls nesting area in the Tătărași Park soon after the juveniles had left the nest. By means of tweezers we gave the hand-reared juvenile chicken meat-based food (necks and liver), on a small tree, once a day, at 19^{00} PM in the evening, for five days.

Results and Discussion

The long-eared owl does not build its own nest, it uses instead either the other birds' nests or the squirrels' dreys (Cramp & Perrins, 1994). At the beginning of the breeding season, in March, the male's advertising-call can be heard close to the corvids nests. Such vocalizations are the typical expression of the territoriality at meeting an intruder at the nest-site (Martínez *et al.*, 2002) and actually the only form of intraspecific aggression (Cramp, 1998). We found in Iași pairs of long-eared owls breeding in rook colonies in green spaces in Copou, Păcurari, Tătărași, Podu Roș, Parc Sala Sporturilor and Antibiotics S.A. The population size in Tătărași was estimated at five pairs. One of them keeps using magpies nests (*Pica pica* L.) on the Ciric river bank, while the other four pairs are to be found in the rook colonies.

At the beginning of the breeding season we noticed the competition for the occupancy of a nesting territory. During the early spring of 2011 we saw two pairs of long-eared owls arriving simultaneously in a rook colony, passing from one nest to another and performing the wing-clapping display flight over the tree tops. At the same time we recorded the typical calls for the breeding season (on the 12^{th} of March 2011). The long-eared owl emits such signals both to intimidate potential rivals and to attract mates (Johnsgard, 1988).

At the onset of the breeding season, in the case of this strigid, the pairs roost during the daytime in the nesting territory (Pirovano *et al.*, 2000). We noticed the allo-preening, an activity typical for mates, in the roosting site of a pair of long-eared owls. The birds would allo-preen their head feathers while emitting squeaky calls. The male would bring food to its mate in response to such calls. During the nocturnal activity the long-eared owl would make swinging motions that have probably the same role as the vocalizations at the nesting territory in order to attract the mate.

The male provides food for its mate throughout the incubation period (25-26 days) and during the development of the young until they reach the age of three weeks post-hatch and are ready to fledge (Cramp & Perrins, 1994; Fabrizio *et al.* 2008). The egg hatching is unsynchronized (Village, 1981), which determines post-hatch age differences between the siblings throughout their development. We pursued the female brooding the young at the nest by day. It protects the chicks to maintain the proper nest temperature and allo-preens them during the feathers formation.

In the final stage of the young's development at the nest, while they were soliciting food by begging on branches, we have noticed how the parents were bringing prey to their offspring. The long-eared owl fledglings can hold food in their claws in order to eat it, once they are able to perch on the branches. The hunting period in the long-eared owl begins relatively early, after sunset, reaches its peak at midnight, followed by a period of rest after which, before dawn, a new hunting phase takes place (Johnsgard, 1988). During the family movements in the nesting territory we noticed the competition between the siblings for the access to the prey brought by their parents. During June and July we watched the long-eared owls from the Tătărași Park performing to-and-fro flights between

the valley of the Ciric chain of lakes, respectively the valley of the Bahlui river, and the nesting territory. These movements were related to the use of the trophic resource for the rearing of the young. Mention should be made that this strigid often establishes its nesting territories close to the open areas corresponding to its foraging ecological preferences (Rodríguez *et al.*, 2006).

If there is no abandoned nest within reach, the long-eared owl would drive away the birds similar in size to itself from their own nest. We met such a case in the mid-March of 2011 while monitoring a rook colony. The nest would be usurped in an aggressive manner. The female long-eared owl would perform simulated attacks on the rook which would aim for the neck. By that time, in the study area, a high incidence rate of nest desertion took place in the rook population during the sexual activity in the long-eared owl. The interference between the two species of birds is limited to the onset of the breeding season in the long-eared owl, while the strigid is looking for a nest.

Regarding the particular adoption case of the hand-reared juvenile in the Tătărași Park, we recorded some tonal differences in the food-begging calls, compared to those of the local young. A plausible explanation might be the familiarity with the hand-rearer. At the beginning of our experiment we provided all the necessary food for the rehabilitated bird untill it was adopted. We recorded the tonal particularity of those vocalizations for the first time at meeting the hand-rearer in the last day, when the interference with that bird was still possible (the 25th of May 2014). After having been adopted, the subject of our experiment joined the family group of long-eared owls in the canopy, undertaking their behavioral pattern in all respects including the movements outside the nesting territory.

The fall from the branches of the large young might be caused either by their avoidance to encounter predators or by their failed attempt to jump from one tree to another (Rodríguez *et al.*, 2006). If the young cannot climb on branches soon they are exposed to predation or to human intervention, often unjustified, as in this case. This is one of the reasons we have rehabilitated the juvenile concerned that had been caught and kept as a pet by a pauper. We have foreseen, at the same time, the risk of the young being hit by a vehicle, the nesting site to which the juvenile belonged being situated in the proximity of a road. Our rehabilitation experiment resulted in the adoption of the hand-reared juvenile in a quieter semi-natural habitat, away from traffic, with easy access to small richly branched trees such as those in the Tătărași Park.

Conclusions

The living conditions of the long-eared owls in Tătărași enable the breeding success, as our ethological and ecological data show. The presence of the corvid populations (rooks and magpies) breeding inside Iași enables the long-eared owl's breeding since this species uses mainly the open nests built by other species of birds. The relationship between this strigid and the rook is notable by the aggressive nature of the former. This type of relationship is maintained only during the early breeding season, when the female seeks an available rook nest for laying eggs. Otherwise, the adults of both species, similar in size and with a similar agressive potential, would cohabit without interfering in the nesting territory.

While soliciting food by begging, the juvenile long-eared owls compete for the prey brought by their parents. The hand-reared juvenile was found by night and day in the

nesting territory of the foster family all along two months, which proves that it had not only been protected but also fed by its foster parents, as was the case with their own offspring.

There is probably a connection between the foster parents' response and the food-begging calls of the juvenile in our study, which had been initially directed to the hand-rearer. The advanced age at which that juvenile was rehabilitated (nearly three weeks) is less permeable to imprinting on the human, which explains the delay of the positive response to the hand-rearer, materialized in the begging display.

The variety of the ecosystems with optimum productivity and favorable climate conditions in the study area explains the success of our rehabilitation experiment in the long-eared owl breeding season in 2014.

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DISTRIBUTION AND CONSERVATION STATUS OF EURASIAN OTTER (*LUTRA LUTRA*) IN PUTNA VRANCEA NATURAL PARK (SOUTH-EASTERN CARPATHIANS, ROMANIA)

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Abstract. The distribution and status of the eurasian otter (*Lutra lutra*) in Putna Vrancea Natural Park, were assessed by applying two field survey methods: standard otter survey and spot check, during the period November 2012 - November 2015. Otter signs of presence (tracks, spraints, anal secretions, holts) were recorded on 41 transects of 600 m length (sampling sites) using standard otter survey method and spot check method in 151 monitoring sites during the preliminary otter survey. The distribution survey results revealed that *Lutra lutra* is widespread within Putna Vrancea Natural Park rivers and streams, an important percent of transects were found as positive: 63.41% and 81.13% of the monitoring sites were found also as positive. The otter population is concentrated on the main watercourses and otter presence is being very scarce in small streams or absent at altitudes over 1100 m. Using GIS methods, all the data obtained from surveys were plotted in maps of distribution for a better comparison, analysis and data visualization. Distribution of the otter, in Putna Vrancea Natural Park, is a key element which must be known in order to establish conservation measures and a good management of otter (*Lutra lutra*) species.

Keywords: *Lutra lutra*, distribution, conservation status, field survey methods, South-Eastern Romania

Rezumat. Distribuția și starea de conservare a vidrei euroasiatice (*Lutra lutra*) în Parcul Natural Putna Vrancea (Carpații Orientali, Romania). Distribuția și starea de conservare a vidrei euroasiatice în Parcul Natural Putna Vrancea au fost cercetate în perioada Noiembrie 2012 – Noiembrie 2015 prin utilizarea a două metode de studiu: metoda standard pentru studiul vidrei și monitorizarea siturilor de marcare. Semnele de prezență lăsate de vidră (urme, excremente, secreții anale, vizuini) au fost înregistrate utilizând metoda standard prin parcurgerea a 41 de transecte cu o lungime de 600 de metrii și utilizând metoda monitorizării siturilor de marcare prin vizitarea a 151 de situri de monitorizare în timpul studiului preliminar pentru stabilirea acestora. Studiile privind distribuția vidrei au arătat că această specie este răspândită pe râurile și pârâurile din Parcul Natural Putna Vrancea, un procent important din transecte au fost identificte ca pozitive: 63,41% și 81,13% din siturile de monitorizare au fost identificate deasemenea ca pozitive. Populația de vidră este concentrată pe cursurile de apă principale, fiind redusă pe pârâurile mici și absentă la altitudini de peste 1100 m. Cu ajutorul metodelor GIS, datele obținute din studiile de teren au fost transpuse în hărți de distribuție, pentru o mai bună comparare, analiză și vizualizare a datelor. Distribuția vidrei (*Lutra lutra*), în Parcul Natural Putna Vrancea, este un element cheie care trebuie să fie cunoscut, pentru a putea fi stabilite măsuri de conservare eficiente și o bună gestionare a speciei.

Cuvinte cheie: *Lutra lutra*, distribuție, stare de conservare, metodologie de studiu în teren, sud-estul României

Introduction

The distribution range of the Eurasian otter (*Lutra lutra*) has been vast; from Ireland to Japan and from arctic areas to North Africa, Middle East and Sri Lanka. The populations decreased in many areas between the 1950s and the 1990s (Macdonald & Mason, 1994). Distribution became erratic, located mostly in isolated areas on the outer edge of Europe (Foster-Turley *et al*., 1990). After all, in the 1990s and the 2015s, the otter

populations have been increasing in most parts of Europe (Kranz, 2000; Roos *et al.*, 2001; Conroy & Chanin, 2002; Mason *et al*., 2004; Prigioni *et al.*, 2007; Romanowski *et al.*, 2013).

The otter was classified as "vulnerable" speces in until 2004, when it was re-evaluated as "near threatened" by IUCN (Roos *et al.*, 2015) and considered "vulnerable" by the Romanian Vertebrate Red Book (Botnariuc & Tatole, 2005).

At the beginning of this work in 2012, the status of the otter in Romania was unknown (Bouroș, 2014a), only a few local studies were carried out in Romania (Ardelean, 1993; Sike *et al.*, 2008; BOUROȘ, 2014b).

The need to improve the knowledge of the ecology and distribution of otters was urgent. It is difficult or even impossible to plan the conservation and management of the species with very limited information of the otter.

The countries from the European Union, including Romania, have a legal duty to collect data on the distribution and population trends of threatened species such as the otter (Habitat Directive; 92/43/EEC, 1992). The otter is listed in annexes II and IV on the list of Species of Community Importance. However, even today, the monitoring of otters is working well only in few Europeean Union countries (Crawford, 2003; Bouroș, 2014a).

The survey and the monitoring of the Eurasian otter populations are commonly based on searching for otter signs (spraints, tracks, anal secretions, holts) and environmental factors (river depth, river width, human disturbance, vegetation cover). The most used technique for otter survey is the standard method that is described in detail by Reuther *et al*., 2000. The standard method with some adaptation and the spot check method are widely used for otter monitoring in protected areas (Chanin, 2003).

Nowadays we can only guess the distribution and the population size of the otter in Romania as long as it doesn't exist a proper national otter survey, even if we know that, in this country, the otter is widespread and common. Aiming to determine the otter distribution and population on a local scale, may contribute to a better estimation of the national population. This study examines otter distribution, population structure and field survey methodology in Putna Vrancea Natural Park, South-Eastern Carpathians.

Material and Methods

Study area

The study was conducted on the rivers and streams from Putna Vrancea Natural Park belonging to one main river basin: Putna river.

The natural park is located in south-eastern Romania, north-east of Vrancea County (Long. 26.503436; Lat. 45.921461) and covers an area of 382.13 km², with altitude ranging from 435 ma.s.l. in the valley of the Putna River to over 1785 m a.s.l. in Goru Peak.

The lanscape is predominantly mountainous, with few villages located in the main valleys.

The climate is characterized by high variations of temperature that shows a wide altitudinal range. The average temperaturesregistered close to the highest point from the natural Park, Lăcăuți weather station, 1777 m (1.34º C) and lowest point, Tulnici weather station, 560 m (8.52º C). In general, there is an increase in the number of days with frost from east to west, from about 115 days in Tulnici, to 192 days in Lăcăuți. A representative difference of rainfall was recorded at the two weather stations from the studied area: Lăcăuți with over 800 mm/year and Tulnici, with about 600 mm/year.

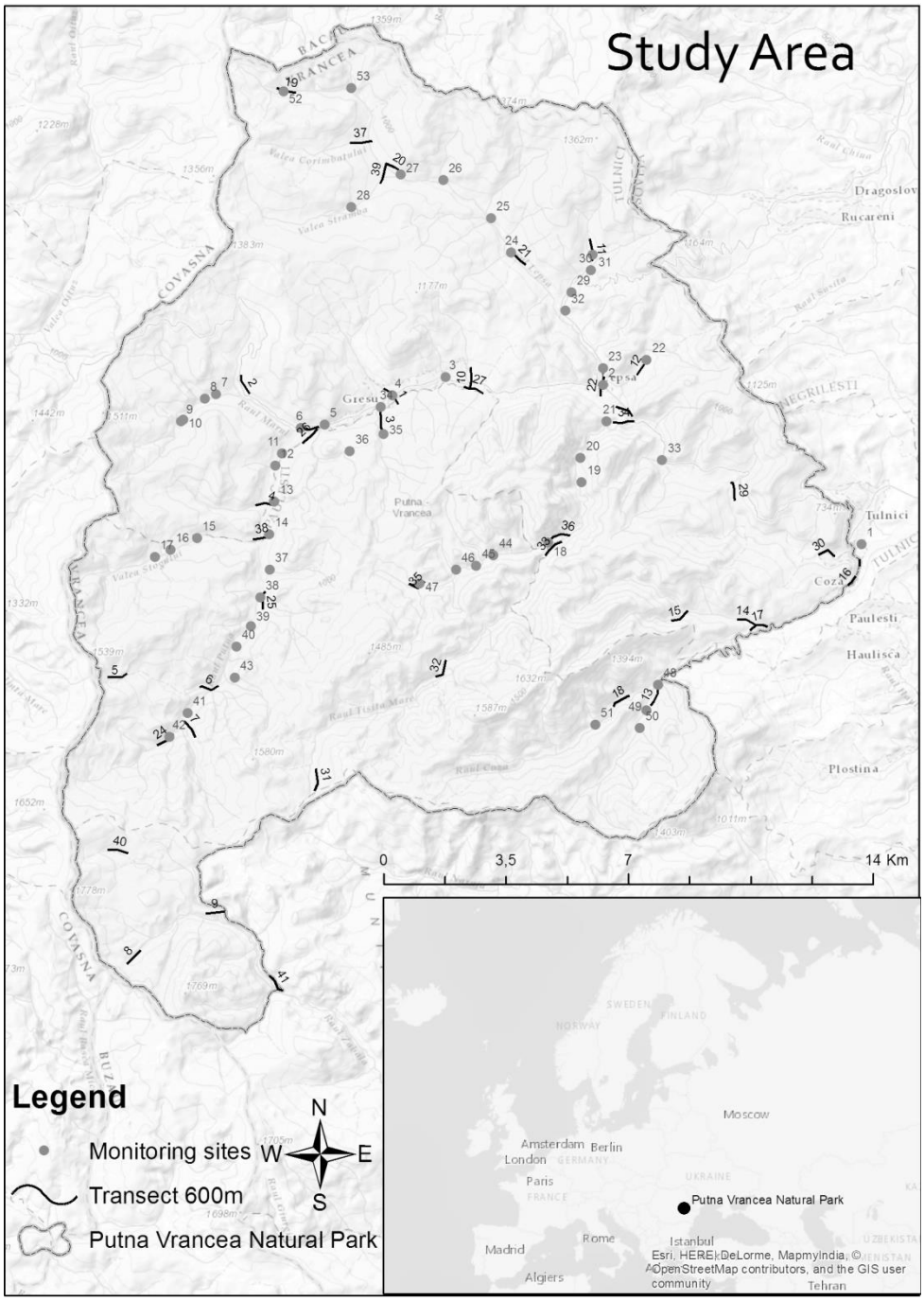

Figure 1. Map of the study area, and the field survey sampling locations from Putna Vrancea Natural Park.

The main hydrographic system is represented by Putna river which collects all the streams in the Putna Vrancea Natural Park and forms a narrow west-east oriented valley. The multiannual flow of Putna river measured at hydrometric station Lepșa, at 21 km from its sources, is 1.83 m^3/s and in Tulnici, when it leaves the park area, is 4.58 m^3/s.

The water system of the park consists of 373.15 km of rivers and streams, of which 107.5 km is formed only by 8 main rivers and streams: Putna 32.7 km, Tișița Mare 17.9 km, Lepșa 16 km, Coza 13.6 km, Mărul 7.3 km, Tișița Mică 7.1 km, Ostogul 6.9 km, Strâmba 6 km. The hydrographic network have a high density of 0.98 km of watercourses per km^2.

The streams are characterized by a torrential flow, with rapid, shallow waters. Most of the flow takes place at the end of the spring (44%) and early summer (30%), when there is a substantial increase in the fluid flow, resulting in significant floods.

The main Putna river has a pH ranging from 8 to 8.7, even if the upper headwaters are considered generally more acid, because of the presence of coniferous forest, but in the natural parkthe lowest value registered for pH was 7.7. The other main watercourses have the following pH values: Tișița Mare 8.2, Lepșa 8.7, Coza 7.9, Mărul 7.8, Tișița Mică 7.7, Strâmba 8.

The watercourses are generally characterized by salmonids and cyprinids fish populations.

The natural park vegetation is composed by broadleaf forest dominated mainly by *Fagus sylvatica* and other deciduous species: *Quercus petraea, Carpinus betulus, Acer plantanoides, Acer campestre, Fraxinus excelsior, Ulmus montana, Betula pendula*. Mixed forest are dominated by three species: *Fagus sylvatica*, *Abies alba* and *Picea abies*. The coniferous forest is formed mainly by *Picea abies*.

Forest exploatation and uncontrolled canalization and embankments often alter riverbeds and riparian vegetation, which, when is undisturbed, is formed mainly by alder (*Alnus glutinosa* and *Alnus incana*).

Field survey methodology

From November 2012 to November 2015, 41 transects/sampling sites (mean length = 600 m, total lenght = 24.6 km) distributed along 22 watercourses of the Putna Vrancea Natural Park, were searched seasonally for otter signs (Fig. 1). The study method followed the guidelines of the standard method recommended by the IUCN / SSC Otter Specialist Group (Reuther *et al.*, 2000). The watercourses from the park were divided into segments of 5 km lenght, representing the sampling sites. The first 600 m of each sampling sites were investigated for signs of otter presence, basicaly at intervals of 5 km. A sampling site was considered to be positive when it was found sign of presence and negative when no sign of otter presence was found within it. At majority of the sites, as soon as otter presence was found, the search was stopped and the site was confirmed as positive.

Another method used in this study is the spot check survey (Chanin, 2003). This method is based on monitoring sites (bridges), commonly used by otters for defecation and marking of territory. Best are those that have a place that allows defecation (a prominent object like a: a rock, a log, a concrete border etc.).

In order to establish the site which will be monitored, there were identified the all the bridges from the park using the military topographic maps with a scale of 1:25.000 and a GIS software. The bridges location was inserted in GPS and an initial visit was performed

(preliminary study of the monitoring sites). Each of the 150 bridges were considered potential monitoring sites and the following data was recorded on a field form:

- All potential sites for droppings under the bridge and at a distance of 50 m upstream and downstream of it;
- Access; safe parking place; working conditions and risks (deep water, the need for boots etc.);
- Water depth and width;
- The presence or absence of otters's presence signs;
- Habitat features;
- Pictures taken at each site'.

Not all bridges have suitable places for depositing spraints and there are certain factors that make the difference between a site suitable for monitoring and one wrong:

- bridge architecture (high and large bridges were avoided by otters, but the small ones situated mostly on forest roads were intensively used by the otters);
- size and nature of the river;
- existence of proeminent objects like: stones, wood or concrete;
- presence of ledges that pass under the bridge, thus providing continuity of banks and a potential site for spraints;
- areas with sand, gravel or mud under bridges (they can offer a favorable substrate for tracks observation).

After an analysis of the field forms there were choosen the most suitable sites.

Once it was established the suitable monitoring sites (n=53) it was performed the actual survey.

So for each site we collect the following information, through a field form:

- The presence or absence of the otter;
- Number of spraints;
- If the water level is higher than normal for this time of year.

Each monitoring site (bridge) was visited by a team of two observers.

The signs of otter presence found, were photographed, recorded using a GPS device: Garmin Etrex H or Garmin Oregon 450 and were registered their characteristics: type of otter presence (occasional or certain), type of otter signs (predation remains, tracks, spraints, anal jelly, entrance in water and in ice, holts and resting places), number and age of the spraints (dry fragmented – old; dry compact – average; wet – recent), type of otter latrine (stone, gravel, sand, wood, concrete, plastic), track size.

Tracks were measured and described to otter sex and age classes as it follows: cub/juvenile <5 cm; adult female 6-7 cm; adult male >7 cm; the track size between 5-6 cm were considered sub-adult male and female (Jefferies, 1996; Ottino, 2004). The measurements of the tracks were taken across the foot from the tip of the middle toe to the extremity of the heel (length).

Also, it was included in this study the data that was collected accidentaly during the period November 2011 and August 2012, in order to have an extended period of observations.

Results and Discussion

The distribution survey results revealed that *Lutra lutra* is widespread within Putna Vrancea Natural Park rivers and streams, an important percent (63.41%) of transects that were sampled on 22 watercourses were found as positive and 81.13% of the monitoring sites were found also as positive.

A total of 1239 signs of otter presence were identified over the whole study period in 184 different locations, the most common being spraints (n=962), followed by latrines (n=151), tracks (n=96), annal jellies (n=17), holts (n=9), ice holes (n=2) and predation signs (n=1) (Fig. 2).

Table 1. Statistical data of the otter sprainting activity across the study area in different 123 locations.

Spraints number	Mean	SD	Min. – max.
962	4.33	3.33	1 - 20

SD – Standard deviation

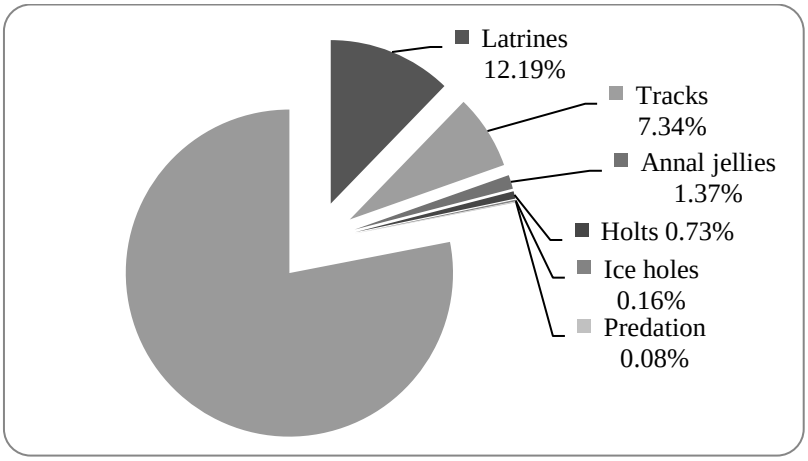

Figure 2. Other signs of otter presence than spraints.

Otter spraints were found in 66.85% locations from the study area, were otter presence was found, during a study period of 4 years. The majority of spraints were deposited on large prominent stones near and/or in the rivers or under bridges.

Most of the otter presence points were recorded on Lepșa river (34.44%) and Putna river (21.16%), followed by Tișița river (10.79%), Strâmba stream (6.22%) and Mărul stream (5.40%), on the other streams from the park were recorded percentages under 3.5%.

Applying the two methods that were used for this study: standard method and spot check, similar results for the otter distribution (Fig. 2) were obtained. Most of the otter population from the park is concentrated in the main river valleys. A high number of otter signs were recorded in the north part of the park in Lepșa river basin and in the west of the park on Putna river. As we can observe in the distribution map from the Figure 3, the otter is missing from the south part of the park due to high altitudes and low water flow which leads to a lower trophic potential.

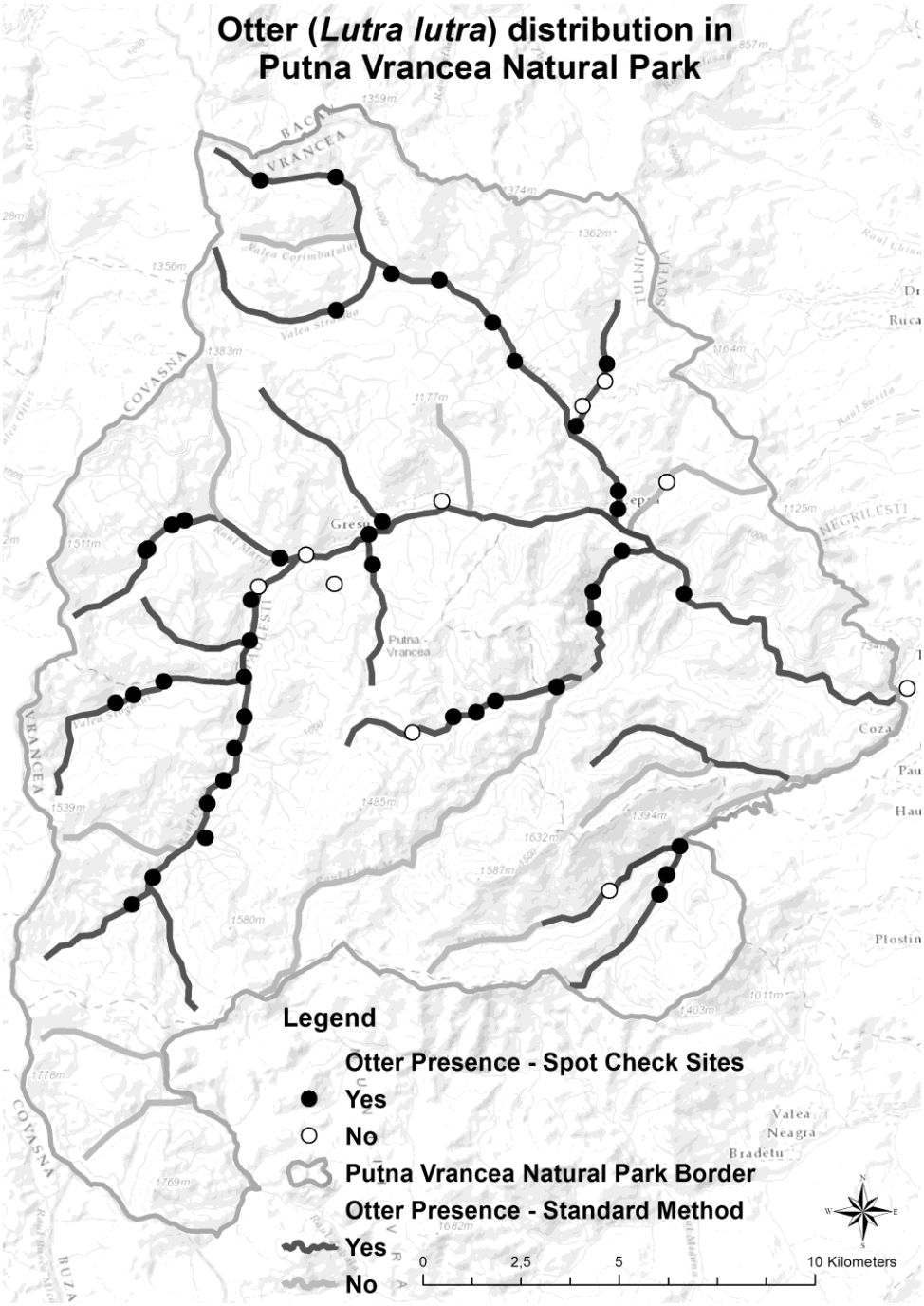

Figure 3. Otter distribution in Putna Vrancea Natural Park.

The otter activity was higher in spring (29%), an important number of otter signs of presence were found in spring, also in summer (27%) and in winter (26%) we have registered a high percentage of otter activity. The lowest number of otter signs were found in autumn (18%), probably due to the heavy rains that occurre in this season. But in the study area heavy rains and floods that may wash away the spraints and other otter presence signs, occure also in spring and early summer.

Based on otters tracks size, that were measured and registered, it was determined the structure of the otter population from Putna Vrancea Natural Park. Male population has 23.52% from the total population and female 51.94%. It is a high probability that it was included in the female population also some sub-adult males because at this age because they have almost the same track size as the adult females. Sub-adult males represents 7.84% of the total population, a percentage identical to that of juvenile and cubs. When were found tracks of females together with cub tracks it was considered that is a mother otter with their cubs, they represent only 4.9% of the otter tracks found (Fig. 4).

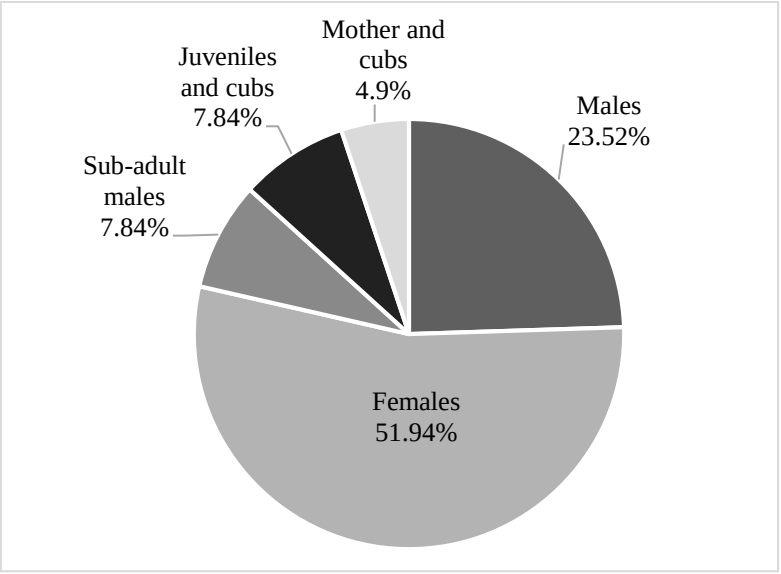

Figure 4. Otter population structure in Putna Vrancea Natural Park based on otter track size.

Table 2. Median values of the track sizes measured in the study area.

Sex/age class	No.	Median	Min. – max.
males	24	7 cm	7 – 8 cm
females	51	6 cm	6 – 7 cm
cub/juveniles	13	4 cm	3 – 4.5 cm
sub-adult males	8	5.25 cm	5 – 5.5 cm

The presence of one family group, as indicated by cub/juvenile tracks found in association with larger tracks (adult female), occurred five times: three times on Lepșa river in spring (May and April), and twice on Putna river in autumn (September and November).

Cub/juvenile and sub-adult male otters tracks were recorded on 16 occasions, on the following watercourses: Putna (n=4), Lepșa (n=5), Tișița (n=3), Strâmba (n=2), Mărul (n=1), Alunu (n=1). All of them beeing recorded between spring and autumn, none in winter.

Otter spraints revealed important information about otters activity in the natural park. The highest number of otter spraints was recorded in spring (n=347) and in autumn (n=254), with a minimum registered in summer (n=215) and winter (n=131). Thereby, the most intensive period of the territory marking occurs in the seasons spring and autumn (Fig. 5).

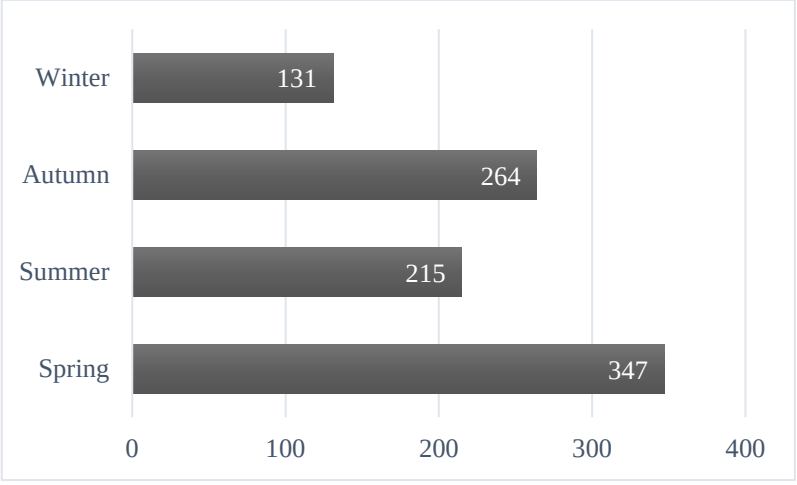

Figure 5. Otter sprainting activity by season in Natural Park.

Most of the spraints that were found per location/latrine indicated signs of all the ages: fresh – wet; medium – dry intact; and old – dry fragmented (33.48%). This suggested a permanent use of those areas. Also it was an important number of latrines that contains dry intact and fragmented spraints (20.81%) or wet and dry intact (17.65%). There also have been situations when we found only one single age spraint class per latrine: 4.98 % wet, 19% dry intact and 4.07% dry fragmented (Fig. 6). Most of the single dry fragmented - old spraints, were found in Coza river basin, under the bridges, deposited on height objects were the high waters couldn’t wash them.

During the field work were collected also information about otter preference for choosing defecation sites, and registereded the type of the object on which was deposited the spraint (Fig. 7). The majority of the otters from Putna Vrancea Natural Park prefer to deposit their spraints on stones (78.33%). Otters used also other type of objects for depositing the spraints: concrete blocks (10.74%), sand (7.41%), gravel (6.67%), wood (1.48%) and plastic (0.37%). In the stream or on the banks of the watercourses from the study area, can be found numerous large boulders, so otters manifests a preference for marking them, beeing the most prominent objects from the area.

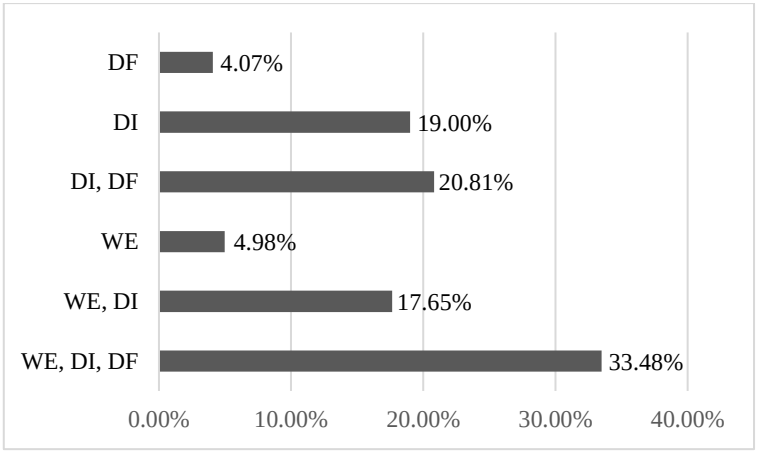

Figure 6. Otter spraint age per latrine/location (W = wet, DI = dry intact, DF = dry fragmented).

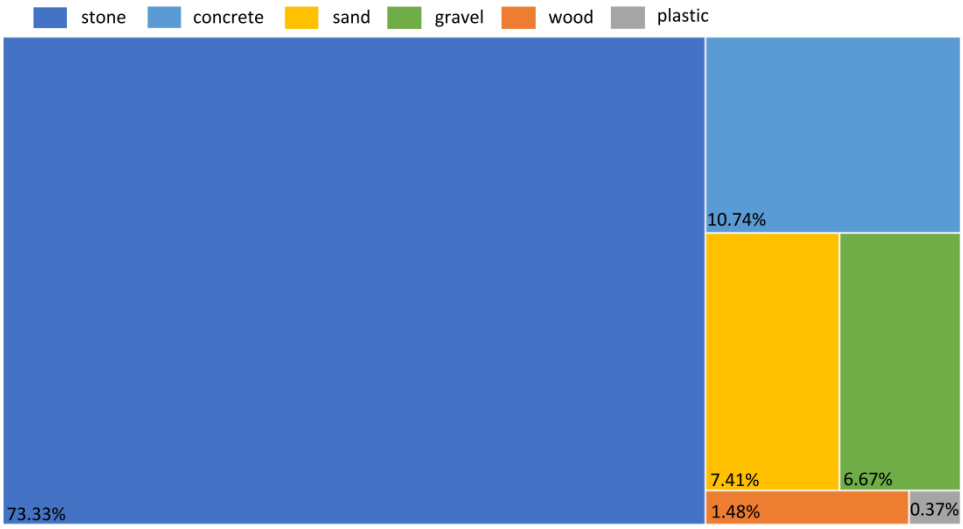

Figure 7. Otter preference for spraint deposition object in Putna Vrancea Natural Park.

In most of the areas from Romania, otters are elusive and nocturnal and therefore are hard to study based on direct observations. Most of the studies that have been carried out on otter in Europe were based on presence signs, which are considered indicators of the otter presence (Kruuk, 2006; Mason & Macdonald, 1986).

The type of field survey carried out in the present study, over the entire watercourses from the study area, is a particularly suitable approach to obtaining more detailed information on otter presence and distribution in a relatively small area like a protected area.

Using the detailed and extensive results of the present study is possible to conclude that the otter population is widespread within the study area, Putna Vrancea Natural Park.

A high percent (55.6%) of the otter presence locations were recorded on main river valleys (Lepșa and Putna rivers), this could be explained by the high trophic abundance and the high water flow from these two river valleys.

The otters seems to be strongly present and abundant in the northern (e.g. Lepșa, Strâmba), western (e.g. Mărul, Putna) and central (e.g. Putna, Greșu, Tișița) part of the park, where there is a good river system connected with other tributtaries holding viable otter populations. The streams from the south (e.g. Zăbala, Murdanul) part of the park are not used by otters because of the high altitudes from that area that cause a low water flow and food scarcity.

In the east (e.g. Coza, Alunu) part of the park, the otter is present in low density, the most of the otter signs from here were old, and the presence was scarce. This part of the park was less well marked by otters with rivers discontinuously used. The Coza and Alunu otter population is quite isolated from the main population of the natural park, mainly because of the high salinity of the water and lack of food from the last sector of this streams, downstream (Fig. 2). Probably, only roaming individuals during dispersal reach this area, marking it as a suitable feeding area upstream.

The high percentage of positive sites from our study area and the high percentage of spraints found in the study area (66.85%) confirms that spraint/latrines density can represent an indicator of otter population size (Jefferies, 1986; Mason & Macdonald, 1987).

The highest number of spraints, the most common otter sign that were discovered in thestudy area, occured in spring (n=347) and in autumn (n=254). This could be related to the raising cubs period (Green *et al.*, 1984; Mason & Macdonald, 1986) or to the the dispersal of the young otter individuals when they become independent and established their own home ranges.

Conclusions

Putna Vrancea Natural Park can thus, be considered a good conservation area for otters, particulary in the main river Putna and the tributary Lepșa. Other areas of the natural park may only offer secondary habitats, although they are frequently utilised.

The conservation value of Putna Vrancea Natural Park relates to the availability of key habitat features and a broad prey base.

In contrast to the extensive surveys that provide some useful information on large scale national and regional distribution, the detailed approach adopted in this study is urgent required to begin to understand the chain of connections between otter distribution, ecology and habitat, that is esential for establishing the conservation measures and the implementation of management practices to encourage and maintain otter populations along Romanian river systems.

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PIG (*SUS DOMESTICUS*) IN CHALCOLITHIC SETTLEMENTS FROM EASTERN ROMANIA: A MORPHOMETRIC APPROACH

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Abstract. The study is a morphometric analysis of Chalcolithic pig conducted on samples collected from archaeological sites from eastern Romania: Targu Frumos, Poduri, Hoisesti and Fetesti. A decrease in pig size is evident in diachronic analysis, taking in account the radius (Bp) and scapula (BG, SLC). The high degree of variability in characters emphasizes the presence of pig that fits the “palustris” type, which characterized the Neolithic period.

Keywords: pig, morphometry, Chalcolithic, eastern Romania.

Rezumat. Porcul domestic (*Sus domesticus*) în situri calcolitice din estul României: analiză morfometrică. Lucrarea prezintă analiza morfometrică pentru resturi de porc domestic provenite din situri calcolitice din estul României: Targu Frumos, Poduri, Hoisesti și Fetesti. Analiza diacronică a evidențiat o scădere a dimensiunilor porcului domestic, pe baza datelor metrice pentru radius (lățime proximală) și scapula (lățime cavitate glenoidă, lungime gât). Gradul ridicat de variabilitate al caracterelor metrice evidențiază prezența unor porci care se potrivesc tipului "palustris", care au caracterizat perioada neolitică.

Cuvinte cheie: porc domestic, morfometrie, Calcolitic, estul României.

Introduction

The abundance of pig remains in Chalcolithic assemblages from eastern Romania is a marker of the sedentary life of the human communities. The relative importance of pig in the economy of the studied communities reveals an increase in the importance of pig in the economy of the Early Neolithic compared to that of the Chalcolithic (Precucuteni Culture: 4800-4500 BC; Cucuteni Culture: 4600-3500 BC) (Stanc *et al*., 2011).

Previous archaeozoological studies for Chalcolithic in eastern Romania have mainly related to subsistence practices in Precucuteni and Cucuteni cultures, and many sites yielded suitable for analysis (Coroliuc, 2009; Cavaleriu & Bejenaru, 2009; Oleniuc, 2010).

Our study is focused mainly on morphometric variation in pig populations from eastern Romania in the Chalcolithic period.

Material and Methods

This study is based on pig remains (*Sus domesticus*) recovered in Chalcolithic assemblages from eastern Romania belonging the Precucuteni and Cucuteni cultures (Fig. 1). The primar osteometrical data were provided by previous studies concerning the following sites: Targu Frumos (Coroliuc, 2009), Poduri (Cavaleriu & Bejenaru, 2009; Oleniuc, 2010) and Fetesti (Cavaleriu & Bejenaru, 2009; Oleniuc, 2010).

Only skeletal remains of adult individuals were used; the estimation of age is based on both fusion of post-cranial bones epiphyses and degree of erosion of occlusal surface in teeth. The relevant measurements recorded on different anatomical elements (the lower third molar, scapula, humerus, and radius) were taken using traditional

measurements. The descriptive analysis was carried out separately for each analyzed variables. We described the variability using coefficient of variation (CV%), which is dimensionless and allows a comparison of variability of large and small bones. The degree of difference was estimated using difference index: DI% = (greater value-small value/greater value) x 100) (Ocal, 2004).

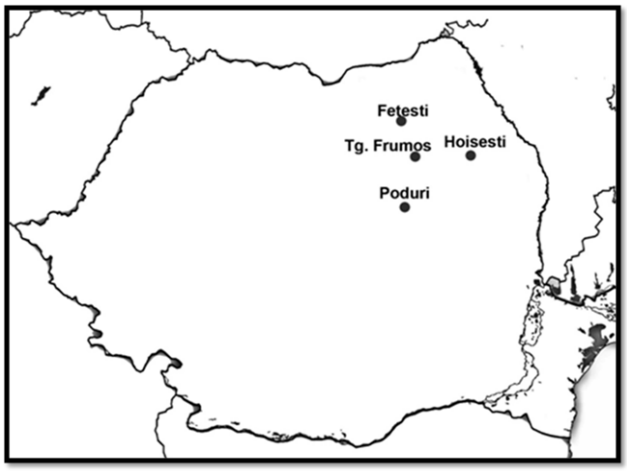

Figure 1. Map of Romania showing the sites that have been analysed.

To test the homogeneity of the populations, the Kolmogorov-Smirnov test, was used on each variable. The measurements of variables are compared using one-way ANOVA. The statistical analysis was performed by the software PAST, version 2.08b and Excel (Haber *et al*., 2002; Hammer *et al*., 2001).

Results and Discussion

The observed distribution of data was insignificant different from normality for every variable ($p>0.05$). The results of one way ANOVA indicated that there were no significant differences between the size of variables from the sites of Cucuteni period ($p>0.05$) and this made possible to pool of data from the sites belonging the same period together in descriptive analysis.

The descriptive analysis is presented for every anatomical element in Table 1 and represents an overview of the size in investigated populations. The confidence interval and coefficient of variation for the anatomical elements of the two contexts are comparatively illustrated in Figures 2-5. In variables of radius was observed both a low and high variability: CV%=5.68 in Bd and CV%=23 in Dp.

Even though a decrease in size of pigs from Precucuteni Culture to Cucuteni Culture is obvious (all variables of scapula, BFd of humerus, and Bp of radius), a difference significant between pigs from Precucuteni and Cucuteni Cultures are shown only for SLC variable of scapula (one-way ANOVA: $F=5.76$; $p=0.02$; Tukey test: $Q=3.96$; $p=0.02$). A decrease of 10.42% of size in SLC in scapula of Cucuteni Culture then SLC in scapula of Precucuteni Culture was estimated according to Difference Index.

No significant differences between variables of other anatomical elements were obvious.

Table 1. Descriptive analysis in suine measurements. Abbreviations: n - number of bones examined; min - minimum value; max - maximum value; mean - mean value; CL - confidence level; SD - standard deviation; CV - coefficient of variation in %; GL/GB - greatest length/breadth; Bp/Bd - breadth of the proximal/distal part; SD - the smallest length of diaphysis; LG - Length of the glenoid cavity (scapula); BG - Breadth of the glenoid cavity; SLC - Smallest length of the collum scapulae.

Anatomical element	Historical culture	Variables	n	Mean	St.dev.	Min.	Max.	CL(95%)	CV%
The lower third molar (M_3)	Precucuteni	GLm_3	17	37.05	5.26	26	43	2.70	14.20
	Cucuteni	GLm_3	7	34.53	3.69	29.5	39.5	3.41	10.69
		GBm_3	8	16.24	1.55	14.4	19.2	1.30	9.57
Humerus	Precucuteni	Bd	9	39.89	2.42	37	44	1.86	6.07
		BFd	7	32.86	3.34	28	38	3.09	10.16
		Dd	6	40.50	2.88	37	44	3.02	7.11
	Cucuteni	Bd	14	39.48	5.34	30	46	3.08	13.53
		BFd	2	28.25	-	26.5	30	-	-
Scapula	Precucuteni	GLP	16	37.44	4.56	30	44	2.43	12.18
		GL	16	30.75	4.74	23	39	2.53	15.41
		BG	16	26.63	3.54	21	32	1.89	13.29
		SLC	17	26.09	5.06	18	35	2.60	19.39
	Cucuteni	GLP	10	35.14	4.61	29	45	3.30	13.12
		GL	21	29.37	2.58	25	34.2	1.17	8.78
		BG	21	25.18	3.24	20	33	1.47	12.85
		SLC	26	23.37	2.60	19	29.5	1.05	11.12
Radius	Precucuteni	Bp	24	33.88	3.60	27	37	1.52	10.64
		Dp	9	24.89	5.86	18	37	4.51	23.55
	Cucuteni	GL	17	40.79	4.41	26	45	2.27	10.81
		Bp	39	27.09	5.49	15	33	1.78	20.25
		BFp	16	26.53	1.59	24	30	0.85	6.00
		SD	10	16.30	1.62	12	18	1.16	9.93
		Bd	12	30.10	1.71	28	33.5	1.09	5.68

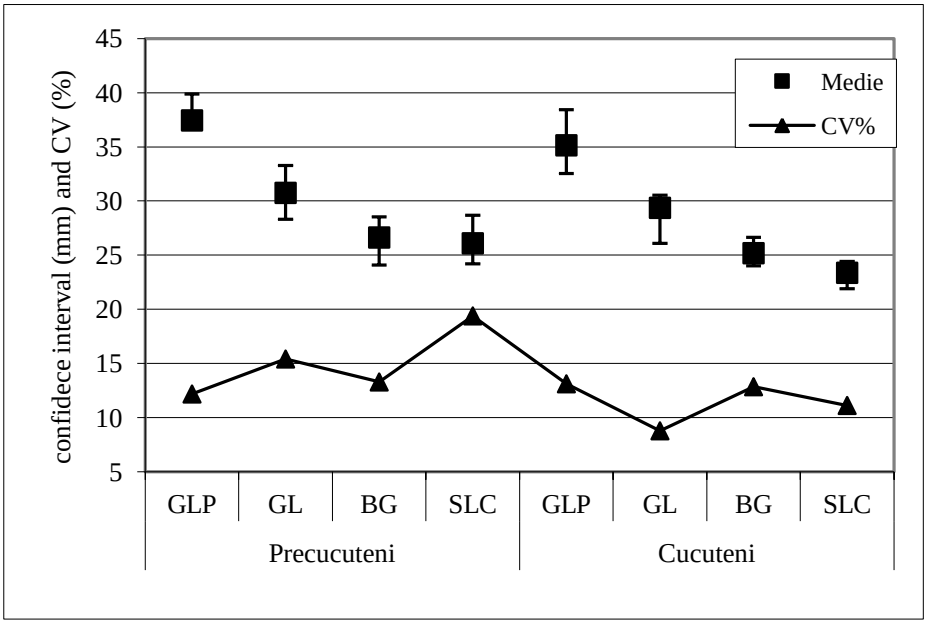

Figure 2. Confidence interval and coefficient of variation in scapula of pig.

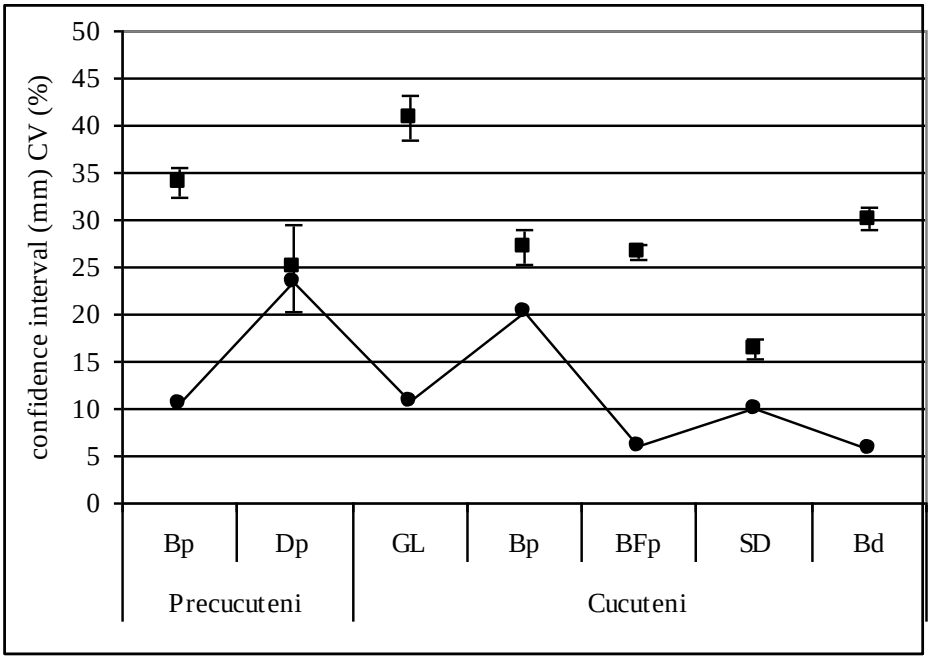

Figure 3. Confidence interval and coefficient of variation in radius of pig.

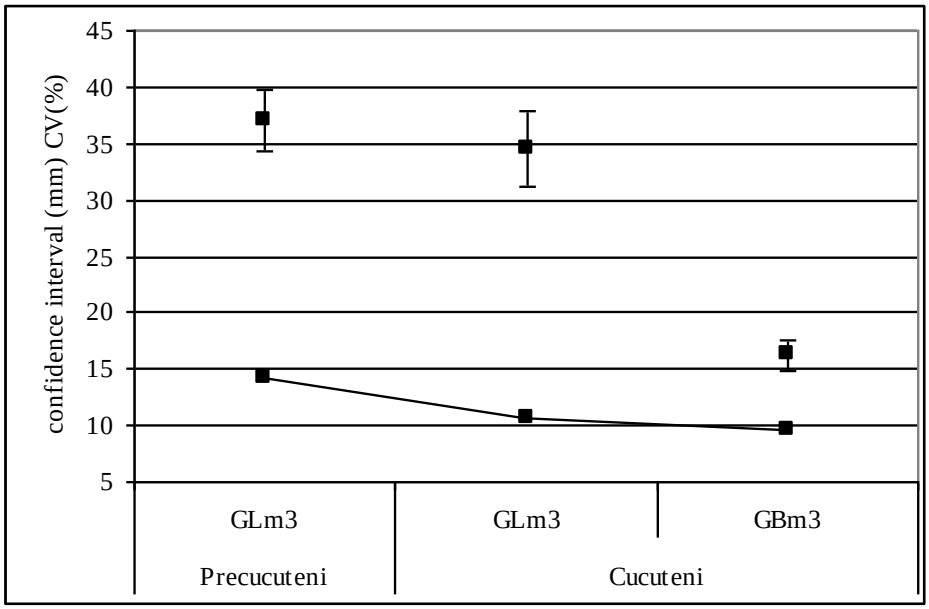

Figure 4. Confidence interval and coefficient of variation in the lower third molar of pig.

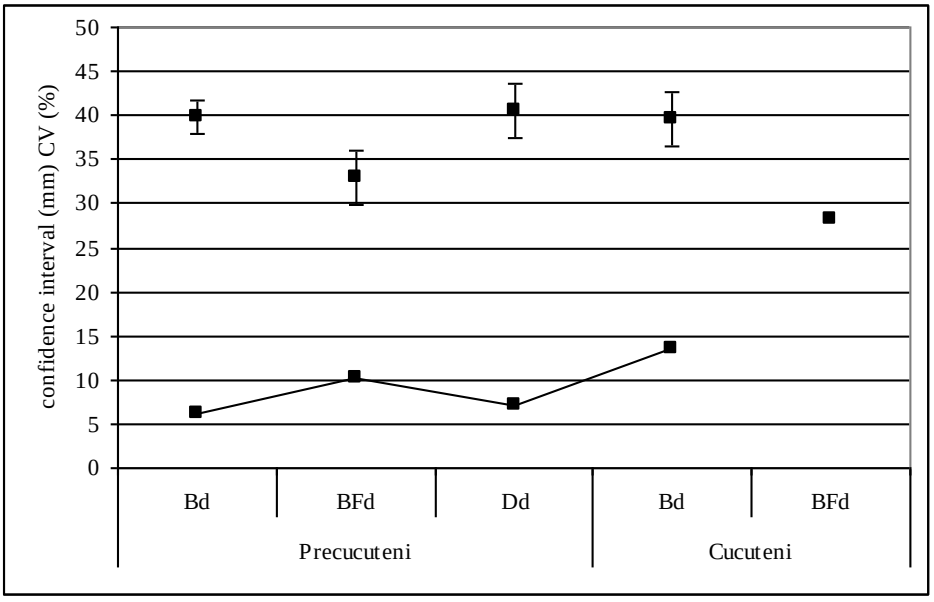

Figure 5. Confidence interval and coefficient of variation in humerus of pig.

Conclusions

The high degree of variability in characters emphasizes the presence of pig regional structures whose size varies but that fits the "palustris" type which characterized the Neolithic period.

Generally, a decrease in size of pigs from Precucuteni Culture to Cucuteni Culture was obvious, but the difference significant between pigs from these two cultures was made by size of SLC variable of scapula.

Acknowledgements

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ANIMAL RESOURCES EXPLOITATION IN THE ROMAN SETTLEMENT FROM NICULIȚEL: ARCHAEOZOOLOGICAL DATA

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Abstract. The archaeozoological sample was collected in the years 2009 and 2011 and includes household waste. The vast majority of the faunal remains come from domestic mammals and those of cattle (*Bos taurus*) are predominant. The identified mammal species are: *Bos taurus, Ovis aries, Capra hircus, Sus domesticus, Equus caballus, Canis familiaris, Cervus elaphus, Capreolus capreolus, Sus scrofa, Bos primigenius, Lepus europaeus*. Animal husbandry was a very important activity for the community at Niculițel, while hunting and fishing had a small importance in the food economy of the settlement. Red deer is in the present days a Carpathian species, but in the early first millennium AD was found in Dobrudja area. Aurochs, now an extinct species in the fauna of our country, was also present in this area during the first millennium AD. Besides the remains of mammals (which are predominant) were identified remains of fish and birds.

Keywords: archaeozoological data, Niculițel, hunting, animal husbandry, 2-3th centuries AD.

Rezumat. **Exploatarea resurselor animale în așezarea de perioada romană de la Niculițel: date arheozoologice**. Eșantionul arheozoologic analizat a fost colectat în anii 2009 și 2011 și este constituit din resturi de origine menajeră. Cea mai mare parte dintre resturile faunistice provin de la mamiferele domestice, iar cele de la vita domestică (*Bos taurus*) sunt predominante. Speciile de mamifere identificate în eșantion sunt: *Bos taurus, Ovis aries, Capra hircus, Sus domesticus, Equus caballus, Canis familiaris, Cervus elaphus, Capreolus capreolus, Sus scrofa, Bos primigenius, Lepus europaeus*. Creșterea animalelor era o activitate importantă pentru locuitorii așezării de la Niculițel, în timp ce vânătoarea și pescuitul aveau o importanță redusă pentru economia alimentară a așezării. Cerbul, în zilele noastre, este o specie carpatică, dar la începutul primului mileniu creștin era întâlnit în zona Dobrogei. Bourul, specie actualmente dispărută din fauna României, la începutul primului mileniului d.Hr. era prezent în zonă. Pe lângă resturile provenite de la mamifere (care sunt predominante) au fost identificate și resturi provenite de la pești și păsări.

Cuvinte cheie: date arheozoologice, Niculițel, vânătoare, creșterea animalelor, secolele 2-3 d.Hr.

Introduction

Located in an area marked by an abundance of historic vestiges, Niculițel (Fig. 1) experienced an intense habitation during Roman period, which was also favored by the auspicious habitation conditions.

In the centre of locality, on a plateau limited on the eastern side by the Niculițel stream and on the west side by the Niculițel Hills, a *vicus* type settlement was unearthed. An altar dedicated to *Iupiter Dolichenus*, a funerary stele and an inscription in Latin, dedicated to the Emperor Julian the Apostate, all come from the mentioned settlement. As a result of a sondage made north-east of the village, in 1953, the foundations of a Roman building were discovered, as well as Roman and Getae pottery fragments (2nd-4th centuries AD). An aqueduct was also discovered in the central area of the village, a discovery which was confirmed through researches made in 2005, with three such aqueducts being

documented. Furthemore, the eastern terrace of the Niculițel stream was used during Roman period by the *villae rusticae* owners; at the beginning of IV century AD, the *Basilica of martyrs with crypt* (Baumann, 2004) was built on such a farm. North and north west of the village, on a vast surface, up to Capaclia, Bădila and Cocoș monastery, many *villae rusticae* and Roman necropolises (2nd-3rd centuries AD), were identified following field researches. Between 1972-1973, V.H. Baumann carried out surface researches and an archaeological sondage, north of the northest mound, which was investigated in 1970-1971 (Baumann, 1976). In the same area, a *villa rustica* type of settlement was identified, including the enclosure wall with buttress. Based on construction materials, pottery and numismatics, the *villa* was dated to 2nd-3rd AD.

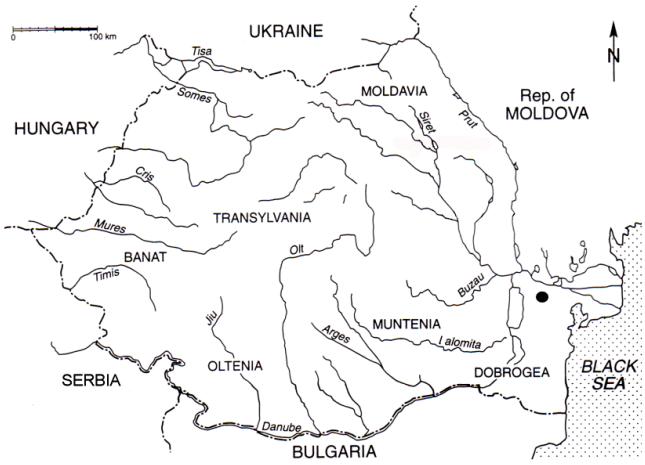

Figure 1. Settlement location.

***Villa rustica* from the northern side of the locality**. In the summer of 2011, a *villa rustica* was researched as part of a rescue archaeological campaign. The actual point is situated in the northern part of the locality, at approximately 200 meters south from the wave earth and 10 meters from a stream flow. In the professional literature, the existence of a *vicus* south from the wave land and of a *villa* on the north, which can be dated to 2nd-3rd AD (Baumann, 1983; Bărbulescu, 2001), is well documented. V.H. Baumann carried out archaeological researches within the *villa* area in the 70's, brought about by the extension of the live-stock complex (Baumann, 1983).

The property, with an extent of 2500 square meters is located on the spot occupied by the former CAP, in the area that concides with a *vicus* type of habitation. On the surface a concrete plaque was installed with a foundation filled with yellowish earth. The ancient habitation levels were disturbed by municipal interventions and contemporary traces (foundations, resistance pillars, holes for water pipes) were found in the archaeological sections. Results of the researches revealed habitation levels and archaeological material belonging to early Roman period – 2nd-3rd AD. A *villa* type habitation was partially investigated, which included an interior courtyard, portions of walls

made of stone, fragments of pavement from limestone tiles and a *hypocaustum* installation from a thermal edifice.

The archaeological material is higly diverse. The pottery confirms imports from the south Pontic area as well as from Aegean and western provinces of Empire. Apart from amphorae (*Zeest 94, Zeest 104-105, Zeest 84-85, Dressel 24, Dressel 2-5, Cretane 4, Berenice MR 3, Berenice MR 5, Kapitän II, Berenice 298-299, Carthage LR 2*), fragments of *vasa escaria* were discovered (Eastern *sigilatta*, Western *sigilatta*, south Moesian pottery manufactured in the slurry technique, Çandarli ware), *vasa potatoria* (discus jugs, *oenochoe*), *thuribula* and lamps Discovered glass vessels were mainly plates, bowls, *unguentaria* and flasks characteristic for 2nd-3rd AD.

In the north-eastern part of the *villa* a workshop for processing iron functioned. In this area, along with a significant amount of iron slag and lumps, a hearth (forge) was discovered. Local workshops most likely produced the 50 bone objects (pendants, hairpins, needles, a medical spoon), some of these still in the manufacturing process.

Chronologically, the settlement belongs to the 2nd-3rd AD. time frame, its final moment of functioning being around 3rd century AD., influenced by the Carpi-Gothic attacks. In the area, a series of coins were unearthed, the earliest from Antoninus Pius, while the majority being issued during the Severan dynasty (Septimius Severus, Caracalla, Geta).

Material and Methods

The identification of the archaeozoological remains aimed to establish the anatomical and taxonomical origin of the specimens according to their morphology. The archaeozoological quantification aimed at evaluating the relative frequencies of the different species and of the different skeletal elements in the sample. The quantification methods used were based on establishing the number of identified specimens (NISP) and on estimating minimum number of individuals (MNI) (Udrescu *et al*., 1999).

The faunal material analyzed was gathered from the Roman level at Niculitel site, during the archaeological research which took place in the years 2009 and 2011. The sample consists of 2870 faunal remains, of garbage origin.

Results and Discussion

The analysis of 246 faunal remains from Niculițel, collected during the excavation conducted in the year 1970, was published in 1996 by Haimovici S., and that analysis is referenced for comparisons in the following study. The sample consists of two fish remains, one from birds and the rest from mammals. Most of the mammal remains belong to domestic ones (94.7%) and between them the cattle (*Bos taurus*) represents the largest share (70.9%). Mammalian species identified are: *Bos taurus, Ovis aries, Capra hircus, Sus domesticus, Equus caballus, Cervus elaphus, Capreolus capreolus, Bos primigenius, Ursus arctos, Canis lupus* (Haimovici, 1996) (Table 1).

The analysed sample contains 2870 fauna remains, 36 belong to birds, 13 from fish and the rest from mammals. It wasn’t possible to determine, down to the species, all the mammalian remains. Therefore, 895 remains consisting in rib fragments, vertebrae, skull, as well as diverse long and wide bones couldn’t be clearly assigned to a certain mammal species and were not included in the present study.

Table 1. Quantification of faunal remains
(NISP – number of identified specimens; MNI – minimal number of individuals).

Species	Sample from 2009 and 2011				Haimovici, 1996			
	NISP	**%**	**MNI**	**%**	**NISP**	**%**	**MNI**	**%**
Bos taurus	1304	67.71	43	49.43	134	70.9	10	37.03
Ovis aries/Capra hircus	308	15.99	14	16.09	24	12.69	5	18.51
Sus domesticus	182	9.45	12	13.79	13	6.88	4	14.81
Equus caballus	15	0.78	2	2.3	8	4.23	2	7.4
Canis familiaris	17	0.88	3	3.45	-	-	-	-
Total domestic mammals	**1826**	**94.81**	**74**	**85.06**	**179**	**94.7**	**21**	**77.7**
Sus scrofa	30	1.56	3	3.45	-	-	-	-
Cervus elaphus	33	1.71	3	3.45	6	3.17	2	7.4
Capreolus capreolus	6	0.31	2	2.3	1	0.53	1	3.7
Lepus europaeus	13	0.68	3	3.45	-	-	-	-
Bos primigenius	18	0.93	2	2.3	1	0.53	1	3.7
Ursus arctos	-	-	-	-	1	0.53	1	3.7
Canis lupus	-	-	-	-	1	0.53	1	3.7
Total wild mammals	**100**	**5.19**	**13**	**14.94**	**10**	**5.3**	**6**	**22.2**
Total identified mammals	**1926**	**100**	**87**	**100**	**189**	**100**	**27**	**100**
Gallus domesticus	28	-	-	-	1	-	-	-
Anser anser/A. domesticus	4	-	-	-	-	-	-	-
Aves unidentified	4	-	-	-	-	-	-	-
Total birds	**36**	-	-	-	**1**	-	-	-
Huso huso	1	-	-	-	-	-	-	-
Acipenser sp.	1	-	-	-	-	-	-	-
Silurus glanis	4	-	-	-	-	-	-	-
Cyprinus carpio	5	-	-	-	**2**	-	-	-
Teleostei unidentified	2	-	-	-	-	-	-	-
Total fish	**13**	-	-	-	**2**	-	-	-
Unidentified mammals	895	-	-	-	54	-	-	-
Total sample	2870	-	-	-	246	-	-	-

Animal husbandry was an essential activity for the inhabitants of Roman settlement at Niculițel; the archaeozoological investigations performed during recent years provided numerous information that concur such statements. The sample contains a large amount of domestic mammal's remains, up to 94.8%.

The list of the domestic mammals identified at Niculițel settlement is quite comprehensive. The composition on the livestock seems relatively homogenous, compared to other samples Roman samples from Dobrudja; the identified domestic mammals are: cattle (*Bos taurus*), sheep (*Ovis aries),* goat (*Capra hircus*), pig (*Sus domesticus*), horse (*Equus caballus*), dog (*Canis familiaris*). *Canis familiaris* is a domestic species with no direct economical relevance.

As far as the number of identified specimens (NISP) and the minimum number of individuals (MNI) are concerned, the prevailing domestic mammal in the investigated site is cattle and its breeding was a basic component of local economy. Cattle holds a 67.7%

share from the total of mammal remains; it is followed, in frequency, by sheep – 16% and pig - 9.4%. Cattle also presents the highest frequency in terms of estimated individuals - 49.4%, followed by sheep and goat - 16% and pig - 13.7% (Table 1).

Hunting held a less valuable importance for the Niculițel settlement; the remains of wild mammals have a lesser share within the two samples from Niculițel. Compared to the earlier studied sample (Haimovici, 1996), the wolf and bear are two unidentified species in the sample from 2009-2011; however, we were able to identify remains of wild boar and hare, which were not present in the sample collected in 1970. The complete list of wild mammals contains the following species: *Cervus elaphus* (red deer), *Sus scrofa* (wild boar), *Capreolus capreolus* (roe deer), *Bos primigenius* (aurochs), *Lepus europaeus* (hare), *Ursus arctos* (bear) and *Canis lupus* (wolf). Wild boar and deer appear most often from wild mammals (Table 1).

Bird remains are scarce (1.82%). 28 remains belong to domestic hen (*Gallus domesticus*), other four belong to goose (*Anser anser*/*A. domesticus*), without clear evidence to distinguish between wild goose or domestic goose, while other four fragments are too small to identify the species or gender (Fig. 2).

Fish remains are also scarce (0.66%). The identified species are *Silurus glanis* (catfish), *Cyprinus carpio* (carp), *Acipenser* sp. (one remain belongs to sturgeon) (Fig. 2).

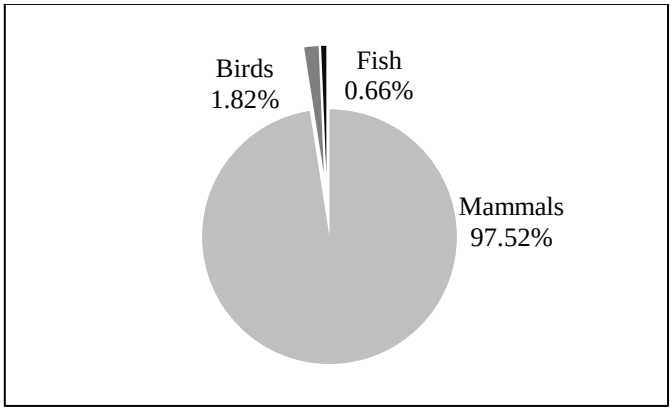

Figure 2. Distribution of faunal remains from the Niculitel sample.

Conclusions

Animal husbandry was a vital activity for the inhabitants of Niculițel settlement. The high portion of domestic mammals from the studied sample (94.8%) proves that it was more important than other activities (hunting, fishing).

The largest share from the domestic mammals is held by cattle (*Bos taurus*); followed by sheep and goat and then by swine (considering the remains number and the estimated individuals number).

The largest share of identified wild mammals is represented by red deer and bear, which nowadays are mainly located in the Carpathians area, but in the first century AD were also present in Dobrudja (another clue regarding the large forests in the area at that time). Due to intense deforestation and excessive hunting, they receded to the Carpathian area. Aurochs, an extinct species today, was living in the skirt of the forests in the area.

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IS THE GAMMA DOSE RATE DANGEROUS FOR THE HUMAN POPULATION FROM THE SURROUNDING AREA OF THE URANIUM EXPLOITATION CRUCEA, ROMANIA?

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Abstract. This study aimed at gamma dose rate evaluating in the surrounding area of uranium exploitation, integrating the medical reported cases that proved their long-term effects upon human population health. The measurements for gamma dose rates (39 sampling sites) and water parameters were conducted in May 2015. The population health data were collected from local medical offices and doctors. Human population located around the uranium exploitation is the best indicator for the radioactivity level when the environment is contaminated. The parameters like pH, DO, TDS and redox potential (ORP) are some of the drinking water quality indicators. They were considered important in this study because water itself dissolves minerals from the area. The gamma dose rates averages from the uranium exploitation Crucea do not represent any threat to the local population or tourists. Medical reports proved that people suffer from chronic illness caused by other factors like age, life style and social-economic problems/individual's status.

Keywords: gamma radiation, uranium exploitation, population health, drinking water

Rezumat. Este periculoasă doza de radiații gamma pentru populația umană din jurul exploatării de uraniu Crucea, România? Acest studiu a avut ca scop evaluarea dozelor de radiații gamma din împrejurimile exploatării de uraniu, care a fost integrată cu cazurile medicale raportate ce au demonstrat efectele pe termen lung asupra populației umane. Măsurătorile dozelor radiațiilor gamma (39 puncte de prelevare) și a parametrilor apei au fost realizate în luna Mai 2015. Datele privind sănătatea populației umane au fost obținute de la cabinetele medicale și medicii din zona de studiu. Populația umană localizată în jurul exploatărilor de uraniu este cel mai bun indicator pentru nivelul de radiații atunci când mediul este contaminat. Parametrii precum pH-ul, OD, TSD și potențialul redox (ORP) sunt câțiva dintre indicatorii privind calitatea apei potabile. Aceștia au fost considerați importanți în studiul prezent deoarece apa are capacitatea de a dizolva sărurile și mineralele din zonă. Mediile dozelor radiațiilor gamma rezultate de la exploatarea minieră Crucea nu reprezintă vreun pericol pentru localnici sau turiști. Rapoartele medicale au demonstrat că oamenii din zonă suferă de boli cauzate de alți factori precum vârsta, stilul de viață și problemele socio-economice/statutul individual.

Cuvinte cheie: radiație gamma, exploatare de uraniu, sănătatea populației, apa potabilă

Introduction

The natural background radiation is for most of the human population the largest component of their exposure (UNESCEAR 2000). The main sources of natural radiations are the terrestrial radionuclides like ^{232}Th and ^{238}U, with their decay products, and ^{40}K (Almgren *et al*., 2008; Quarto *et al*., 2013). The geographic location and bedrock composition are important factors that influence the background radiation values all around the world (Almgren *et al*., 2008; Al-Sharkawy *et al*., 2012; Hosseini Poya *et al*., 2015). The cosmic radiation originated from outer space is reduced by the atmosphere and only contributes with 15% of the total dose (UNESCEAR 2008). The human exposure to

radiations has many pathways: ingestion of radionuclides from food and water, external radiation and inhalation of dust particles charged with radon (Carvalho *et al*., 2014). The genotoxicity caused by radiations in humans at cellular level was well studied (Kuzmina *et al*., 2016; Aypar *et al*., 2011; Pogribny *et al*., 2005; Raiche *et al*., 2004). Uranium mining started to develop when the applications with this element increased. In the mining areas, the contamination of the environment can occur very fast if the entire process is not well controlled. Human population in the surroundings of the uranium exploitation is the best indicator of the environmental contamination level. The fast measurements of electromagnetic gamma radiation from air, medical reports about population's health and other factors like water quality can quickly prove who is responsible for the biggest damage.

This study is part of a larger research regarding population's health state in the upper basin of Bistrita River run by Cruceanu *et al*., 2015. Present paper aimed at gamma dose rates evaluating from the surrounding area of uranium exploitation, integrating the medical reported cases that proved their long-term effects upon human population's health.

Material and Methods

Area description

The geological research and exploration for the future uranium mining exploitation Crucea-Botusana, Romania started in 1965. In 1983, after years of geological exploration, two new mining sites were opened in Crucea and Botusana villages (Cruceanu *et al*., 2015). At present is one of the largest uranium exploitations and supplies Cernavoda nuclear power plant - the only one in Romania. The uranium exploitation Crucea has the location in Stanisoara Mountains, approximately 35 kilometers away from Vatra Dornei town – an important mountain resort. During winter and summer thousands of tourists are present in the area. The uranium extracted from Crucea mining site is loaded in covered trucks and directly transported 40 kilometers away in Argestru village. From here it is loaded in trains and transported in other areas for processing, in order to obtain the final product necessary for the nuclear power plant. The transportation route crosses an inhabited area and there is a possibility of contamination. In addition to that, the Crucea village surrounding area is considered to have a negative impact because people from other villages and tourists think that is highly contaminated with radiations and claimed to have headaches and nausea during their visit (Fig. 1).

The data collected from Crucea village describe the geological structure of the area. This consists of crystalline schists, thick layers of sedimentary rocks, sandstones and limestone conglomerate. The soil components are different from one area to another but clay is the major one. The erosion process influenced the soil formation. The natural underground resources are complex with major components as: uranium, copper, lead, silver, zinc, gold and sulphur. The main activities of the population were for centuries the animal husbandry, wood resources exploitation and mining.

Figure 1. Crucea village and the road to uranium exploitation.

In situ measurements

The measurements of the gamma dose rate and water parameters were conducted in May 2015. As in a previous research (Cruceanu *et al*., 2015), these were recorded *in situ* as continuous samples during the sun light from 8 AM until sunset. The gamma dose was measured in the populated and surrounding areas of the uranium exploitation at 9 highly populated sites. The ground zero area was considered to be the mining village Crucea from Suceava County with a stable population of 1833 inhabitants in the year 2011 which decreased due to economic issues. The young population migrated to other areas and countries, searching jobs and a better life. Most of the people worked in the mining industry in the past when the uranium exploitation was at the highest peak. Nowadays, only a small number of people work in the uranium mine that has highest employees number (201 from a reported total of 307 employees in Crucea) in the area. There is no hospital or specialized medical office there and all inhabitants must go when they have significant health problems to Vatra Dornei town hospital - the largest in the area - or at the medical office from Dorna Arini. Though, the medical conditions that require specialized interventions can only be treated in larger towns like Suceava, at 150 km distance.

The gamma dose rate from all the sites was measured using the Voltcraft Gamma-Check-A Geiger Counter. This device is in conformity with EMC directive 2004/108/EC and RoHS directive 2002/95/EC, according to the producer Voltcraft, Germany. The apparatus measured the gamma dose rate for 3 minutes at each 60 seconds. The range of the minimum gamma dose was 0.01 µSv h^{-1} and the maximum gamma dose that could be measured was 999 µSv h^{-1} with an error of ±10%. The gamma total dose rate in air was measured at 1 m above the ground level. pH, TDS (total dissolved solids), dissolved oxygen and ORP (redox potential) were measured for the drinking and spring water. The apparatus used for the measurements of these parameters was HI 9828 from Hanna Instruments, which was calibrated using certificated reagents. The water measurements were run in 10 replicas at each sampling site. Geographical coordinates were recorded using the GPSMAP 64 from Garmin.

From medical offices and doctors from localities Panaci, Dorna Arini, Carlibaba and Vatra Dornei town (Fig. 2) were collected data recorded in 2010-2014, in order to observe any chronic exposure to the radiations for each studied area. The data were analyzed and plotted in OriginPro 9.3 (2016) software. For the gamma radiation dose was applied the one-way ANOVA test followed by post-hoc Tukey HSD after the Shapiro Wilk

test of distribution. During the measurements were not trespasses against any private property.

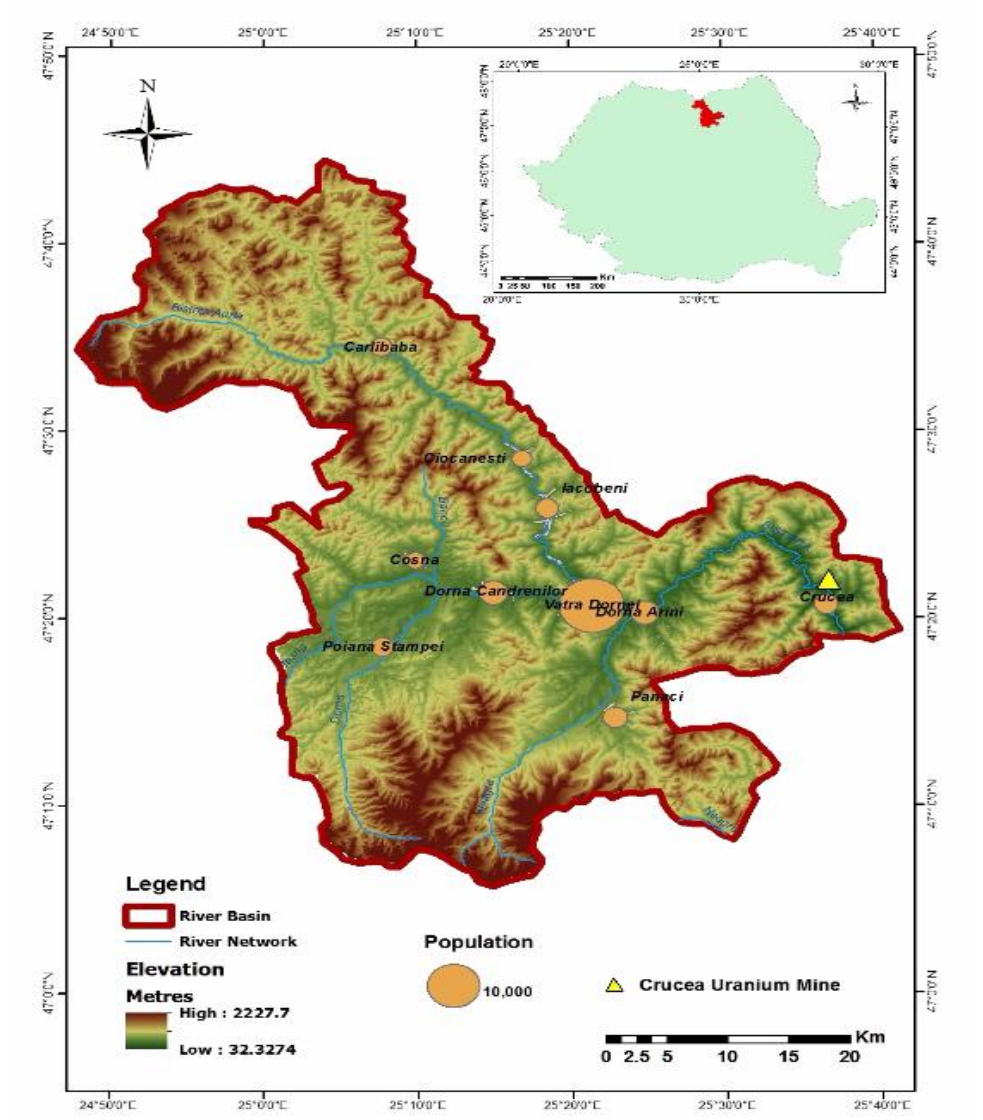

Figure 2. Map of the studied area with medical reported cases.

Results and Discussion

The gamma dose rate

The obtained results of gamma dose rate were compared with values from the Romanian legislation Order no. 1978 from 19.11.2010 Regarding the National Network of

Environment Radiation Survey (text in Romanian language) to set the critical level of the environmental contamination. The legislation separated the air gamma dose rate in three limits. The first limit is 0.25 µSv h^{-1} (lowest warning) where the sample must be measured again and the environmental protection agency must be announced. The second limit is 1 µSv h^{-1} (medium warning) where the samples must be measured again and environmental protection agency must be quickly announced for an emergency laboratory expertise. The third limit is 10 µSv h^{-1} (high warning) where samples must be measured again; environmental protection agency must be quickly announced for an emergency laboratory expertise and, if the results are positive, the entire force for emergency situations must act.

Table 1 presents the values obtained after three consecutive measurements in different geographic points around the exploitation area. Most of the results did not exceed the first limit of 0.25 µSv h^{-1}; however, there are few areas that require attention.

The radiation dose rate is higher for point sources only, suggesting that the geological composition of the area has the main influence. The Crucea village recorded the highest value of 0.438 µSv h^{-1} which requires further investigations in the village center, near the road where the uranium ore is transported in covered trucks. This may be responsible for the increased dose at this point due to some dropped contaminants or there is a different geological structure rich in radioactive ore. Another high value was recorded (0.308 µSv h^{-1}) in a populated area in Vatra Dornei town in a car parking made from concrete and stone. This raises the hypothesis that the main radiation source is the geological composition and small stones can have radioactive ore that increase the concentrations at certain points. The one-way ANOVA variability test results for the gamma dose rate from all the studied areas showed no significant differences ($p>0.05$ and F statistic value was 0.1581) between the 9 populated areas. The Tukey HSD test showed no specific areas with significant high concentration ($p>0.05$ in all comparisons). The total mean±SD of the gamma dose rate for all the areas had the value of 0.178±0.014 µSv h^{-1} which is lower than the first limit: 0.25 µSv h^{-1}. The pollution may have point sources only, according to the results. The possibility of contamination from trucks during the transportation should be not excluded, if these are not well decontaminated in the exploitation area.

The environmental levels of gamma dose rate in the populated areas cannot be considered insignificant. Doyi *et al*., 2013 measured the gamma radiation levels in the underground artisanal gold mines from eastern Ghana where the doses ranged from 0.06±0.02 mS y^{-1} (equivalent with 0.0068±0.0022 µS h^{-1} reported to one year with 365 days) to 1.23±0.04 mS y^{-1} (equivalent with 0.14±0.0044 µS h^{-1} reported to one year with 365 days). Al-Sharkawy et al., 2012 reported around the Sharm El-Sheik town from Egypt an average±SD for the absorbed dose rate of 112.8±24.4 nGy h^{-1} (equivalent with 0.112±0.0244 µS h^{-1}). The indoor gamma dose rate without the cosmic contribution in dwellings of Campania regions, Italy was measured by Quarto et al., 2013 and the average±SD was 264±111 nGy h^{-1}(equivalent with 0.264±0.111 µS h^{-1}).

Almgren *et al*., 2008 measured the gamma radiation doses in dwellings from western Sweden. The highest range was in Göteborg with 0.087-0.26 µS h^{-1} in apartments and 0.094-0.14 µS h^{-1} for the inhabitants. The outdoor public exposure to gamma background from Iran measured by Hosseini Pooya et al., 2015 was for the sampling years 2010-2011 the mean±SD range between 32.73±5.50 µS/month (equivalent with 0.044±0.0075 µS h^{-1}) and 69.08±13.5 µS/month (equivalent with 0.094±0.018 µS h^{-1}).

Table 1. The gamma dose rate values from the sampling locations (the cosmic dose rate of 0.032 μSv h^{-1} was subtracted according to UNSCEAR 2000).

Sampling sites _location	Geographical coordinates		Sampling sites description	Gamma dose rate (μSv h^{-1})	Elevation above the sea level (m)
	North	East			
Ostra, Suceava County	47^0 21'	24^0 42.49'	Ex-mining deposit, area without inhabitants	**0.198**	838
Ostra, Suceava County	47^0 20.368'	25^0 42.339'	Ex-mining deposit, area without inhabitants	**0.138**	878
Holda, Suceava County	47^0 15.721'	25^0 40.686'	Village with inhabitants	**0.198**	655
Holda, Suceava County	47^0 15.701'	25^0 40.685'	Village with inhabitants	**0.238**	665
Holda, Suceava County	47^0 15.717'	25^0 40.745'	Village with inhabitants	**0.138**	652
Holda, Suceava County	47^0 15.615'	25^0 41.342'	Village with inhabitants	**0.238**	638
Holdita, Suceava County	47^0 14.942'	25^0 41.57'	Village with inhabitants	**0.238**	633
Neagra, Suceava County	47^0 13.609'	25^0 41.57'	Village with inhabitants	**0.138**	644
Neagra, Suceava County	47^0 13.841'	25^0 41.453'	Village with inhabitants	**0.218**	654
Brosteni, Suceava County	47^0 14.063'	25^0 41.836'	Village with inhabitants	**0.098**	647
Brosteni, Suceava County	47^0 14.080'	25^0 41.834'	Village with inhabitants	**0.308**	645
Brosteni, Suceava County	47^0 14.369'	25^0 41.976'	Village with inhabitants	**0.238**	633
Holda, Suceava County	47^0 16.314'	25^0 38.962'	Village with inhabitants	**0.198**	644
Holda, Suceava County	47^0 16.908'	25^0 38.943'	Area without inhabitants	**0.138**	654
Holda, Suceava County	47^0 17.596'	25^0 37.907'	Area without inhabitants	**0.238**	693
L. Ursului, Crucea, Suceava County	47^0 17.979'	25^0 37.891'	Village with inhabitants	**0.138**	673
Crucea, Suceava County	47^0 19.986'	25^0 37.182'	Village with inhabitants	**0.168**	683
Crucea, Suceava County	47^0 21.064'	25^0 36.291'	Village with inhabitants	**0.308**	685
Crucea, Suceava County	47^0 20.895'	25^0 36.466'	Village with inhabitants	**0.238**	694
Crucea, Suceava County	47^0 21.054'	25^0 36.419'	Village with inhabitants	**0.198**	713
Crucea, Suceava County	47^0 21.605'	25^0 38.692'	Uranium exploitation road	**0.238**	889
Crucea, Suceava County	47^0 21.373'	25^0 38.594'	Uranium exploitation road	**0.168**	790
Crucea, Suceava County	47^0 21.194'	25^0 38.321'	Uranium exploitation road	**0.198**	761
Crucea, Suceava County	47^0 20.906'	25^0 36.932'	Uranium exploitation road in village	**0.198**	716
Crucea, Suceava County	47^0 21.085'	25^0 36.617'	Uranium exploitation road in village	**0.438**	706
Cojoci, Suceava County	47^0 22.841'	25^0 35.202'	Village with inhabitants	**0.268**	722
Cojoci, Suceava County	47^0 23.581'	25^0 34.58'	Village with inhabitants	**0.268**	741
Neagra Sarului, Suceava County	47^0 13.54'	25^0 17.936'	Village with inhabitants	**0.268**	985
Neagra Sarului, Suceava County	47^0 11.396'	25^0 15.157'	Village with inhabitants	**0.268**	1083
Vatra Dornei town, Suceava County	47^0 20.647'	25^0 21.248'	City, parking area	**0.308**	808
Vatra Dornei town, Suceava County	47^0 20.647'	25^0 21.248'0"	City, park	**0.168**	816
Vatra Dornei town, Suceava County	47^0 20.526'	25^0 21.248'	City, park	**0.138**	821
Vatra Dornei town, Suceava County	47^0 19.945'	25^0 20.692'	City	**0.168**	875
Panaci, Suceava County	47^0 15.429'	25^0 22.497'	Village with inhabitants	**0.138**	886
Panaci, Suceava County	47^0 14.832'	25^0 22.675'	Village with inhabitants	**0.378**	914
Panaci, Suceava County	47^0 14.221'	25^0 23.225'	Village with inhabitants	**0.098**	927
Dragoiasa, Suceava County	47^0 09.090'	25^0 26.191'	Village with inhabitants	**0.238**	1043
Dragoiasa, Suceava County	47^0 09.220'	25^0 26.679'	Village with inhabitants	**0.198**	1036
Dragoiasa, Suceava County	47^0 09.391'	25^0 27.301'	Village with inhabitants	**0.198**	1023

Considering the literature results, the investigated area may be affected by radiations but this depends from point to point. The Environmental Protection Agency from Suceava County (the studied area is under its jurisdiction!) published data regarding the gamma dose rate in the air but the location of the automatic sampling station was not specified. It could be one of these three: SV1 urban background (located in Suceava town), SV3 traffic background (located in Siret town) and EM3 close to natural background

(located in Poiana Stampei village which is close to Vatra Dornei town). However, the data recorded in 2015 before and after this study were: average of 0.111 μS h^{-1} with maximum value 0.147 μS h^{-1} during February, average of 0.11 μS h^{-1} with maximum value 0.142 μS h^{-1} during March, average of 0.11 μS h^{-1} with maximum value 0.148 μS h^{-1} during April, average of 0.11 μS h^{-1} with maximum value 0.148 μS h^{-1} during May, average of 0.113 μS h^{-1} with maximum value 0.146 μS h^{-1} during July and average of 0.113 μS h^{-1} with maximum value 0.153 μS h^{-1} during August. The results from the reports are similar to those from Vatra Dornei Park but are not conclusive because there was one sampling site only. In our study, a larger number of samples from different locations provided different results suggesting the importance of the geological composition of the bedrock. In the report was not specified if the cosmic dose rate was subtracted or not.

Population's health status

The population health can be successfully used to prove the harmfulness of the radiations. The long-term investigation for chronic exposure is an important tool in this type of research. The reported number of cases in the studied area from 2010 to 2014 was considered. The type of disease proves if the gamma dose rate from the ambience (Kuzmina *et al*, 2016) is responsible for the human health damages. A higher number of tumors, cancer and congenital abnormalities cases should prove that the radiations represent a risk to local population.

In all the studied areas were reported higher numbers of hypertensive and cardiovascular diseases caused by various factors like lifestyle, age, smoking, unhealthy diet (Kordalewska & Markuszewski, 2015). These types of diseases are the main cause of the death worldwide (Kordalewska & Markuszewski, 2015). Similar to previous studies (Cruceanu *et al*., 2015) based on medical reports (Fig. 2), most of the cases were recorded in medical offices from the most populated areas like Vatra Dornei town. The number of cases increased or decreased from one year to another. In Vatra Dornei were recorded 2681 hypertensive and 1387 cardiovascular cases in 2010, increasing to 2805 hypertensive and 1396 cardiovascular cases in 2012. The inhabitants from Crucea area go to Vatra Dornei town and Dorna Arini at the medical offices. Diabetes, cirrhosis and chronic lung diseases come on second place as most abundant reported cases in the studied area. The reported diabetes cases for the year 2012 were: 21 in Panaci, 68 in Dorna Arini, 648 in Vatra Dornei town and 29 in Carlibaba. The cases of cirrhosis and chronic lung diseases can be caused by several factors like smoking, alcohol, working place and others.

The reported congenital abnormalities in the studied areas were: 11 cases in Panaci; 9 cases in Dorna Arini in 2010, increasing to 10 in 2014; 43 cases in Vatra Dornei town in 2010, decreasing to 40 in 2012; in Carlibaba were reported 3 cases in 2010 and 4 cases in 2014. The available data for malignant tumors were 8 cases in Panaci for the period 2011-2013 and 11 cases in Carlibaba for 2012-2014. Reported cases suggested that population from the studied area suffered common medical conditions caused by age, life style and social-economic and the gamma radiations had no significant influence.

Drinking water parameters

The drinking water parameters like pH, DO, TDS and redox potential (ORP) are some of the water quality indicators. They were considered important for the present study because water itself dissolves minerals present in the area.

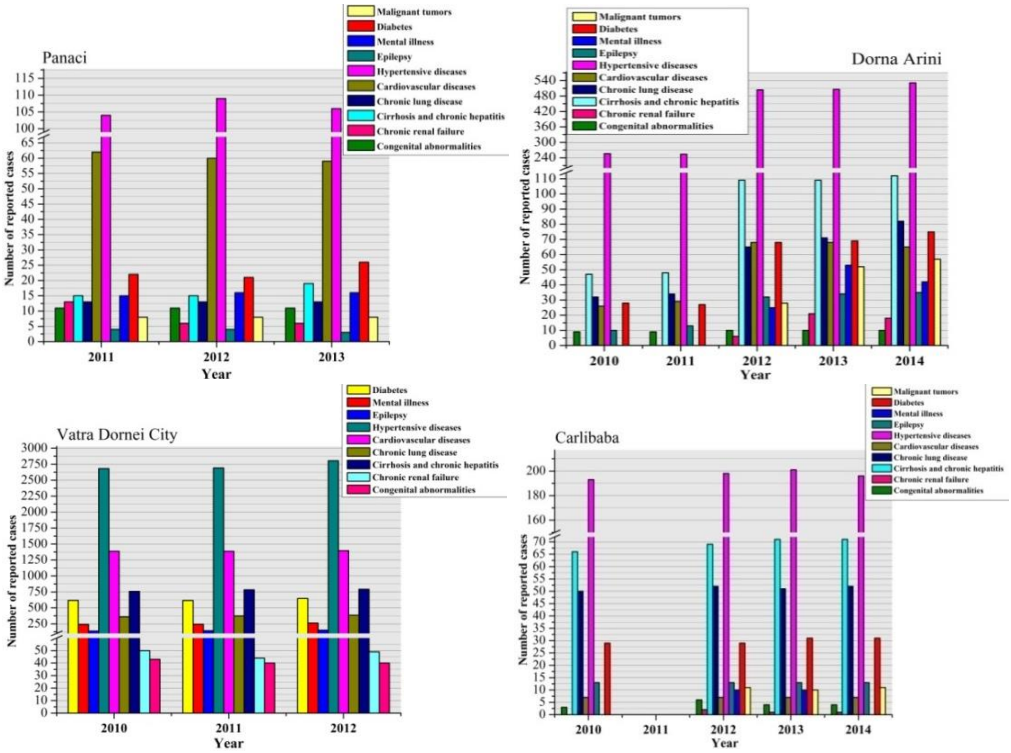

Figure 3. Medical reported cases from the studied area.

The drinking water pH had the mean±SD from 8.55±0.17 in Ostra to 6.88±0.88 in Vatra Dornei town. The lower values from Vatra Dornei were caused by few natural springs from where people drink from time to time. In the town, there is a public water supply system which follows the standards protocols for water quality. Per totally, the water has a neutral to alkaline pH that may reduce the concentration of dissolved minerals (Fig. 4). The dissolved oxygen (DO) from the drinking water is originated in the atmosphere; the water flows under pressure and is quickly mixed with the air or is accumulated in manmade reservoirs. The mean±SD values range between 8.55±0.14 mg l^{-1} in Ostra and 6.08±2.31 mg l^{-1} in Crucea. The lower concentrations from Crucea were recorded in private wells, close to sources of pollution with organic matter (animal stables or outdoor latrines). This may cause the reduction of oxygen within the decomposition of organic matter into salts. This can explain the high variation of total dissolved solids (TDS) in drinking water from Crucea 179.8±133.74 mg l^{-1}. The averages values of this parameter range between 39.75±17.83 mg l^{-1} in Panaci and 239.18±1.67 mg l^{-1} in Ostra. Generally, the variation of this parameter is caused by many factors like water pH, geological substrate, organic matter, precipitations, and compounds resulted from anthropogenic activities. The redox potential (ORP) indicates if the chemical processes from the drinking water consist of oxidation or reduction. The mean±SD range was -38±102.02 at Crucea and +77.72±10.11 in Panaci. The anaerobic activity can produce compounds dangerous to human health. Organic matter turns into salts and metals into oxides or other stabile compounds (Calmano

et al., 1994). The negative values were recorded for the mineral springs and private water reservoirs that may be contaminated with organic matter from anthropogenic activities.

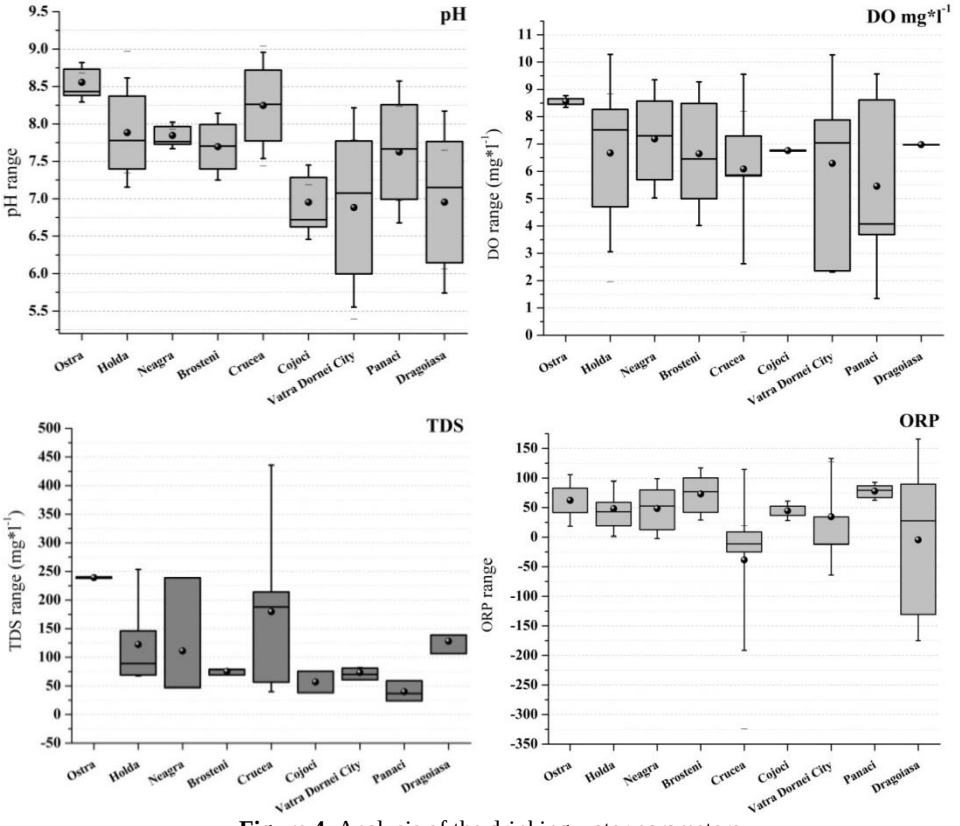

Figure 4. Analysis of the drinking water parameters.

Conclusions

The gamma dose rate from the uranium exploitation Crucea did not represent at the study moment a threat to local population or tourists. Medical reports proved that the people from this geographical area suffer from chronic illness caused by other factors like age, life style and social-economic problems. The highest number of medical cases consisted of hypertension and cardiovascular diseases, one of the worldwide cause of death. The congenital abnormalities and tumors cases had the lowest number suggesting that the gamma radiations are not responsible for the major health problems. Even in those terms, it is recommended a long-term monitoring, both for gamma radiations, and population's health in the study area. The environmental doses from air are higher than others reported in studies but their values depend from one area to another. The drinking water from mountain mineral springs and water supply system has different physical-chemical composition and is an important tool to understand processes occurring between environment and local population.

Conflicts of interests

All the authors declare that were not involved conflicts of interest in the study.

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ANNIVERSARY MOMENT – 90 YEARS SINCE THE ESTABLISHMENT OF “PROFESSOR PhD. IOAN BORCEA” MARINE BIOLOGICAL STATION FROM AGIGEA

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There have been 90 years since the establishment of **“Professor PhD. Ioan Borcea” Marine Biological Station** from Agigea, which belongs to “Alexandru Ioan Cuza” University of Iași, and 25 years since the Recovery, Renaissance and its official Relaunching in the circuit of similar stations in Europe.

Established on the 1st of March 1926 by the **High Royal Decree** no. 810, The **“King Ferdinand I” Marine Zoological Station** started to operate in a former barrack, used during the First World War, in a landscape of sea dunes, populated by numerous endemic species of plants and animals, having a proper private beach and a coastline with very different facies and with an adequate biodiversity.

The founder of the “King Ferdinand I” Marine Zoological Station, Professor Ioan Borcea, nicknamed **the Titan of the Romanian Zoology,** managed to establish the first Biological Station on the Romanian coast of the Black Sea, the first and the most powerful **School of Marine Biology**. Zoologist and oceanologist of European level, formed in Romania and specialized in France at Sorbonne University and Banyls-sur-Mer and Roscoff stations, Professor Ioan Borcea realized the first extensive researches regarding the fauna of the Black Sea, very little known until then, a true black box of knowledge and he succeeded to throne the so-called **Spirit from Agigea,** dominated by **the sacred fire of scientific research.**

Through his encyclopaedic spirit and an exceptional work capacity, Ioan Borcea opened many directions of research in the field of marine biology:

- knowledge of the Ponto-Caspian relicts from the banks of Dobrogea and from the Black Sea;
- elucidation of the origin of the migratory fish in the Black Sea;
- taxonomic research on the **Gobiids, Mugilids, Clupeids and Bleniids**;
- research of morphology and comparative anatomy on fish (**Gobiids**);
- elucidation of the Black Sea fauna origin;
- research on the structure of benthic biocoenoses in comparison with the nature of populated facieses.

Fallen like a lightning on the 30th of July 1936 as a result of a sepsis caused at the working table in the laboratory, Professor Ioan Borcea left us the ornament of his soul, **the Marine Biological Station from Agigea**, which now bears his name.

At the Station management, there followed the eminent biologist **Constantin Motaș**. A true gray eminence, a world-class acarologist and hydrobiologist with obvious inclinations towards aquatic ecosystems, the founder of **Phreatology** as a new direction in the research of phreatic waters, Professor Constantin Motaș managed to maintain the high

level of **"the spirit from Agigea"**, to equip the Station with a motor boat and to equip two researching laboratories of marine Zoology.

Motaș Constantin founded the scientific journal *Works of the* ***"King Ferdinand I" Marine Zoological Station*** and was able to edit the first three numbers: 1938, 1939, 1941.

After the departure of Professor Constantin Motaș to the University of Bucharest and to the Natural History Museum, at the management of the Station, there came professor Ioan Botez.

The Station survived the Second World War and remained functional thanks to the work and sacrifice of Professor Ioan Botez, the first great Romanian anthropologist, who passed his examination for a doctor degree at the **French Institute of Anthropology** and was laureate of Paul Broca Prize.

After the passing of the wraths of the war and as a result of the entry of Romania under the Soviet sphere of influence, well-masked delatores succeeded to eliminate the director Ioan Botez, who was raised by security in 1949 from the Library of the Station and taken to the Danube-Black Sea Canal where he found his end like a martyr.

At the leadership of the Station, much later, there followed Sergiu Cărăușu, lecturer, a disciple of Professor Ioan Borcea.

As a result of the 1948 Education Reform, the Station would get its founder's name, becoming **"Professor Ioan Borcea" Marine Biological Station.**

Sergiu Cărăușu together with his wife, Aurelia Cărăușu, were bound morally to the Station, being particularly welcoming hosts for all guests: researchers, professors, students, etc. Making himself an appreciated carcinologist, specializing himself in the study of **Amphipods** and reaching the status of a leading ichthyologist, in 1954, he became laureate of the **State Prise** for the impressive **Treaty of Ichthyology.**

Beginning with the leadership of Professor Sergiu Cărăușu, the Station has started to flourish, both in terms of scientific research in the field of marine biology, and in terms of improving working conditions. The large building was completed with a row of rooms on the seaward side; it was built a model of the Black Sea, extremely successful, which today constitutes a fulcrum in the presentation of the Black Sea. The Station was equipped with two research ships, **"Gilort"** and **"Emil Racoviță"**. The "Emil Racoviță" ship was transferred to Stejarul Station from Pângărați where it is today, beaten by the calamity of time and times.

New researchers were hired and among them the spouses Ion and Florica Porumb, Șerbănescu Octavian, who is among us today and we welcome him with respect, as an eminent researcher in the field of radiobiology and as a close collaborator of Jack Ives Cousteau.

Another researcher formed in the study of marine algae, who passed her doctor's degree at Sorbonne University, **Maria Celan,** strengthened the collective of researchers of the Station.

Since 1960 there have been at the leadership of the Station more directors, namely: Paul Borcea became later the founder of the **Pedagogical Institute** in **Constanța** and thereby of the current **"Ovidius" University**; Ion Suciu and Nicolae Gavrilescu and last but not least, the researcher Ionel Andriescu, today Professor emeritus (2017) at the Faculty of Biology. In a short time, the Station knew an impressive leap. In the 1962-1966 period, there were employed 12 researchers and there was constructed an impressive number of research laboratories:

- **Zooplankton** – PhD. Florica Porumb;
- **Phytoplankton** – PhD. Pia Mihnea;
- **Ichthyology** – PhD. Ioan Porumb;
- **Zoobenthos** – Ionel Andriescu, Radu Mihnea, Dan Manoleli;
- **Animal Physiology** – Valeriu Crăciun, Adrian Telembici, Ion Neacșu;
- **Vegetal Physiology** – Maria Stadniciuc, Aurora Ciobanu;
- **Radiobiology** – PhD. Octavian Șerbănescu;
- **Terrestrial Ecology** – Victor Ciochia, Carol Nagy, Clement Horeanu;
- **Biochemistry** – Petrescu Ion.

The Station's library had become the largest library of Marine Biology and Oceanography in Romania with over 7,000 volumes and with exchange books and magazines with 137 similar institutions from 47 countries. During the leadership of the Station by the Director Ionel Andriescu (September 12, 1966 – March 1, 1970) there were employed seven new researchers and the accommodation space was expanded, reaching 80 places for students and 30 for researchers. The scheme for personal increased from 46 to 63 employees. The Station from Agigea became a Research Institute of national-level.

In the period 15-31 July, the Director of the Station, the researcher Ionel Andriescu, succeeded to organize **the International Summer MAMBO Course under the Mediterranean Association of Marine Biology and Oceanography Aegis**, with the support of FAO, to which 22 researchers and professors from 11 countries and 21 Romanian teachers and researchers attended, among whom the academics, Mihai Băcescu and Eugen Pora, university professors Motaș Constantin and Radu Codreanu, reader PhD. Maria Celan, etc.

The International participation to the MAMBO course was due to the prestige enjoyed by the Station from Agigea, among the similar institutions in Europe and not only that. But this action would be the “swan song” of the Station, because obscure reasons would lead to decay, through its integration in the **Romanian Marine Research Institute** of Constanța.

The **Romanian Marine Research Institute** was organized around the “Grigore Antipa” Institute of Oceanography, which was focused on issues of oceanic ichthyology, while Agigea Station had a broad spectrum of research of marine biology, aiming at studying the biodiversity of the fauna, flora and of the microorganisms in the Black Sea and Mediterranean Sea and not only that. The union of the two big institutions was not achieved by fusion under a unique leadership, but by reduction of the number of researchers, which led to the disorganization of the research teams.

If until 1975, there had been activity at the Station, after 1975 it was abandoned completely being occupied by several port institutions: SERUN, Shipyard Constanța, CUG Basarabi and even a Military Unit of Constructions.

To the anxiety of invading institutions, Reader PhD. Maria Celan continued to live in one of the buildings of the Station, similarly to Pepelea's nail, taking care to remind them that they are on the territory of a Research Station and that the **marine dune reserve** from precincts of the Station is protected by law.

By her personality and behaviour, Maria Celan filled the space – time between the two major events: the abolition and recovery of the Station.

The recovery of the Station could not have been achieved without the direct involvement of the Rector of “Alexandru Ioan Cuza” University of Iași, Professor Călin

Ignat, who was in real cordial relations with the Rector of "Ovidius" University in Constanța, Professor Adrian Rădulescu, who was also prefect of Constanța County. However, without the understanding and the direct and selfless support of the Director **Mihai Dulică** from **SERUN**, who took over the resort own transfer of the Station from the **Ministry of Transport and Telecommunications** to the **Ministry of Education**, could not have been achieved anything.

On June 28, 1990, while the students from the Faculty of Biology were already in practice and were accommodated in the big building, it arrived at **the University, the transfer Order no. 4147 /June 28.1990** signed by the two ministries.

In the same day, there arrived to the Station some persons, who posed as supporters of our cause, but they planned to divide the Station buildings among the universities of Iași, Bucharest and Constanța, but the transfer order had definitively resolved the fate of the station. .

We ought to give our thanks to University professor PhD. Adrian Bavaru, the former rector for two legislatures, who can be considered the founder of the New University of Constanța who at the time was the dean of the **Faculty of Natural Sciences - Ecology** and to Director of I.R.C.M., **Simeon Nikolaev**, who laid no claims on the Station and supported us in our struggles.

Even if the act of transfer was signed on June 28, 1990, the official opening was made on June 29, 1991. Although our students made their field training at Agigea in the summer of 1990 in conditions of courage and sacrifice, the buildings of the Station were released by SERUN only in December 1990, without being heated. As a result, water froze in radiators and in a connecting pipe located in the attic of the large building, which caused a catastrophic flood in March. The interior walls were wet and mouldy and the musty smell removed you unconditionally from the building.

There were made great efforts to remove the building from the state it was in and to set up the other two buildings: the tower building and the administrative building. I have again appealed to **Director Mihai Dulică** to help us in the equipping of the Station with blankets and bed sheets. They were just disbanding a construction site from Agigea and they could offer us what was necessary at a very affordable price. I do not know how it happened, but in this period, I became a favourite friend of the distinguished man who died in a car accident.

On June 29, 1991, when it was made the official opening of the Station, this was particularly welcoming: the canteen and the dining room were functioning, the accommodation space was sufficient for 100 students and about 20 teachers and researchers. We had washstands both inside of the building and outside, in specially arranged areas.

The Organizational scheme of the Station was formed of 18 employees:

- 1 administrator;
- 4 guards;
- 4 stokers;
- 5 researchers;
- 2 skilled workers;
- 2 unskilled workers for the nature reserve of marine dunes.

The most complete scheme of organization was realized in 1995, when the Station had 5 researchers.

The working conditions for students and for researchers became increasingly better:

- there were arranged two laboratories: one for students and one for researchers;
- there were bought a small boat (6 persons) and a boat; we received the ship engines from the University of Neuchatel;
- we were equipped with cupboards, tables, night stands and numerous books by the University of Constanta;
- the canteen and the dining room became functional;
- the green space was arranged with the help of the military who still occupied a part of the space Station.

The Station was like an oasis of tranquillity and the Nature Reserve of marine dunes, where the soldiers had a soccer field and were making front training, was saved only shortly before being too late.

Regarding the practice of the students from Iași and from the whole Romania, it had a special success. With the help of the students, we began to lay the foundations of a Museum of the Black Sea, in the memory of the excellent Museum, which had functioned until 1975.

The Station became welcoming to students from Iasi, from Biology, Geography and Geology, from Bucharest, Cluj, Constanța, Bacău, Suceava, Pitești, Galați, Chisinău and Tiraspol.

During summer, it was assured the stay for numerous teachers, students, researchers and employees of the University, being assured three series of 10 days in the month of August.

In 1995, it was organized with a great success the **“Romanian-British expedition in Razelm Sinoe complex of lagoons and the Black Sea”**, together with the specialists from the **Oceanological Department of the University of Southampton,** led by Paul Riddy. The results of the expedition were published in the Proceedings of “Professor Ioan Borcea” Marine Biological Station.

For 5 years after the expedition, some students and researchers from Agigea enjoyed scholarships offered by the Oceanological Institute from Southampton.

There were resumed some researches of marine biology after a break of 20 years:

- there were realized 19 contracts of scientific research;
- there were organized 4 National Conferences with international participation during the years: 1996, 2001, 2006 and 2011;
- it was resumed the series of **Scientific Papers of “Prof. Ioan Borcea Marine Biological Station”**, initiated by the eminent Professor Constantin Motaș.

At the initiative of the Station, there were conferred three titles of Doctor Honoris Causa by “Alexandru Ioan Cuza” University of Iași:

- **Academician Mihai Băcescu**, a disciple of Professor Ioan Borcea;
- **Academician Peter Bănărescu**, ichthyologist and zoogeographer of world class;
- **Academician Nicolae Botnariuc**, one of the greatest evolutionists of our nation.

Among the scientific personalities who were beside us and supported us in solving some scientific problems and who were honoured with the title of **Honorary Professor of “Alexandru Ioan Cuza” University Senate**, we mention:

- Academician University Professor Ion Dediu, from Chișinău, at that time functioning as Minister of the Ministry of Environment of the Republic of Moldova;
- Academician Marian-Traian Gomoiu, director of the Institute of Geomar Constanța;
- The First Principal researcher Stefan Negrea, from the Institute of Speleology in Bucharest.

In the 19 to 28 September 2003 period, Professor Laurențiu Șoitu organized, under the auspices of the **European Institute Sumer Academy**, a **METAMORPHOSE** edition, inspired by the Ovidius' work, Metamorphose, to which 120 students and teachers from 12 European countries attended. Through the conditions offered by the Station it was preferred by organizers before "Ovidius" University of Constanța and other institutions.

Being open to all universities of Romania, the Station became a basis of field training for biologists, ecologists, geographers, geologists. At the Station, students from Spain, Belgium, France and the Republic of Moldova made their field training of specialty, too.

The Station attracted a large number of bachelor and master students who did researches in view of the elaboration of some graduation papers or dissertation theses:

- 74 graduation papers;
- 12 dissertation theses made until 2008, to which it is added those realized under the leadership of the directors, Victor Surugiu and Mircea Nicoară;
- there were elaborated 4 PhD theses;
- there were organized two National Conferences with the international participation **"The role of entomophages in the keeping of the natural balance"**;
- there was organized a painting camp;
- two editions: www.Poetries.Romania;
- Reader PhD. Victor Surugiu managed to bring to the Station the ship "Ioan Borcea", a new, modern, luxury ship that lies however in the court of the Station.

In 2009, the Director Victor Surugiu obtained within the National Programme II, **the Programme IDEAS, a Project of Exploratory Research 2008. 1.** ***The development and reglementation of some modern proceedings of integrated monitoring of epibenthic communities associated to the hard substrate of the Romanian shore of the Black Sea*****.**

He also obtained a research project within F.P. Capacities Programme, FP7 Science in Society - Science in Society - 2001 - 1 and also in this program a grant with the title ***European Marine through Research Science (EMERSE)***.

Mr. Victor Surugiu succeeded to obtain a project within the Sectoral Operational Programme 2007-2013.

I have realized today an anniversary moment dedicated to the 90th anniversary of the establishment of "Professor Ioan Borcea" Marine Biological Station, Agigea.

For such a celebration, it should be done more. But we are pleased that we were given 15 minutes to mark the event. And these are good, even sufficient to shoot a warning signal. The Station is in decline. Now, it is a single researcher, but for years it functioned without any researcher. The solemn promises made in the year 2008 during the works of the Senate Office of "Alexandru Ioan Cuza" University of Iași, which took place at Agigea Station that there would be employed, in the first phase, five researchers, did not have any echo.

The excellent and modern “Ioan Borcea” ship lying for years inside the Station without being launched to water, without being used by researchers of marine Biology.

The fence of the Station, made by Ioan Borcea 90 years ago, collapsed completely; the created aspect is of great helplessness.

The large building has the windows from the beginning of the casemate construction, being functional in the First World War, but in a state of total decay in the year 2016.

The nature reserve of marine dunes founded by Ioan Borcea and legislated by the eminent botanist Alexandru Borza was practically abandoned; the marine dunes is covered by wooden vegetation and ruderal flora, which has no connection with the marine dunes.

The Marine Biological Station is unique in the constellation of scientific stations of the Romania. Still it is not late to be truly saved and repositioned in the circuit of the similar European stations.

The first university from Romania and the first Marine Biological Research Station on the Romanian coast of the Black Sea must go hand in hand and raise up to the level of contemporary demands both in the field of didactical activity and scientific research.

We express our hope that in the new leadership of the University there will be done all the efforts for the salvation of the Station and for its Relaunching among similar stations.

MRS. RESEARCHER PHD. FLORICA PORUMB AT THE AGE OF 90 YEARS

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This year (2016) marks the 90th anniversary from the establishment of the “King Ferdinand I” Marine Zoological Station from Agigea, which belongs to the “Alexandru Ioan Cuza” University of Iași.

Founded on the first of March, 1926, through a High Royal Decree, by the “titan” of the Romanian Zoology, the Professor Ioan Borcea, the Resort has become, over time, the biggest Romanian school of Marine Biology, or Oceanology. Here there were formed and worked some of the greatest personalities of the Marine Biology in our country.

We cannot talk about the Resort from Agigea without mentioning the big managers who, over time, entered in the history of science: Ioan Borcea, Constantin Motaș, Ioan Gh. Botez, Sergiu Cărăușu, Paul Borcea, Ioan Suciu, Ionel Andriescu etc., and a pleiad of eminent researchers who have linked their names of Agigea and contributed to the development of the Romanian Biology and not only: Mihai Băcescu, Sergiu Cărăușu, Maria Celan, Aurelia Cărăușu Ioan Porumb, Ion Neacșu, Adrian Telembici, Florica Porumb, Octavian Șerbănescu, etc.

The last two researchers are still alive and carry on their shoulders the glory of the Resort from its first existence, linking the past with the present, which is a rebirth from its own ashes and with the future, which depends on the merit and abnegation of future generations.

When we talk about 90 years of existence we are not too impressed; even it seems less to mark the first institutionally organized beginnings of the Romanian research at the Black Sea. But its rapid ascension, the creation of that **“immortal spirit”** from Agigea and its penetration in the row of the similar resorts in Europe and the world, gives us the right to be truly proud of. If we talk about the past century and especially about the last millennium, the time gets other proportions, I think. If we remember about the devotion with which the founder, the Professor Ioan Borcea and some researchers such as: Maria Celan, Mrs.

Aurelia and Mr. Sergiu Cărăușu, Mrs. Florica and Mr. Ioan Porumb, Octavian Șerbănecu, Ion Neacșu, Adrian Telembici and others tied their existence and fate of the Resort's reputation, of the fact that the director Gh. Botez sacrificed himself on the **"altar"** of it, then our relatings get proportions of historical value.

Having some affinities with the history of Biology, I wrote many about the personalities of the Romanian biology. Celebrating 90 years from the setting up of the Resort and having among us some of the so-called **"sacred monsters"** of the Romanian marine biology, I have decided to resume the interrupted activity and printed out the scientific contributions of other researchers too.

Mrs. researcher PHD. Florica Porumb is among the greatest Romanian specialists who has contributed to the zooplankton research on the Romanian coast of the Black Sea, in general, and especially of **Copepods.**

Starting as far back as in 1961, through the works devoted to knowledge of the family **Monstrillidae**, Mrs Florica Porumb has directed her researches towards the knowledge of the most important groups of zooplankton in the Black Sea.

It is sufficient to cite just a few among the papers published by her in order to have an idea about the broad spectrum of addressed researches:

- ***Contribution à l'étude de la reproduction, du développement et de la répartition des Copépodes pélagiques dans la zone néritique du littoral roumain de la mer Noire (Acartia clausi et Centropages kroyeri) (1968)*;**
- ***Contributions à la connaissance des migrations nycthémérales de quelques Copépodes de la mer Noire (Pseudocalanus elongatus, Centropages ponticus et Acartia clausi) pendant l'été. (1968)*;**
- ***Variations quantitatives du zooplancton dans les eaux néretiques de la mer Noire (1981)*;**
- ***Production des pricipaux composants du zooplancton des les eaux de la mer Noire (1983)*;**
- ***Evolution du zooplancton des eaux du plateau continental roumain de la mer Noire au cours des derniéres trois décennies (1992)*.**

Dedicated to the study of the marine zooplankton and recognized as being on the top of the greatest researchers of our nation in this field, Mrs. Florica Porumb has already entered in the history of science.

In this sense, we have as proofs both the thesis: ***Researches on the seasonal dynamics and nictemeral variations of the main species of Copepods in the Romanian waters of the Black Sea*** (1975) and over 70 scientific papers published in prestigious journals of speciality. The doctoral thesis carried out under the guidance of the eminent academician Mihai Botez and evaluated by renowned Hydrobiologists: Constantin Motaș Eugen Pora and L. Rudescu was the **"passport"** with which the young scientist has entered among the great specialists of the field.

Her researches on the zooplankton have elucidated many aspects, surpassing the systematics and taxonomy of the main groups of zooplankton and rising herself to the modern researches of Ecology, Ethology, and dynamics of populations, etc.

The dynamics of the development of populations, the seasonal and nictemeral migration and even the distribution of the zooplankton in the pelagic level, from small depths up to 200 m:

- there were elucidated multiple aspects connected with the reproduction, fertility, number of generations, ecology, ethology and the behaviour of the main groups depending on the anthropeic impact;
- there were carried out researches on some species of parasite **Copepods** in the pale cavity of some bivalve molluscs; she discovered two new species: *Modiolicola insignis* and *Septosaccus cuenoti*; she also discovered Saculina carcini as a parasite on decapods:
- there were carried out researches on some other groups of zooplanktonic organisms too; **Cladocerans**, jellyfishes, *Noctiluca miliaris and N. Scintilans*, meroplankton, etc;
- there was studied the exponential development of the zooplankton, due to the phenomenon of eutrophisation of waters of the Black Sea and there were elucidated the ecological factors that have generated the appearance of this phenomenon;
- the researches regarding the dynamics offered by zooplankton of the planktonophagous species have been used successfully together with her husband to the elucidation of some aspects of trophology and migration of fish.

In order to be more convincing as regards the significance of the zooplankton in the Black Sea ecosystems, we nominate just a few of her published papers:

- ***Base trophique zooplanctonique et son importance pour la répartition et la nutrition du sprat dans les eaux devant le littoral roumain de la mer Noire*;**
- ***Importance du zooplancton pour la répartition des poissons pélagiques dans les eaux du plateau continental devant le littoral roumain de la mer Noire*;**
- ***Efficience de la transformation de l'énergie dans l'écisystème pélagique devant le littoral roumain de la mer Noire*.**

In her researches there were elucidated some aspects regarding the importance of the zooplankton in the secondary productivity of the pelagic ecosystems in the Black Sea.

The accumulated experience in the research of the zooplankton in the Black Sea allowed to Mrs. Florica Porumb to process and interpret the collected scientific material by researchers from the Romanian Institute of Marine Researches in the Indian Ocean.

In the 1975-1976 period, she accomplished researches on the zooplankton in the Mediterranean Sea. The researches were accomplished at the board of B22 “the Delta of Danube” ship on the occasion of those three expeditions conducted in the Mediterranean Sea, in the waters of the Libyan coastline.

Researcher with an intellectual structure of encyclopedic type, Mrs Florica Porumb managed to achieve outstanding synthetic scientific papers:

- ***Niveau de développement du zooplancton dans les eaux roumaines de la mer Noire pendant la période* 1970-1984;**
- ***Le zooplancton des eaux de la mer Noire*;**
- ***Contributions à la connaissance de la dynamique des populations et à la production des Copépodes dans les eaux roumaines de la mer Noire* (1972).**

Born in 1928 in Caracal, Florica was constrained to follow his family to Piatra Olt and Craiova, his father was active military and moved from one garrison to another. She learned at the Primary school in Piatra Olt and the high school at Craiova.

The Young school-leaver of the “Elena Cuza” High School in Craiova orientated herself towards the Faculty of Natural Sciences from the “Babeș-Bolyai” University in Cluj. Thus, in 1947 she became student at the Section of Zoology from that faculty, considered at that time as being a research section. Being about of such department and a

five-year course and being a passionate lover of nature, Florica was engaged herself with all her intellectual potential and with all her power of work to form herself as a true researcher. Her passion was far much maintained by the aura of eminent researcher of the academician Eugen Pora and of the whole pleiad of great university professors who were known abroad.

The academician Eugen Pora was strongly linked of Zoological Resort from Agigea, where in summer gave their meeting some of the great hydrobiologists of the country: Mihai Băcescu, Constantin Motaș, Sergiu Cărăușu, etc.

Being appreciated by the Professor Eugen Pora and trained in his research collective, Florica Porumb, married while still a student with the biologist Ioan Porumb, who would become one of the great ichthyologists of our nation, began to pave the way towards the achieving of the longed dream - the scientific research in the **"world of waters"** or **"the world of silence"** as he liked to say to the eminent academician Mihai Băcescu.

As a student she distinguished herself by a native intelligence and a sense of observation particularly developed and being equipped with a high-power of work succeeded to graduate the faculty in 1952 with **diploma of merit,** which had a major importance in her appointment as a university preparator at the **Faculty of Fishing and Pisciculture** from Constanța on the 1st of October 1952, discipline of Hydrobiology.

In this time the renowned carcinologist and ichthyologist Sergiu Cărăușu, director of the Marine Biological Station from Agigea was a teacher too at this Faculty. She functioned in that post until on the first February 1953 when she became Head of Laboratory at the same Department and discipline, a post she had untill on the 1st of October 1953.

Her husband being appointed on the 2nd February 1949 by the Professor Ioan Gh. Botez at the Resort from Agigea, he ruled it as director, it is easy to understand that Mrs. Florica Porumb was emotionally attached to this Resort.

This explains the fact that on the 15 st of September 1953 by the Order of the "Alexandru Ioan Cuza" University of Iași, Mrs. preparator Florica Porumb was transferred to the Marine Zoological Resort from Agigea, with responsibilities of research in the field of marine Biology and also didactic activities with the students during their summer practice.

The Mr. and Mrs. Porumb have dedicated their whole life to researches of marine biology, having different specialties, well-defined (Ioan Porumb in the field of Ichthyology and Florica Porumb in the field of the marine zooplankton), but ideally realizing the happiest interconnections.

On the first of October 1956, Mrs. Florica Porumb was advanced as a scientific researcher at the Resort from Agigea.

Definitively devoted to marine researches, she became a specialist of high academic position in the field of zooplankton, but approached with the same expertise and dedication in other fields, too, climbing gradually in the hierarchy of scientific researchers.

Thus, on the first of February 1961, she becomes a **principal scientific researcher**, and on the 22nd January 1962, was advanced as **Head of Plankton Section**, a function she honored until March 1979, when the Resort Agigea enters in the composition of the Romanian Institute Marine Research from Constanța (R.I.M.R.).

Within the Romanian Institute of Marine Research she continues the promotion in the hierarchy of researchers, occupying, through competition, on the first of December

1970 the position of scientific researcher and from the first of November 1975 the function of main researcher.

In the period the first of February 1977 - the first of October 1979 she advanced as head of the **Laboratory of Ecology, Cultures and acclimations from the Romanian Institute of Marine Research).**

We have to mention that in the period the first of November 1955 - to 31 October 1956, she also carried out the function of Scientific Researcher at the Commision of Hydrobiology of the of The Romanian Republic Academy

The first scientific work was carried out collectively together with her husband, Ioan Porumb, under the co-ordination of the Professor Eugen Pora and D. Rosca in 1956 and is dedicated to the biology of the scad in the Black Sea. **The food of the scad in the Black Sea during one season of fishing** (May-October 1953).

If on the first of October 1952 Florica Porumb begins her research career at the Faculty of Fishing and Pisciculture in Constanța and so in 1953 she participates in a scientific expedition in the Black Sea, and in 1956 made her publicistic debut, participating to the making of her first work, carried out with a prestigious research collective.

The first published scientific papers as a sole author in 1959 are: *Rathke octopunctata (M. Sars), a new jellyfish for the Romanian waters of the Black Sea.* (Communications of the Academy of the Popular Republic of Romania, Bucharest, 9, 10: 1037-1040) and on the presence of the larva Verruca (*Cirripedela pedunculate*) in the Romanian waters of the Black Sea. (Lucr. Ses. St. Stat. Cercet. Marine “Prof. I. Borcea” Agigea, Univ. “Alexandru Ioan Cuza” University of Iași: 309-313).

The young researcher discovered two new species for the fauna of the Black Sea. What I find meritorious is the fact that she managed to identify the larvae, not the adults of *Verruca* as a result of her developed sense of observation.

The wife and husband Porumb formed a couple of researchers who can be taken as a model in terms of collaboration in life and profession. Although the areas of specialization were very different (zooplankton and fish) they found multiple bridges of connection, which enabled them to work together and to clarify a number of processes and complex biological phenomena in both areas.

It is not about of being done a favor each other, so as to have as many scientific papers, but a creative collaboration, many of the species of fish inves tigated being zooplanktonophages.

The collaboration between the two great specialists was done ideally in the elaboration of several scientific works; We only cite just some of them:

- ***Contributions à l'étude de la biologie des poissons pélagiques en face du littoral roumain de la mer Noire. (1958)*;**
- ***Contribution à l'étude de la biologie du tassergal (Pomatomus saltatrix) de la mer Noire. Rythme de croissance chez les jeunes individus. (1959)*.**

At these papers the first author is Mr. Ioan Porumb, the accent of researches being put on the biology of the fish, while at the works:

- ***Base trophique zooplanctonique et son importance pour la répartition et la nutrition du sprat dans les eaux devant le littoral roumain de la mer Noire (1982)*** **and**
- ***Importance du zooplancton pour la répartition des poissons pélagiques dans les eaux du plateau continental devant le littoral roumain de la mer Noire (1983)*** appears as the first author Mrs. Florica Porumb, the emphasis being on zooplankton.

Having at our disposal the list of scientific papers published by Mrs. researcher Florica Porumb, we find that, after a number of scientific papers appearing as one author, it begins to make their appearance works carried out in collaboration with younger researchers.

It is about of the noble gesture which many of the great researchers do, who approach a number of young research workers, passing them as in a courier a part of the accumulated scientific treasure, towards the use of future generations.

In this sense, we quote the works: The associations of planktonic animals in the Black Sea. The protection of ecosystems 1978, together with Petran A.)

- ***Données concernant la faune des Copépodes des eaux de la Méditerranée du sud. Rapp. Comm. Int. Mer Médit. (1981, împreună cu Onciu T.)*;**
- ***Sur les quantités de zooplancton dans les eaux de la Méditerranée de Sud. Rapp. Comm. Int. Mer Médit. (1981, împreună cu Onciu T., Ialina E., Petran A.).***

The zooplankton does not represent a some systematic unity, but a complex of groups of animals, of subkingdoms that, the whole life, or in a certain period of the biological cycle, spend their live in the aquatic mass of the pelagic places (being about here about meroplankton: larvae of worms, annelids, mollusks, arthropods, echinoderms, etc.).

A specialist of European renown in the field of **Copepods**, Mrs. researcher Florica Porumb researched multiple aspects connected with the ecology and ethology of the zooplankton: the trophic structure of the zooplankton, the main components of its, the seasonal and nictemeral dynamics, the planktonic associations, the biodiversity of the zooplankton, reaching to elements of evolution, productivity and behavior in relation to the anthropic aggression: the development of zooplankton in eutrophic conditions.

You cannot remain impressed by the value of some synthesis papers on the zooplankton in the Black Sea:

- ***Changes in the structure of the marine zooplankton in the Romanian coastal waters with small depths in the period 1972-1980*;**
- ***Evolution du zooplancton des eaux du plateau continental roumain de la mer Noire au cours des dernières trois décennies;***
- ***The evolution of the Black Sea ecosystem in the last decades.***

It deserves a special attention the synthetic works belonging to the History of Biology and the contribution of the Romanian researchers to the development of Marine Biology researches:

- ***The contribution of the Romanian researches to the knowledge of the pollution phenomenon of the Black Sea (1999)*;**
- ***L'histoire des recherches marines Roumaines en mer Noire (2000).***

As regards the History of Biology, Mrs. PhD. researcher Florica Porumb has contributed to the knowledge of some Romanian scholars (Grigore Antipa, Ioan Borcea, Eugen Pora etc.) who contributed to the research of the aquatic life in the Black Sea.

As a recognition of her contribution to the development of Marine Biology researches Mrs. researcher PHD. Florica Porumb became a member of important and prestigious scientific institutions:

- The International Committee of Scientific;
- Explotation of the Mediterranean Sea;
- The Plankton Committee (CIESM), Monaco;
- The Romanian Naval League.

After retirement, Mrs. and Mr. Porumb have continued their activity of researchers within The Romanian Institute of Marine Researches, benefiting by the material basis of the institution.

Mr. researcher PHD. Ioan Porumb passed into the world of spirits leaving behind an impressive scientific work.

Mrs. researcher PHD. has remained the senior Dean of researchers from the “Professor dr. Ioan Borcea” Marine Biological Station from Agigea.

Now (2016) at 90 years since the setting up of the “Professor dr. Ioan Borcea” Marine Biological Station, Mrs. researcherr Florica Porumb appears as a living icon alongside Mr. researcher PHD. Octavian Şerbănescu making the connection between the past and future.

Mrs. researcher PHD. Florica Porumb still continues to write and to offer us some synthesis scientific works of great value.

We wish her much good health and assure her of our esteem and valuing.

THE RESEARCHER OCTAVIAN ȘERBĂNESCU PHD. A “SACRED MONSTER” OF RADIOBIOLOGY RESEARCHES, WAITING FOR THE JUBILEE FROM AGIGEA

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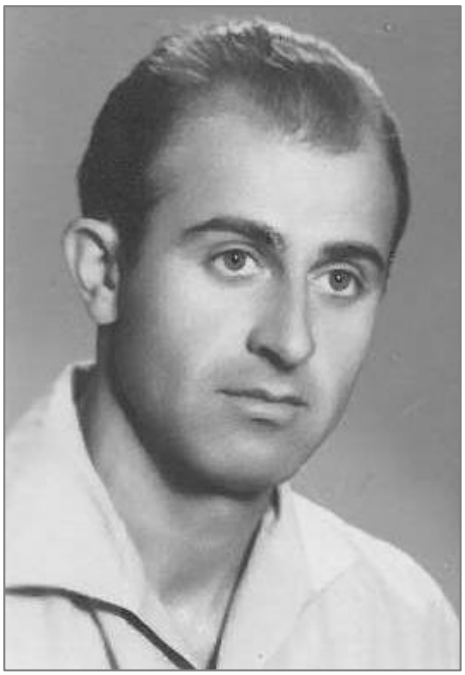

There are to be celebrated 90 years since the setting up of The **“King Ferdinand I” Marine Zoological Station** from Agigea, belonging to “Alexandru Ioan Cuza” University of Iași. The founder of the Station is the university Professor Ioan Borcea, former minister of Public and Religious Instruction. After he obtained the promise from King Ferdinand I that he would set up a zoological Station on the Black Sea coast, in 1925, he went on foot from Sulina to Vama Veche in order to find the most suitable place for such a station. Among the fixed objectives he wanted a place in which to be able to provide the necessary material basis and marine facies as varied as possible. After having crossed the established distance he returned to Agigea, where there were some military barracks, which had operated during the First World War, buildings of which corresponded to the proposed purpose and the beach and marine facies were very varied. After choosing the right place, he informed the Crown Council and waited somewhat impatiently the answer.

On the first of March, 1926 it appeared the **High Royal Decree** approving the setting up of the Station, the use of the material basis from Agigea and the appointment of Professor Ioan Borcea as a director.

Receiving certain financial funds too, the director of the “King Ferdinand I” Marine Zoological Station appointed, for a beginning, an administrator, bought a marine boat and hired six fishermen to be able to exit in the space of the Black Sea and collect scientific material in order to study the organisms living in this sea, which seemed to be a **“black box”** in the field of knowledge of the fauna.

The first scientific expedition carried out in the Black Sea was in 1926. Borcea was accompanied by his best students, Mihai Băcescu and Sergiu Cărăușu.

The second expedition was organized in 1928, going up to the Kaliakra Gulf. In time, the station had become a real mecca of the Romanian biologists; it was not just a seaside station, but a true school in the field of marine biology.

With an intellectual structure of encyclopaedic type and a huge labour power, Ioan Borcea spread around him the thirst for knowledge; he was the carrier of the **"sacred fire"** of science.

Hosting zoologists, botanists, hydrobiologists, chemists, physicists, doctors, the Station from Agigea became a school of marine biology and not only that. Borcea considered that if you do not work with passion and with all dedication, without thinking about a profit or material gain, then you cannot be bearer of the **"sacred fire"** of science.

As the academician Petre Jitariu presented us: "*In the conception of professor Borcea, Agigea must represent the place where the toil and the role of the researcher were called to carry on biological science in a new field in which to affirm fully the existence of a constructive creation of young talents*".

We cannot talk about Agigea Station without mentioning **"the spirit from Agigea"** planted and grown by Professor Ioan Borcea, who continues to enlighten us and watch over us in these days, too.

By his structure of encyclopaedic type, Professor Borcea opened many directions of research not only in the field of marine biology, but, in this field, we must enumerate some directions:

- **knowledge of Ponto-Caspian relics in the banks of the rivers within Dobrogea and the shore of the Black Sea; elucidation of the origin of migratory fish in the Black Sea;**
- **taxonomic researches on Gobiids, Mugilids, Clupeids and Blenids;**
- **elucidation of the origin of the Black Sea fauna;**
- **study of crustaceans and molluscs;**
- **researches of benthic biocoenoses related to the nature of populated facies.**

Fallen at the working board, like a thunderbolt, on the 30th of July 1936, Professor Ioan Borcea left to his followers:

- **a school of animal morphology;**
- **a school of hydrobiology (marine biology);**
- **a school of entomology;**
- **and a "cart of the Romanian soul".**

The School from the "King Ferdinand I" Marine Zoological Station from Agigea would become in time a research institution of European first–rate, reaching on the peak of glory in 1970, precisely when, paradoxically, was disbanded or, to say with a more optimistic air, integrated into a new institution of marine research, of huge dimensions – **The Romanian Marine Research Institute**.

After the death of the Professor Ioan Borcea, the leadership of the Station was taken by the eminent hydrobiologist and acarologist Constantin Motaș who maintained and developed the **"spirit from Agigea"**. The Station survived the trials of the Second World War thanks to the skill and dedication of Professor Ioan Gh. Botez, who had to pay with his life the dedication with which he carried out his mission.

Under the leadership of the eminent hydrobiologist, carcinologist and ichthyologist, Sergiu Cărăușu, The Station began to increase its number of research laboratories and researchers, becoming a Research Institute of European class.

Only in the period 1962-1966 there were hired 12 researchers and the spectrum of research was broadened considerably. Here, there are the fields of research that fully operated:

- **Marine zooplankton – Florica Porumb, PhD;**
- **Marine phytoplankton – Pia Mihnea;**
- **Marine zoobenthos – Ionel Andriescu, Radu Mihnea, Dan Manoleli;**
- **Ichthyology – Ioan Porumb, PhD.;**
- **Animal Physiology – V. Crăciun, A. Telembici, I. Neacșu;**
- **Vegetal physiology – Maria Stadniciuc, Aurora Ciobanu;**
- **Radiobiology – Octavian Șerbănescu;**
- **Terrestrial Ecology – Victor Ciochia, C. Nagy, Clement Horeanu.**

At the leading of the Station there were also succeeded each other: Professor Paul Borcea (a grandson of brother of Ioan Borcea), Ion Suciu, Nicolae Gavrilescu, etc.

In the period 1966-1970, the position of Director was taken by the researcher Ionel Andriescu. We can affirm without fear of error that the Station reached on its highest peaks. But, paradoxically, on the first of March 1970, after 54 years of uninterrupted operation, it was disbanded. In fact, it was integrated into **the Romanian Marine Research Institute from Constanța.** Was it better, was it worse? We do not give our opinion anymore as it could be considered subjective.

The truth is that work continued at the Station till 1975, then the building was abandoned, the material goods more scattered than turned to account and the library, unique in the field of marine Biology and Oceanology passed to the **Romanian Marine Research Institute**. Some researchers were scattered, others continued the research activity in the framework of the institution.

In 1990, “Alexandru Ioan Cuza” University of Iași succeeded to recoup the Station; only the buildings and a part of the adjacent land, and this, once again, to become again functional for the students’ summer practice, but also for scientific research.

Now (2016), 90 years after its setting up, “Professor dr. Ioan Borcea” Marine Biological Station from Agigea is still on the trajectory of its recovery.

Interview with the researcher Octavian Șerbănescu PhD, a “sacred monster” of Research from “Professor Dr. Ioan Borcea” Marine Biological Station Agigea.

Prof. dr. Ghe. Mustață:

Dear researcher **Octavian Șerbănescu, PhD,** I feel destined by God to be able to meet now, in the threshold of great celebration, on the occasion of the celebration of the 90th anniversary of the establishment of “Professor Ioan Borcea” Marine Biological Station Agigea belonging to “Alexandru Ioan Cuza” University of Iași. I consider you a real **“sacred monster”** of marine research in the field of radiobiology.

You have opened a new research direction at the Station from Agigea and have established a well-equipped and functional laboratory in conditions of normality.

I have been deeply impressed by your achievements and it would be a joy for me to be able to achieve together an overview of the greatest achievements in your profession.

Thank you for accepting my invitation and I want to start with the beginning of the beginning.

Dear researcher PhD. Octavian Șerbănescu, you are among the few researchers from the Agigea Station, who have survived until our days. You are a kind of **“living**

fossil" (but I do not like much the expression) a **"sacred monste**r" of scientific researchers who gave their life, intelligence and energy on the altar of science, at the first Marine Biological Romanian Station on the Romanian seaside of the Black Sea.

You entered this **scientific Temple** on the first of October, 1956, so, in the past century, and more importantly in the past **Millennium.**

You have worked with dedication, submitting often superhuman efforts in order to move forward and to achieve the first Romanian Radiobiology Laboratory able to measure the pulse of pollution in the Black Sea and not only this.

You are like an information bank or like a holographic device which, well used, could present us integrally the film of the evolution of the Station from Agigea and of radiobiological research in our country.

I watched the beginning of the beginning and found that you penetrated into the Station as into a temple and begged God to guide your steps on the path of scientific research.

As a deviation from the normal, the first scientific work was carried out at Agigea and published as one author in the Nature journal, no. X - ***Action of cold in the winter of 1957/1958 year on the coastal life in the Romanian waters of the Black Sea***.

Like Ovidius who exiled on the Euxin Pontus was impressed with the cold winters of the Black Sea and of the destructive effects of frost and left for the posterity a series of information, the young researcher Octavian Șerbănescu was surprised and strongly intrigued by the destructive effects of the winter of 1957/1958 and decided to inform those interested in offering them surprising data, almost unbelievable.

Being particularly active and behaving like a real host, Mr. Octavian Șerbănescu established not only courtesy relationships with some of the Station guests but also relations directly connected with profession. This explains the collaboration with Professor N. Calinicenco to the second work: "The transport of salt from the water of the Black Sea coast by mechanical evaporation".

Where did the collaboration start from?

Researcher Octavian Șerbănescu, PhD:

I lived in the Station a period of time and I was often walking on the sea coast with Professor N. Calinicenco. I observed how strong gusts of wind tore the wave crest, amounts of water being transported ashore. In this way, there emerged the work with Professor N. Calinicenco regarding the transport of salt from the coastal marine waters from where it followed a mechanic restoring.

I must mention that professor N. Calinicenco was part of Professor I. Borcea collaborators and he brought his contribution to the knowledge of sea physics.

Prof. Dr. Ghe. Mustață:

Mr. Șerbănescu, being part of the first exchange of students between "Alexandru Ioan Cuza" University of Iași and "Fr. Schiller" University in Jena in 1961, I had the opportunity to know the curator, researcher and diver Dietrich **Kühlmann**, who was working at the Zoological Garden in Leipzig. On this occasion, I learned that he performed at Agigea the initiation in aquatic plunges. Later, I learned that you were part of the initiated team. What can you tell us about **Kühlmann** and about the value of such an experience?

Octavian Șerbănescu:

In 1961, for 6 months, I was trained in shallow diving with an instructor, Dietrich

Külmann, in the German Democratic Republic. The accumulated experience was of great help for all my life. Dietrich Külmann was an elite diver, a researcher with a highly developed sense of observation and a great ornithologist. I have now one of his books that proves his skills as a researcher.

Prof. Dr. Ghe. Mustață:

In the year 1960, in your life, it appeared a major shift that changed your professional path. Can you present us what is it about?

Octavian Șerbănescu:

Yes, the year 1960 produced a major and definitive turning in my activity: I followed a course for 6 months for the use of radioactive isotopes in medicine and biology; it was held in Bucharest at IFA. The problem attracted me a lot especially that I was able to realize directly the amount of radioactive pollutants that are depositing daily on the soil, at Agigea, mostly with the help of an installation specially built at IFA and the apparatus for measuring of β and γ radiation.

Prof. Dr. Ghe. Mustață:

Specialization in the field of using radioactive isotopes in Radiobiology was like a glove for you. I realize that you have accepted gladly and with open heart this new specialization intuiting accurately the perspective of the modern research directions, which appeared as a strict necessity in the conditions of exponential growth of pollution in general and more particularly of radioactive pollution.

Octavian Șerbănescu:

So, it is. I felt myself strongly attracted by this field of research, especially since I was admitted by great specialists, real master minds. Returned back to Agigea, I started to put the bases of the **Radiobiology Laboratory** and work passionately and with all my physical and intellectual power. And it was of great use for me.

Rejoicing myself the guidance of the team of physicists from IFA led by Professor PhD Mircea Oncescu who assured also the service of the equipment, I perfected myself in the technique of daily dosimetric measurements. I was part of the team of researchers led by the academician professor H. Hulubei who was supervising the entire national territory on the line of radioactive deposits, in peak period of experimenting nuclear weapons, at ground, in the water, air and underground. The other observation points were in Bucharest, Cluj, Iași and other cities, always within universities or faculties of Physics. Periodically, the results were analyzed at central level.

The problem attracted me much and since then my whole activity has been concentrated on the radioactive pollution of the sea and the use of radioactive isotopes as tracers for putting into evidence the movement of the coastal sand in the area of Eforie toward sea as a result of abrasion.

Between 1961 and 1963, I published the first dosimetric results regarding the radioactivity of marine organisms evidencing the radioactive contamination and the concentration of artificial radionuclides in hydrobionts in the Scientific Annals of the University of Iași. I hoped to be able to identify, in the future, the radio-indicator species with which in a short time to appreciate the degree of health from a radioactive point of view of a basin of natural water.

Having accumulation coefficients ranging from 1 to tens of thousands accumulated radionuclides that can move into the sea together with the currents to very great distances, and along the way, enter the food chain, planktonophagous fish could be also contaminated;

thus, the last element of the food chain, namely people, can ingest large amounts of radionuclides without knowing it and thus to be subjected to an additional radiation.

I also found that the activity in pCi / g was much higher in the samples collected during the rain time or immediately after the rain. This is explained by the fact that raindrops "wash" the atmosphere loaded with radioactive dust and bring it all into the sea, where the organisms metabolize it.

Prof. Dr. Ghe. Mustață:

The results and self-confidence in proper forces determined you to expand your researches. What did it follow?

Octavian Șerbănescu:

Being located at a short distance from Agigea, I paid little attention to Tekirghiol Lake and, together with doctor Arpad Szabo from IFA Cluj, we emphasized the presence of Uranium and Radium both in water and sapropelic mud.

Relative to the use of radioactive isotopes as tracers in order to demonstrate unmistakably that the waste water coming from South Eforie purge Station, discharged into the sea and got on the beach, I used βr82. There were also correlated some medical observations made by doctors present on the seaside with the presence of sewage. For this study, I used for the first and last time the "Emil Racoviță" ship of the Station; afterwards, it was uploaded on a truck of large dimensions and transported to Bicaz Lake for **"Pângărați" Station.**

There followed a period in which the researchers of the station rarely breathed the marine air, until getting of the **"Gilortul"** metal fishing vessel. Alongside with these applied researches that had a pioneering character, I must emphasize the support received from IFA Bucharest through professor M. Oncescu and his team of technicians who performed for the first time field devices for the necessary measurements.

The tightness was the main problem for the works **"in situ"** on Geiger-Müller counters of CTC-6 type mounted in different types of probes and connected with portable particle counters.

In the year 1965, together with a larger group, we made evident through spectrometric analyses the presence of the artificial radionuclides fission products (Sb^{125}-Te^{125}), Ru^{106}, (Ce^{144}+Pr^{44}) and Cs^{137} in the marine zooplankton. All the samples were collected in 1963-1964; their ashes had a specific activity comprised between 30 and 1,728 pCi / g ash.

Prof. Dr. Ghe. Mustață:

Apparently eager to try your powers and to demonstrate to some of your colleagues who travelled in various countries of Africa as associate university professors that you have native qualities in this direction of activity, you have chosen for an academic career in the Republic of Guinea.

What can you tell us about this period? For sure you experienced joys and fulfilments, but also unexpected troubles.

Octavian Șerbănescu:

Indeed, I also entered into such an adventure. I realized that it was appropriate a change of scenery at one time. First, I realized that I was not a stranger of what it means **didactic grace**. During this time, I changed not only my behaviour but also my mode of working, thinking and speaking. I put more order where I thought there was no need; this aspect was a big win for me. I managed to acquire my work style characteristic to a

university professor, which helped me during the time when I was at **"Șaguna"** University in Constanța.

I must admit that I had some discomforts related to the impossibility to continue the doctoral specialization. But I will return to this issue.

Prof. dr. Ghe. Mustață:

When and how did you restart the doctoral specialization?

Octavian Serbănescu:

Being an aspirant/ a disciple of Professor Petre Jitariu, I followed the plan thesis regarding the accumulation of P32 in the sea water in the chemical composition of species: *Gobius cephalarges* and *Spratus spratus.* These two species, one benthic and the other pelagic, had a totally different metabolism and behaviour. In this way, I explained the fact that they accumulated P^{32} with different speeds and in different quantities in the skeleton, the nervous system and viscera. The problems were very interesting and worth all the efforts.

In the African period, the postgraduate studentship was transformed into doctorate with a term of 6 months for passing all the exams. I passed the exams with very well to which I presented myself, but at the last there was no way to go back home and take it too, so I was expelled.

Prof. Dr. Ghe. Mustață:

And how this impasse was overcome?

Octavian Șerbănescu:

I returned to doctorate hardly after 1972, having professor Sergiu Cărăușu as coordinator.

It followed a period of 3-4 years of intense work and examinations; the title of the thesis, loved by me, was: ***The Study of radioactive interrelations between the radioactive marine environment and the aquatic organisms*.**

The thesis aims were for the first time in our country to determine the radiochemical and dosimetric situation in the waters of our coastline. The research was regarded from a radiobiogeocoenological point of view, seeking not to neglect any of the components of the environment.

I had in mind all the time that the data presented in the doctoral thesis can be over-years, the zero level from which it started in the evolution of radiochemical marine waters, appreciating that the applications of nuclear energy will attract by default some increases in radioactive pollution.

In short, I addressed the following aspects:

1. natural radioactivity of coastal waters;

2. natural and artificial radioactivity of the sediments of the Danube at the pouring and from the Romanian continental platform;

3. the radioactivity of coastal waters and their isotopic composition, evidenced through the bodies of organisms. Here, we showed that the species of algae *Phyllophora*, *Cystoseira* and *Enteromorpha linza* can be considered radio-indicators.

The origin and physico-chemical state of the most important radionuclides in marine environment. If the origin of natural radioelements is known, that of the artificial nuclides is difficult to identify, because of the multitude of places and types of nuclear weapons tested in water, air, soil, subsoil. The identified Radionuclides were $(Sb+Te)^{125}$, $(Ru+Rh)^{106}$, Cs^{137}, $(Ce+Pr)^{144}$, Fe^{59}, Co^{60}.

The spreading of radionuclides in organisms. I found that in the case of the algae *Enteromorpha* and of the fish *Gobius cephalarges* the penetration of P^{32} is not influenced by t^0 (6-20^{0}C). Everything is only due to physical contact processes. At the same time, I found that the variations in salinity of the marine environment between 4 and 18 g% marine environment does not influence the metabolization of P^{32}. Beyond these limits, the accumulation coefficient get values that do not correspond to normal physiology. Once entered the organism, indifferently how, the radionuclide spreads; the rays, the skeletal system, the nervous system and viscera concentrated most part of P^{32} injected in *Gobius* c., while the algae ***Ceramium*** and ***Cystoseira*** and the nodes where the fruiting organs are formed accumulated the most. All these were evidenced by autoradiography.

The establishment of the general dose of irradiation depending of the water depth. The calculated dose is 50.6 mr. Rad / year at the surface of the sea and 42.1 mr. Rad / year 20m. deep. Summing up the data concerning the cosmic radiation, the β and γ radiation of K^{40} in the sea water and in the organism, of the α radiation, and the other contained radionuclides in the organism, it results a dose of 89.3 mr. Rad / year. Is it much? Is it a little? If we take into account that at least 30 % of the natural dose is biologically unimportant because the particles do not cause ionization in tissues, then it follows that about 60mr. Rad / year is the dose of irradiation that a pelagic organism supports it at the surface of the sea (1 rad = 100 erg / g).

From these values we started and developed the subject and we reached the conclusion that in the peak years of the artificial radioactivity of the atmosphere, 1963-1965, from a radiobiological point of view, the marine life was influenced by artificial radioactive pollutants.

But what happened later after the events from Chernobyl?

From here I started and estimated that the dose of radiation would increase in the future, in the human included, who exploits the marine biological resources and uses various sources of radiations in the daily activity.

I considered that the radio-contamination of the sea must be monitored and kept under control and the fixed protection norms set by the International Commission of Radiological Protection should be improved.

Prof. dr. Ghe. Mustață:

The doctorate Thesis represented a culmination of the research work in the field of the radioactive pollution and it had, has and will have a special significance for those interested in shaping the behaviour of ordinary people and of those in the leadership of human society, of a society threatened by dangers from water, air and soil.

I made a deviation from the natural course of events in order to watch easier, the ascent of your lordship on the heights of scientific research.

The road of the ascent was not easy. The murky and threatening clouds that were gathering and were actually expected to unleash violence pounced on the "Professor Ioan Borcea" Marine Biological Station and changed so many destinies, shattered a research institute during its maximum functionality and glory.

The Station from Agigea and the Marine Research Romanian Institute were not similar research institutions - while Agigea Station was an Oceanological institute in the true sense of the word, watching the marine life in its ensemble, the Marine Research Romanian Institute was a big, grand, oversized institute, but of fishery research.

How did you resist to this shock and how did you manage to rise from your own ashes?

Octavian Șerbănescu:

The year 1970 is the borderline year of my activity at Agigea and the abandonment of my well-equipped laboratory. Now there were unified all marine research institutions (except the military) within an institute with over 100 researchers – the Romanian Institute of Marine Research, Constanța.

For, a few decades, the Station was separated from the University of Iași, here being hosted activities specific to the Romanian Institute of Marine Research, Constanța.

In the new structure, I was moved to Constanța, in the central headquarters of the Romanian Institute of Marine Research, being appointed head of the laboratory of prevention and pollution control.

I made a priority program for studying the control of the pollution determined by the sewage waters spilled into the sea and prepared measures to prevent and control the pollution with hydrocarbons, in the perspective of the commissioning of “Gloria” drilling platform.

The research was based on economic contracts with clauses and penalties, if the targets were not achieved or the beneficiary raised objections to the research results.

Everything was supervised scientifically and economically by CNST Bucharest. Any expenditure had been covered by the contract.

This new context allowed me to move on to a new phase – a very much diversified thematic and a team formed of over 20 researchers-chemists, biologists, technologists, doctors, microbiologists, etc. All of them were young and enthusiastic. Their professional growth was rapid because I managed to get their specialization in foreign laboratories but with international prestige in Italy, France, USA, USSR, Poland, etc. Almost all performed specialized training courses, and some participated on large foreign ships in research expeditions in the Black Sea or the Mediterranean Sea.

The material basis for work on the sea or in the laboratory continuously improved by obtaining value currency bills that we used to buy equipment; the bills were from FAO and other international organisms interested in knowing the level of pollution.

We also mention the attendance of the socialist countries at meetings on the issue of protecting the sea against pollution for the crystallization of the first normative acts concerning the Law of the Sea; our young researchers also embarked on research ships, where they entered teams made up of Germans, Poles, Russians, Belgians, etc. On specialties, they brought additional expertise to my collective. The team was well-welded, plus we built a pilot plant to produce a minimum of 100 tons / year of petroabs, which was capitalized. The technology was patented - Patent no. 57629/1974.

On a scientific plan, it was outlined a Romanian technology of controlling the pollution with oil products and, in the workshop of the pilot station, an engineering team manufactured prototypes for oil recovery.

Practical demonstrations at the scale 1:1 were organized in the Constanța seaport or on the Danube, with the participation of competent authorities or ambassadors of some countries potentially interested in these achievements.

All the necessary materials to the demonstrations were produced in our laboratory and the actors of the demonstrations were the researchers themselves. All these practical achievements were presented in scientific papers, too and in a short film.

Prof. dr. Ghe. Mustață:

I understand that some troubles concerning the pollution of the waters in the Black Sea and in the world, took you out of anonymity and you became part of the great specialists in the world, a highly competent expert? Please tell some aspects in this favourable metamorphosis.

Octavian Șerbănescu:

An accident occurred on crude oil pipeline that crossed the PAM channel allowed us to use all the technical-material basis at our disposal to recover the crude oil and to restore the natural water quality, because, at that time, it was the source of drinking water for the city of Constanța.

I recovered 4,400 cubic meters of crude oil from the bed of the canal and all the quantity was reintroduced in the pipeline and pumped to the initial destination.

This unfortunate happening was for us auspicious because it allowed us to homologate the entire technology and especially of the skimmer- with metal discs of Ø 1.20 m, driven by its own engine.

In a parallel direction with these cares I developed a collaboration with University Paris VII, which sent 4-6 students to our laboratory in practice for 6 weeks in summer; in counterpart, 3 researchers were doing practice in the specialized laboratories in the field of pollution at the North Sea or the Mediterranean Sea.

At the same time, at the Station of Marine Research from Portoroz, Yugoslavia, an annex of the University of Ljubljana, where they held training stages for young researchers, I was invited to teach special courses for 3 consecutive years; 1-2 Romanian researchers were among students as scholars.

The effects of these scientific exchanges and the contacts with researchers in better equipped laboratories allowed us to move forward more quickly and to present confidence that the tasks incumbent upon us until the entry into operation of the drilling platform **"Gloria"** would be fulfilled.

I myself benefited from a shift of three months in the USA and Mexico, from the Atlantic to the Pacific, going in research institutes or specialized enterprises in controlling of accidental marine pollution. I joined their team and at an action of pollution of about 20 tons of crude oil I effectively participated for 2 days. They remained deeply impressed by my skills and efficiency. Eventually, I gave up traveling to Mexico because there was used the American technology and technical means. There was no point to get around.

Prof. dr. Ghe. Mustață:

Not only you obtained prestigious results in the work carried out, but you achieved a number of patents, scientific papers that honour you and they put you in the true light. How were all these accomplished?

Octavian Șerbănescu:

All these achievements were the fruit of our collective collaboration with academics from Bucharest Polytechnic Institute, headed by Professor PhD. N. Bărbulescu, with researchers from I. C. Chim, Constanța Shipyard, etc.

In summary, the main research directions and microproductions were the following:

- the realization of some floating absorbent substances and with hydrophobic properties (PETROABS);

- the realization of two types of floating dams to limit the spread of oil at the water surface (2 patents);
- the realization of tensioactive material usable in the depollution of beaches, dams, quays (Navodeg) (1 patent);
- mechanical means for direct recovery of hydrocarbons from the water surface (Skimmer, absorbing line, etc.);
- equipment for the mechanical recovery of Petroabs after its contact with the oil;
- providing of data to design a small ship, coastal craft, self-propelled to combat pollution on small surfaces on the rough sea up to 5-6 degrees on the Beaufort scale;
- ensuring the physico-chemical and microbiological quality of coastal waters following aspects of pollution by fluorine, arsenic, detergents, inorganic phosphorus, organochlorine pesticides, heavy metals, etc.

In this period, I succeeded to attract the collaboration on the basis of multi-annual contract of the department of microbiology of the Faculty of Natural Sciences of the University of Iasi led by Professor Napoleon Topală and Reader Octavia Ailiesei, PhD.

Mastering the degree of physico-chemical loading with different pollutants of terrigenous origin (including those brought by the Danube) and the general microbiological state of coastal waters, it was easier for us to intervene efficiently in the small punctual situations of BDA, along with sanitary organs.

Also, in two consecutive editions, the fifth edition and the sixth edition, the American publication "Who's Who in the World", which take the census of a maximum of 2,000 people, published my biographical data, fields of activity and address. It was an honour for me.

A special activity I carried out too in the quality of expert with personal title in the field of pollution.

Prof. dr. Ghe. Mustață:

That who loves us and controls us from above was careful to throw you in the group headed by the eminent oceanographer and commander J.Y. Cousteau. Only in his dreams a researcher could be seen in such a collective. How was it?

Octavian Șerbănescu:

For nine years (three consecutive mandates) I was part of the expedition body of FAO in the field of marine pollution; the group was led by J.Y. Cousteau, whom I succeeded to bring in Constanta.

Each year, 2-3 times, I was invited to the meetings at FAO headquarters - Rome - or Naples, Paris, Nice, Monaco, etc., to analyze various critical situations in the seas of the Mediterranean basin; here, there were made recommendations to improve the situation. I was convinced in that period, that depending on the collective you work with, the specialists with whom you measure your creative and intellectual powers, so much by empathy, you get up to the level of the collective team.

Prof. dr. Ghe. Mustață:

Right, and I envy your modesty. You were great!!! But neither God suspects what a human mind can do or a collective of specialists who are led by leaders who have reached the top of the pyramid as a result of lack of competence, but politically supported.

The expert Octavian Șerbănescu instead of being praised and honoured for the achievements of prestige was forced to give his resignation and to look for work elsewhere; but not in other fields.

The competence came out again. How was it?

Octavian Șerbănescu:

My activity within the Romanian Institute of Marine Research for 25 years was suddenly interrupted in the year 1981 by resignation due to some misunderstandings between me and the leadership of the Romanian Institute of Marine Research that became military. I passed to the Enterprise of communal careful Management, which would deal with the production, transport and distribution of water to the population and industry in Constanța and the county.

The course of my life changed; the people from here had other tasks and obligations totally different from what I had had. And yet I did not fall down by cowardice and envy; I started with what I knew best: to organize analysis laboratories of drinking and waste water in Mangalia, Eforie South White Gate, Cernavoda, North Constanta, South Constanta. I succeeded to ensure minimal endowments for the beginning of the activity and the staff was selected through competition. I was very pleased from a material point of view, but my thought was at the sea. What to do? I was organically linked to water: I was born on the shores of the Târnava I, I spent my childhood on the Danube shore, and I perfected myself on the sea.

The 70-80 days / year spent on the sea have now become days devoted to the villages and towns in the county of Constanța. I was proud with the taken measures that began to be reflected in a higher quality of the drinking water brought sometimes from tens of kilometres from the source to consumers.

In situations of drought, the water was brought from the Danube, from Cernavodă, where it was treated and taken to Eforie. I was proud of achievements alongside the builders of pipes and pumping stations.

I have published some of my concerns in the "Terra" journal, 1986, no. 3 or the Bul. Cons. National of Waters in 1982, Vol. III.

Though I was gone for 5 years from the Romanian Institute of Marine Research, I received a collaboration from FAO and UNESCO, to write together with professor Balkaș from the University of Istanbul and professor Decev from the University of Sofia, the volume ***State of the marine environment in the Black Sea Region***.

Though I was contested by my former heads from IRCM by the fact that I did not longer work in the field, FAO and UNESCO remained firm on the position and our report was published under no. 124/1990.

At the end of the decade VII, I published a few articles concerning the future of the Romanian coastline and the necessity of ensuring some clean water for tourism, sport and health.

In the years between 1970 and 1981, I brought my contribution to the publication of some works to improve the methods of analysis for different pollutants in the coastal waters.

All these scientific concerns were recognized on national and international plan and had as finality my election as FAO expert in the field of marine pollution, member of the Scientific Council (CAER) in oceanographic problems and member of the International Research Commission of the Mediterranean Sea.

The revolution of 1989 finds me among the first people who were fighting for the establishment of a University in Constanța. The problem was solved in 1990 and in autumn the first courses were held for the first year in Medicine, Natural Sciences, Philology and other faculties.

Prof. dr. Ghe. Mustață:

Now, when you look Agigea from distance, when you know that it returned to Alma Mater, but it is struggling hard to survive, what thoughts are in your mind.

Octavian Șerbănescu:

Now when “Alexandru Ioan Cuza” University of Iași and the Faculty of Biology celebrates 90 years since the establishment of the Agigea Station, I want to say that from these 90 years, 2/3, i.e. 60 years were spent with me present in the day by day life of the Station or being near it.

I suffered or I had moments of glory; I was proud myself with the high-level scientific sessions organized by professor Sergiu Cărăușu, but I also cried when I left it in 1970, entering the Romanian Institute Of Marine Research.

Indifferently of the situation, nobody and never defiled the name of the Station. I had the chance, and not once, walking through the world to find that renowned researchers in Oceanographic Institutes or universities, renowned Oceanographic Institute, knew something about Agigea and the name of Cărăușu was familiar to them. This was the result of exchanges of books that the Station achieved or with the University Annals, in which there were often published papers based on studies made at Agigea. The direct correspondence between specialists and sometimes working visits to Agigea were practiced especially after the year 1950, when things have normalized after the war.

Renowned scientists from Romania and abroad, as well as students, candidates for a doctor’s degree, high school teachers, who were gathering their didactic material, but also tourists interested in the knowledge of the sea, crossed its threshold every year; some were working in laboratories, others were consulting the wonderful library of specialty.

Here, there were the sources, from here there everything left, even if some works were published by publications belonging to the Academy or the universities in Cluj, Bucharest and Iași.

Agigea, in its spirit, inherited from its founder, professor Ioan Borcea, never died; it was only dimmed for a period, despite the leap of the in van of some directors, with the exception of professor Ionel Andriescu who followed professor Sergiu Cărăușu. The times left their mark and perfected the left-handedness of some who have not lived up to their predecessors. I hope such moments will not happen again in the future of the Station.

Today (2016) when the Station Agigea came back where it is its place, to the University, which also created it, 90 years ago - needs the support of the University and also youthful impulse and abnegation to resume its triumphal march.

The ensuring by the University and the Faculty of a permanent scientific staff, with a modern theme, doctoral theses, undergraduate theses, summer courses for young researchers from European countries, international collaborations with marine theme and external financing, students practice for naturalists students from big university centers, etc., are just a few ideas.

A part of present professors of the University, some of whom have played an important role in the life of the Station, even if now they have careers directed westward,

they could contribute directly or through their collaborators to raise it, and for sure, they still have something to say.

The sea has a hidden theme for future research; it is inexhaustible, but it must be found and even embraced by some researcher who have the love and enthusiasm of the founder Ioan Borcea.

I am sorry I am over 80 years; I would have joined a future enthusiastic team. If you work correctly on a well-chosen direction, the results come; they come faster than you expect.

Prof. Dr. Ghe. Mustață:

Dear Mr. Octavian Șerbănescu where did you see the light of the day and how you spent your childhood?

Octavian Șerbănescu:

I was born on the bank of the river Târnava in a family of teachers; I grew up on the embankment of the Danube and spent the adolescence on the coast of the Black Sea. My universe was the Trinitarian: the family, the school and water.

I think the entourage of children from Seimenii Mari where we were equal in games or at the crossing of the Danube to eat blackberries in the island near the village marked the beginning of the social life. Then, the hardships during the war, with the father on the front, with sick grandparents and the mother busy from morning to evening, with those 7 classes of children led me to assume some household tasks bigger than normal for a 9-10 years old child. I always managed to solve difficult things with much dedication and skill, being personally satisfied with my achievements.

Not seldom, the neighbours or other elderly people seeing what I did, congratulated me. I think in that period of time it was ingrained in mind that only through continuous work and good results one could achieve results and be appreciated by all; if you work hard and correctly, the results come.

Prof. dr. Ghe. Mustață:

What can you say us about the role of the family in society?

Octavian Șerbănescu:

I had a united and respected family; the parents being teachers integrated perfectly into the village life. The war was the only one that troubled the balance. After the returning of my father and other men from the war, there were organized celebrations at school, evening sittings of women village, birthdays, etc., which maintained an atmosphere of calm, safety and social peace.

We, the children were direct beneficiaries of this good family atmosphere, which spread throughout the whole commune. The commune was quite small, the people knew and respected each other, forming a larger family. My parents were a model for all the inhabitants of the commune and many people came to us at home to ask my parents a good advice. I was mighty glad when I saw that my parents were consulted in all matters.

Prof. dr. Ghe. Mustață:

How were reconciled the genes provided by parents, natural and human factors in Seimenii Mari commune?

Octavian Șerbănescu:

Having full liberty, but advised by parents, grandparents and the parents of some playmate friends and from school, the environment and natural factors in totality (The

Danube, the islands, the marshes and other marvels of the place) were part of my childhood universe, a universe that I loved and was proud of.

I was working side by side with older people and enjoyed together the results of our work. I loved the earth and felt the same with the dust that ate us.

Prof. dr. Ghe. Mustață:

You always had an athletic structure and a stubborn behaviour - I wonder myself if they were developed and potentiated by the time spent at “Mircea cel Bătrân” secondary school in Constanța?

Octavian Șerbănescu:

I was a healthy child, who worked outdoors from cutting woods in the forest and to carrying melons with the sack at the edge of the road. All left their mark on the harmonious development of my body.

At the secondary school, the sport hours were loved due to the teacher and his way to teach; there were prepared the Pyramids for the school celebration (with 3-4 floors), as well as the bar exercises, trampoline, jumping horse or the sand box, etc. All these contributed to the development of an athletic and harmonious body. There can be also added swimming on hundreds meters at the sea, even when it was not enough calm”. All of these transformed me slowly - slowly, into a pupil who was always in competition at school and at sport. But I did not dedicate myself to sport.

Prof. dr. Ghe. Mustață:

What determined you to orient yourself towards Iași for university studies and to choose as a field of training Natural Sciences?

Octavian Șerbănescu:

I had a few teachers at the secondary school who were from Iași, or studied at "Alexandru Ioan Cuza" University; the biology teacher was, for a short time, assistant at the Department of Botany. All had a special impressive prestige and adequate behaviour to function: they were teaching impeccably, were harsh, but were true educators and they also successfully replaced our parents who were away in the country and we, the children of 12-14 years old, were trying to copy our colleagues born in the city.

Our teachers were talking to us about their student life, about the supported hardships and sometimes we made comparison with our lives as we bought bread and clothes on cards, wood and other goods were rationalized, etc. However, they encouraged us to learn that the things would become normal in a short time.

The reports of our teachers completed with stories of some older colleagues, students in Iasi, I went with to the beach in the last days of August, planted in my soul the firm desire to do university courses in Iași.

I choose the Faculty of Natural Sciences, as nature in all its diversity was the environment from which I came and with which I never entered into conflict. I wanted to know more and many other things.

Prof. dr. Ghe. Mustață:

If you had to choose again the academic environment in which to form yourself as a specialist would you choose again the city of Iași?

Octavian Șerbănescu:

Certainly, I would choose the city of Iași, again, if I had to reinvent the moment 1952. The fame of the University, the name of some scholars of Iași that I heard of during the secondary school, the courses of some great professors such as: Olga Necrasov, Petre

Jitariu, Vasile Pavelcu, etc., the general climate of the city, with its monuments, the conditions of study and why not the musicality of the Romanian language spoken by Moldovans, in a word – the university life - would return me again at Iași. And I hope, now I would have a personal reason, in addition: I married a colleague of year, Carmen, who is from Iași and from then, from January 1957, I come back to Iași, at least once a year with a special delight.

I must say I never forget to climb the Copou hill, to the university and to the Eminescu's lime tree. I meet with the colleagues, some professors at the university, I breathe the air of the city and feel stronger.

Prof. dr. Ghe. Mustață:

Who of the professors from the university Citadel of Iași impressed you the most?

Octavian Șerbănescu:

All my professors impressed me deeply and I watched them with great respect. I had the first university course with the great biologist, Professor Petre Suster. When I saw him coming toward the amphitheatre, with his less open to smile and dressed in black clothes, I had a great fear in the first moment. The fear was scattered after the calling of the catalog and our short presentation - where we came from and who I had as teachers; I found that three of my second school teachers were known to him. He asked me if I knew something about Agigea. I was happy after the first uttered sentences; he appeared and then proved he was a good man with an extraordinary biological culture. A good didactician and a wonderful adviser. Then, Professor Mihai Constantineanu, punctual, impeccable attitude, polite, held a course with an exemplary clarity, although the scientific names of various species and their classification seemed something hard to memorize.

I cannot forget Professor Petre Jitariu with his impressive and logical appearance with which he synthesized physiological phenomena and quite complex processes. A great scientist and a great professor. Later I knew him better and I discovered other qualities, too.

I did not have printed courses at any discipline, but the rhythm of speech permitted you to write down everything, at all disciplines.

All the professors that I had were of a high, scientific, moral and pedagogical class. I remember Miss professor Olga Necrasov, who taught the course of Comparative Anatomy of two hours, without any notes in front of her. She was coming to the chair with the box filled with coloured chalk with which she covered the huge blackboard in the amphitheatre with drawings of great scientific probity. How not to impress you such professors, how do not prepare yourself for exams knowing that you will have in front of you such extraordinary humans!

During my faculty, I did not have a professor to take as a model; however, I "stole" something from each one.

However, there is a model of "great man" with multiple qualities who inspired me in my research at the beginning, or later; I met him at Agigea Station, after the graduation of Faculty. He was Professor Sergiu Cărăușu. An imposing, solid, with an athletic structure man, with an agile and smiling sight, with tremendous power of synthesis and with the capacity to see the whole in its complexity; after making the whole, he dealt with the component parts that he dissected with the scalpel of mind in order to surprise the subtlest mysteries, then he - remade THE WHOLE without "gaps" and without uncertainty. He had a well-trained mind through reading (He read very easily in Russian and the Russians

translated everything that was abroad), having an enviable capacity for analysis and synthesis. He had a good heart and was a good man for family.

During the faculty, I did not have him as a professor, but I knew him in 1955 at Agigea in the study trip of my year. Since then he imposed in our eyes as a great personality. From him I learned a lot, although I did not hear any of his courses.

I must mention Professor Gheorghe Hasan, who though was not a direct professor to me, attracted me toward the Hydrobiology course and cultivated my interest properly.

I also mention the lady professor Elena Jean-Renaud for her calm, for the dense and beautiful courses and for the goodwill with which she looked after on our student problems, to find solutions, from the position of vice-rector of the University.

And if I go from discipline to discipline everywhere I found competent people, specialists, passionate researchers and perfect educators.

I thank them all and address them again a sincere THANK YOU!!

Prof. dr. Ghe. Mustață:

I am glad to have in front of me a “sacred monster” of the research of radioactive pollution on the eve of the Great Jubilee of “Professor Ioan Borcea” Marine Biological Station of Agigea, occasioned by the celebration of 90th anniversary from its establishment.

What can you tell us now about “Professor Ioan Borcea” Marine Biological Station and how do you see its future?

Octavian Șerbănescu:

Now, on the occasion of the 90th anniversary of the establishment of “Professor Ioan Borcea” Marine Biological Station, I had the conviction that, in 1956, when I entered the gate of the Station I penetrated into a temple and that, from all parts, there were looking great humans who studied even my breath.

I had the pulse accelerated and I was very excited. With time, I adapted myself and became “of the house”. I lived at the Station and worked from morning until late in the evening. It was quietness and had a great desire to prove to my fellows in the laboratory or on the sea that I can raise to the level of the requirements; no one told me what these are.

Although I had no scientific achievement, I felt fulfilled. With time, things changed, emotions were amplified only in autumn, at the scientific sessions of the University, where I had to present in front of my professors and of other specialists.

Today, when the Station has returned to Alma Mater, I can say, almost it was established again. In fact, it has re-started from zero.

Now it needs a new “Ioan Borcea” with another name, but with his passions and energies. The whole theme is embraced by sea and hidden in its bowels from the shore down to 2,246 m and it reveals it only to those passionate and devoted to work. With empty laboratories, but with full living rooms, especially in summer, the Station will not reach its goal.

The success of the recovery of the Station on its normal track depends on the leadership of the Faculty of Biology especially of the University, of the mode in which its purpose is seen. We cannot speak about scientific Stations at the sea or at the mountain without researchers; we cannot speak about stipulated contract research without diversified laboratories and well-formed researchers, both in the country and abroad at similar stations.

At the entrance into the Station you are encountered by a luxury ship, which, for more than five years, did not see the brilliance of the sea.

We have started talking about the Renaissance of the Stations as about a past: that they were resumed some stipulated by contract, that there were organized four scientific meetings with international participation, that there were published three volumes with scientific communications of the Station, that the students developed dozens of graduation papers, as master students dozens of dissertation theses and that there were realized and have been successfully achieved and sustained three theses, etc. Not to mention that for more than two years, the Station did not have any researcher and now it is hired only one.

The Station must have a good research, well-trained collective with specializations made in the country and abroad. Lastly (but for this it must have scientific credibility and a modern material basis) it is about a place where one can effectuate researches for interested international organizations that dispose of funds and desire the results of research.

Everything is possible, but for this success "Alexandru Ioan Cuza" University of Iași must turn its attention, at least for a period on the Station and its needs.

Personally, I believe the Agigea Station must be coordinated by the University and led from Agigea, not by phone or visits; only in this way, it can have a bright future, on the measure of the past.

I cannot desire for the Station from Agigea than what Eminescu wanted to his country: The brilliant past, a great future!

Prof. dr. Ghe. Mustață:

Dear Mr. researcher Octavian Șerbănescu PhD thank you so much for this interview and I do not want to make God angry, but I beg him to help us that the next interview to take place at the celebration of 100 years since the establishment of "Professor Ioan Borcea" Marine Biological Station from Agigea.

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Professor Victor Ciochia (February 4, 1932 – November 14, 2014), PhD in Biology, attended high school at the "Andrei Saguna" National College in Brasov, then the Faculty of Biology of the "Alexandru Ioan Cuza" University of Iasi, where he had as colleagues other great biologists such as: Professor Gheorghe Mustață, PhD, Professor Ionel Andriescu, PhD, Professor Ioan Moglan, PhD, Professor Constantin Pisică, PhD, Professor Raol Constantineanu, PhD, as disciples of the eminent ichneumonolog of Europe in the second half of the twentieth century, Mihai Constantineanu. As a student he managed to meet great personalities of science and culture in the Moldovan capital and establish solid relations with elite students from other faculties. Since the 1st year of studies he worked in his spare time in the circle of "Invertebrate Zoology" thus developing as a specialist in systematics and biology of some groups of insects such as: Ichneumonoidae, Chalcidoidae, entomophagus, and Mallophaga from birds and mammals, managing to be co-author of various scientific papers while still being a student. In 1972 he obtained his PhD in biology from the "Alexandru Ioan Cuza" University, and his PhD thesis entitled *"Contributions to the study of Trachysphyroids (HYM., Ichn.) in R.S.R."* was published in 1979. As a novelty in this thesis, he studied problems related to ethology and for the first time in science he marked some Ichneumonidae insects with the I_{131} isotope; this discovery was a world premiere. For the original studies and novelty of the thesis he obtained the "Emil Racovita" prize awarded by the Romanian Academy in 1981. Over the years he studied many orders of insects. In 1977 he patented the *"Environmental chamber for use in biology"* (State Office for Inventions and Trademarks Patent 67069), he created a soil trap for collecting the arthropod fauna called Entomograph (State Office for Inventions and Trademarks Patent 64060). And during the invasion of 1975, he studied the biology of the insect to reduce the populations of larvae of *Loxostege sticticalis* hairy caterpillar that lives in the steppe, developing the first thesis in Romania, "The caterpillar of steppe" (*Loxostege sticticalis*) (1975).

Over the years Mr. Victor Ciochia published several monographs dealing with other orders of insects as well: "Catalogue of Lepidoptera collection of Brașov County Museum" (1980), "Catalogue of Lepidoptera educational collection of the "Lucian Blaga" University of Sibiu" (2000), "Day Butterflies of Romania" (2012).

The educational activities of Professor Victor Ciochia, PhD in Biology, began in 1955-1958 as assistant in the Department of Invertebrate Zoology, Faculty of Biology, "Alexandru Ioan Cuza" University of Iasi where he taught the course of Invertebrate Zoology along with the eminent Professor Mihai Constantineanu and the Associate Professor Stefan Vancea. His teaching activity was interrupted by his arrest on May 5, 1958, for political reasons and his sentence to five years in correctional prison at the expense of science and higher education, thus the flame giving impetus knowledge and the impulse to discover the unknown in the field of entomology and ornithology was extinguished for 5 years. After the release from prison, he hardly managed to find a job as unqualified worker in road construction and maintenance, until 1963 he was employed as a designer in the Department of Botany and Zoology, Faculty of Silviculture and Forest Engineering, Polytechnic Institute of Brașov.

The color drawings representing plants and insects are still being used today at specialized courses. He skillfully created drawings for the botany courses of Professor Iuliu Morariu, or hunting and aquaculture of salmonids courses of Associate Professor Alexandru Duda. The tortuous road of life and the destiny bring him again after many years in the academic world, and in 1997 he became professor at the "Lucian Blaga" University of Sibiu, where he taught subjects such as: zoology, entomology, plant protection, and ornithology. Since 1999, he had been a PhD coordinator at the University of Bucharest, Faculty of Biology, and over several years he has trained 11 PhDs in Science, in the field of biology (Stanca-Moise, 2015).

He spent his spare time by conducting ornithological research, passion of his youth, dealing in particular with the dynamics and migration of birds. Between 1951 and 1958 he collected by himself, being a very good hunter, over 600 birds, which he has studied by dissection and by obtaining biometric data from the content of the stomach and the endocrine glands to study their functional effect on migration. He had done an outstanding research in the field of ornithology in Dobrogea, at the "Prof. Ioan Borcea" Marine Research Station in Agigea, between 1968 and 1972, where for the first time in Romania, a census of birds that spend the winter on the Black Sea Coast and in the Danube Delta was conducted from an airplane. Thus, Mr. Victor Ciochia became a collaborator of the International Waterfowl Research Bureau (BIRS, BIROE) located in Slimbridge (England) until 1991. Through his ethology studies and inventorying of the Romanian avifauna, professor Victor Ciochia contributed to the global level with information on the birds from the Black Sea and the Danube Delta. This way he met and got to know the famous explorer Jacques Yves Cousteau. Together, they conduct ornithological studies, developing scientific documentation related to the ethology, ecology and migration of birds from the Danube Delta Biosphere Reserve and the Black Sea. Also as a collaborator of the Romanian Ornithological Society he ringed over 2500 birds with Japanese nets, and about 4% of the birds ringed by the professor were found in: Africa, Asia Minor, Russia, Greece, Italy etc. He discovered the bird *Sylvia melanocephala* in the Agigea Marine Sand Dunes Reserve, that being the first time that bird was mentioned in the Romanian fauna. He also

identified the Histria Sinoe area as the European wintering area of the red-breasted Goose (*Branta ruficollis).*

Over the years he has also been concerned about the effect of the oil pollution of the Black Sea. The study he has conducted was presented at the Tenth European Conference for Birds Protection (CIPO) where he raised the question, and along with researchers from countries bordering the Black Sea brought solutions to resolve the situation. The ornithological studies and research have been translated into several documentary films, working with people from the "Al. Sahia" Film Studios, where, for the first time in Romania, it was presented the ethology, ecology and nesting of waders and the birdsong was recorded on audio tape.

The professor's extensive research in the field of ornithology is embodied in the following monographs: "The dynamics and migration of birds" (1984), "Brooding birds in Romania" (1992), "Aves Danubii" (2001) published in Romanian and German, "Bird Dictionary" (2002), "Small Treaty of ornithology" vol. I, volume II (2007), "Bird flight and migration" (2011), "Sedentary ornithofauna of Romania" (2013).

The study of insects was one of the professor's concerns since he was student. From a taxonomic point of view, from the of the *Ichneumonidae (Trachysphyroidae*), he described for the first time in science 9 species and 10 subspecies, also a new genus and a new species for the fauna of Europe and 5 genera, 64 species, two subspecies and 4 new varieties for the Romanian fauna (Stancă-Moise, 2015).

In 1968 at the XIII International Congress of Entomology in Moscow he presented a paper on the biology of the entomophage *Hemiteles melanarius* Grav. He has found that it paralyzes the cabbage white chrysalis, thereby reducing the populations of this lepidoptera. For the news presented at this conference, being noted by the International Organization for Biological Control he was granted a scholarship for 4 months in the resort "Lutte Biologique d'Antibes" (INRA France).

During this scholarship, the professor acquires modern techniques of controlled insect growth in microclimate conditions and their use in limiting phytophagous insect populations. In the same period of time he did an internship at "Station Biologique de la Tour du Valat" (Rhone delta), that gave him the opportunity to visit a number of nature reserves in Southern France and Corsica Regional Park. As a consequence of these professional internships, when professor Victor Ciochia came back to Romania he focused its entire activity in the area of entomophagous insects to limit by biological means the phytophagous insects, environment protection, and also in-depth studies of ornithology.

As a novelty for the Romanian field of biological control, he created the substance Valuftin made by Antibiotice Factory of Iasi and used to limit the Colorado potato beetle populations and the substance based on the Beauveria bassiana spores. In 1971 he made at the resort "Stejarul" Pângărați Neamt the first Romanian biostation created to grow the entomophagous Hymenoptera *Prospaltella pernicious* and *Aphytis proclia* that limit the San Jose hard-shell scales. This biostation was the first in Eastern Europe, which operated until 1975. By conducting these studies and by creating new concepts of biological control use to limit pest populations, by publishing the technology he made available the biological control method to the research in horticulture and to be used in orchards. This technology was required by 12 countries to be applied. For these achievements he obtained 2 registered patents in 1974. At the Research Institute for Potato and Sugar Beet Brasov, he addressed issues related to the zoology applied in the protection of the respective crops, being

concerned especially with the introduction of biological means into chemical control schemes to limit the populations of phytophagous insects.

The controlled growth of the flour moth (*Ephestia kuehniella*) increased since1976 when he used eggs as natural support of infestation for the entomophagus of the genus Trichogramma. In 1984 he patented industrial machines, creating the first biostation in Romania for industrial growth of the flour moth and of the trichogramma. The treatments carried out in Romania on production areas of over 1000 ha in Brasov, Ialomita, Calarasi, Giurgiu, Roman, Arad, Techirghiol have demonstrated that it is possible to keep under control the sugar beet, cabbage, vines and corn crops without using chemical insecticides to reduce under PED the defoliating larvae. Between 1972 and 1974 he had been a member of the UN team, anti-drug department, where he studied the poppy pests and the possibility to biologically limit the poppy crops in the Middle East through biological means.

In this line of research, he has found and studied the poppy weevil (*Ceutorhynchus macula-alba*), which was then industrially grown in Italy. The results obtained in the research have been published in over 80 scientific papers that have been presented at different scientific events in the country and abroad, to name but a few: the "XVII International Congress of Entomology in Hamburg" (1984), "the II International Symposium on *Trichogramma* and other parasites eggs from San Antony Texas", the "Internationale Entomologen-Tagung, Basel Switzerland" (1999), "XIV International Congress of Plant Protection, Jerusalem" (1999). Throughout his life, he made six inventions, two innovations, dissemination brochures, countless posters and calendars on birds and nature protection. Given that there is no presentation of the aphids in the Romanian literature, in 1997 he made the first monograph entitled the *Brief presentation of aphids, host plants and main natural limiters of Romania*, which presents all aphid species known in our country until 1996, their host plants and also some remarks on some of their natural limiters.

The 24 monographs which he had coordinated and published throughout his life together with other researchers deal with plants and nature protection: "Biological control of pests, the essential component of agroecosystems protection" (1986), "Sugar beet pests and diseases" (1976), "Protection of sugar beet" (1980), "Sugar beet pests and diseases - Album" (1984), "Technologies of industrial growth of several auxiliary insect species used in biological pest control" (1993), "Limitation of plant and animal pest populations in crops through biological and biotechnical means to protect the environment" (1997) (for this monograph he has been awarded with the M. I. Constantineanu prize), "Crop protection in the mountains" (1998), "Ecological Protection of the crop plants and the environment" (2005), "Aphids in Romania, natural limiters, methods of reducing populations" (2008).

The academic and research activity of professor Victor Ciochia is impressive. He left a valuable legacy to the national and global scientific community both in the fields of entomology and ornithology. He published an impressive number of articles in prestigious scientific journals. There are over 200 scientific papers in Romanian, French, Russian, German and English along with the 24 reference scientific monographs. He initiated and organized nine National Conferences for Environmental Protection by Biological and Biotechnical Means (Brasov, 1988, 1992, 1995, 1997, 1998, 2000, 2002, 2005, 2007). The papers presented during these conferences have been published in as many volumes.

During his life, the eminent scientist was a member of: "Gh. Ionescu-Șișești" Academy of Agricultural and Forestry Sciences (1991-2014), the Academy of Romanian

Scientists (1991-2014), Member of the New York Academy of Sciences (1994-2014); member of some national scientific societies: Romanian Ornithological Society (1967-2014), the Romanian Society of Biological Sciences, Romanian Society of Ornithology and Bird and Nature Protection (founder; 1990-2014), Romanian Association for Ecosanogenesis (founder and chairman from 1995 to 2014), Romanian Society for General and Applied Entomology (1994-2014), Romanian Lepidopterological Society (1995-2014); international scientific societies: Société Ornitologique de la France (1966-2014), Ligue Francaise Pour la Protection des Oiseaux (1969-2014), Asociation des amies du Parque Regionaux de la Corse (1973-2014), Société pour l'étude et protection of nature de la Bretagne (1969-1980), the International Council for Hunting, Paris (1968-1976), the International Bureau for the Protection of Birds (CIPO Cambridge, 1985-1988-1991), International Organization for Biological Control (1982-2014), Working Committee for the Atlas of European Breeding Birds (Stanca-Moise, 2015).

Being a close professional collaborator, Mr. Professor Victor Ciochia also offered me and my husband his warm friendship, which really honored us.

It is hard to describe in a few pages the life's work of professor Victor Ciochia, with his outstanding achievements. His fascinating personality attracted the younger generation and gathered around him both students, as exceptional teacher, and young researchers, specialists, being a pioneer in environmental protection, being part of the plethora of great nature protectors. He brilliantly organized scientific meetings at national and international level, being himself a great entomologist and ornithologist, a tireless campaigner of biological control, dedicating his entire life to the Romanian research in this field.

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PROFESOR DR. ION NEACȘU (1939-2010)

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As a terrible lightning followed by a disturbing thunder, the news fell among us that Professor Ion Neacsu, our omnipresent colleague at all activities organized by us or by other academic institutions entered into the world of spirits.

We were scattered, naturally, in the country, each in the preferred area to escape by the canicular heats of a sultry August. Ionică Neacsu was gone to Gruieni (I particularly like the phonetics of that name) to the parental home, in order to charge himself the power reserves on the lands of childhood, hoping that the meeting with his sister and with the childhood will alleviate the eternal troubles caused by the state of his poor health after the meeting with his sister in Dobriceni, where is her dwelling, he was returning to the parental home, thoughtfully and somewhat dizzy from heat and headaches, which rarely granted him a moment of respiration. Going on the concrete edge of the Sărata brook, he felt at one moment that his eyes darkened and a dizziness coming from the interior weakens his members. Scared he tried to gather his strengths, but he did not manage and crashed. The expression of his face still expresses his surprise and bad temper that such a balance just happened to him. With this expression etched on his face greeted us on August 21, 2010, at his start on the road of eternity.

Born on 28th May 1939, at Gruieri, Dobriceni, commune, from the district of Horezu, Argeș Region (now the village Dobriceni, commune Stoienesti, Valcea County), Ion Neacsu started in life with a backpack loaded with humanity, humility and a clean Romanian living. His parents, honest and hardworking people did everything they could to send him to high schools and to make him man of kindness, and they succeeded beyond measure.

He studied the Primary School at Dobriceni and the gymnasium at the Horezu district. In those seven years from home, he learned to love the work and people, to glorify God and to be a devoted servant of the country and his homeland.

He attended the high school studies at Râmnicu Vâlcea, at High School N0. 1 which he graduated in 1956. He did the University studies at Iași, where he would remain for the whole rest of his life.

Formed at the school of some great personalities of the Romanian biology, such as professors **Petre Jitariu, Olga Necrasov, Mihai Constantineanu, Constantin Papp, Zicman Feider**, etc., the young student detached himself by his colleagues through his kind of being sincere, due to his native intelligence and through great passion for knowledge of nature.

As a prelude to the great symphony of the profession the young graduate Ion Neacșu became a teacher at the **General School of the village Agigea, Constanța County**. The "Prof. Joan Borcea" Marine Biological Station of Agigea, belonged to Agigea and presented itself like an iceberg in the Romanian marine researches. I try to imagine what layed in the soul of the young teacher, eager to research and affirmation.

He was visiting the Resort as often as he can and felt like in a family among the young researchers. The General School of Agigea, which later had to be called the **"Ioan Borcea" General School** represented the **"theater**" where Ion Neacșu discovered himself the qualities and the didactic grace. He learned to order the ideas in the exposition of some themes, to use the black board in order to synthesize the information offered to pupils and to look at the pupils as future partners of work.

I remember with how much pleasure could come the researcher Ion Neacșu to Agigea after the recovering of the Station by the "Alexandru Ioan Cuza" University of Iași. He was coming for some treatments to the Sanatorium from North Eforie, but he was living at the Resort. He wanted wholeheartedly to participate in solving problems when we were trying to get the buildings from chaos and to ensure the renovation of the prestigious institution which was taken from the fury of the times. He helped me to complete some gaps appearing in the trial to realize a short historian of the Station. As concerns the Professor Nicolae Gavrilescu, one of the former directors, offered me the most complete information. He felt the real value of the specialist, leaving behind some issues that confuse you in the understanding of the true man of science, who was Nicolae Gavrilescu.

Together with his colleagues, Adrian Telembici, Valeriu Crăciun and Florin Teodorescu made of the Resort Agigea a true temple of the marine researches and a warm home, in which they were feeling truly at home.

During the summer the Resort was visited by great personalities of the Romanian biological sciences. The academician **Mihai Băcescu** felt himself attracted by the foundation of his master, Professor Ioan Borcea, and the academician **Eugen Pora**, together with his team of researchers was caming to the Resort year after year, drawing him particularly through the topics of tackled researches. The academician **Petre Jitariu**, at that time Dean of the Faculty of Biology and Geography-Geology was coming also with his staff, revived **"the spirit from Agigea"** enthroned with divine grace by the Professor Ioan Borcea. If to these collectives we still add the professors: **Constantin Motaș** (former director of the Resort), **Radu Codreanu** from Bucharest, **Gheorghe Hasan**, a true "troubadour" of biologists and the exotic **Ion Țuculescu,** the painter who left us the excellent monograph of Lake Techirghiol, then we can understand why Resort from Agigea became the most powerful school of marine Biology in Romania.

When I was trying to realize an exhibition with photographic images, through which to sketch a journey through the history of the Resort, the colleague Ion Neacșu brought me a picture altogether uncommon.

He together with his colleagues Telembici, Crăciun and Teodorescu appeared in photo collecting different benthic animals from on the sea bed stuck by water due to a severe storm. A strong storm and of a long duration, which beat from shore to the sea, managed to expose the seafloor in supralitoral and infralittoral on a distance of hundreds of meters from the shore. Taking advantage of such a phenomenon extremely rare, the 4 colleagues ventured themselves into a bold action to collect scientific material under the conditions provided by the caprices of nature. They had, however, to return quickly to the shore because the waters of the sea were coming back to their bed.

In February 1965 he succeeds to transfer to the "Prof. Ion Borcea Marine Biological Station" from Agigea, at the Marine Animal Physiology Laboratory, where he formed himself as a researcher alongside with his colleagues Adrian Telembici and Valeriu Crăciun, under the direct coordination of the eminent physiologist, the academician Peter Jitariu.

The Agigea Resort has become his new home; here he started his way in the research and also here he founded his family. For 5 years, he had peace and quiet and had achieved important scientific accumulations in the field of animal physiology and of cellular biology.

We can affirm that Agigea Resort had reached its golden period. But the period of real euphoria would be stopped abruptly.

The transition of the Resort within the **Romanian Marine Research Institute from Constanța** was a drama in his career. But the drama did not degenerate into a tragedy because proving undeniable qualities of researcher Ion Neacsu was transferred on 1st August 1970 at the **Center for Biological Research of Iasi, at the Laboratory of Biology of Cellular membranes**, where he worked until 1990.

Working under the direct leadership of the academician Petre Jitariu and being under the influence of Professor Gheorghe Dimitriu our hero has become an excellent researcher, who penetrated into the mysteries of the cellular biology.

Admitted to the Doctorate with the theme ***The action of some ions and of some organic agents on the electrical properties of the cellular membrane***, he will present successfully the doctoral thesis in 1984, thus entering in the prestigious School of Animal Physiology of the academician Petre Jitariu alongside of eminent researchers: **George Dimitriu, Stefan Agrigoroaie, Vasile Hefco** and his colleagues **Valer Crăciun** and **Pincu Rotenberg.**

In the month of October 1990, he occupies, through the competition, a post of associated reader at the Faculty of Biology of the "Alexandru Ioan Cuza" University of Iași at the discipline of Cellular and Molecular Biology.

The accumulated experience as a researcher in this field has been fully valued in teaching this discipline, proving to be a university professor endowed with didactic grace and a special behaviour to students.

In October 1994 he becomes, through a competition, titular university professor. What impressed us in particular was that Professor Ion Neacsu was able to take on the go, both the course **Cellular and Molecular Biology,** and the one of **Biophysics**, in times of crisis, caused at the Faculty of Biology by the death of the professors Gheorghe Dimitriu

and Mihai Isac. It is not about a miracle everything is explained through the excellence in research of the passionate biologist Ion Neacșu and through didactic grace with which he was endowed, receiving the **"baptism"** at General School from Agigea.

The Excellence in teaching activity and in scientific research have been strengthened also by the quality of the new courses he has proposed and has prepared for the sections of master:

- **Molecular mechanisms of the cellular communication;**
- **Cultures of animal cells in biotechnology;**
- **Molecular biology of the cellular cycle.**

The Professor Ion Neagu proved himself as university professor with an elevated biological culture and with an impressive power of penetrating into the mysteries of cellular biology, rarely met.

In the year 2005, Professor Ion Neacsu became retired. Through his intellectual capabilities and through a great power of work, contrasting with his physical and physiological precarious structure Ion Neacsu demonstrated, without having to ask anyone, that not the age should be the boundary transition from the activity to retirement, but the decline of physical and intellectual potencies. The retired Ion Neacsu becomes a researcher at the Center of Oenological Researches the Branch Iasi, of the Romanian Academy, in the period 1.01.2006 - August 18, 2010, where, together with the researcher Cristinel Zanoaga contributed to the realization of 7 projects of research of Oenology and 52 scientific papers presented at various conferences in the country and abroad (Italy, Hungary, etc).

The departure of our colleague Ion Neacsu was as surprising as it is painful. A colleague left us a rare spiritual nobility.

I cannot imagine Ionică Neacșu speaking ill of someone, or having unnatural behaviour with the students, colleagues and auxiliary staff. Without the rush in someone and without getting you tired, always he was opened in the discussions, being a pleasant interlocutor and particularly balanced. For him, the family, country and profession were the supreme aims of life; But you could not feel him really if you were not able to go into resonance with him.

BOOK REVIEW

PERSONALITĂȚI ALE BIOLOGIEI ROMÂNEȘTI ȘI UNIVERSALE, Gheorghe MUSTAȚĂ and Mariana MUSTAȚĂ, Editura A.O.Ș.R., București, 2014, 796 p.

The matrimonial couple Mustață Gheorghe and Mustață Mariana, well-known university biologists from Iași, are each specialist for the approached field. The presented book has a special theme and is indisputably valuable as it can be integrated in the biographical portraiture addressed to scientists, to biologists respectively, particularly from Romania, and especially from Iași.

The book, impressively voluminous (795 p.), consists of the following parts: *Romanian biologists (59 personalities), aspects of the life and the work of some foreign biologists (7), Anniversaries (15) and Obituaries (2).* Within the book, it is specified the author of each chapter.

The authors have chosen a common manner of presentation of the personalities (typically practiced in case of biographical dictionaries), carrying out scientific-literary portraits focused on the character, activity and the general profile of the subjects. Obviously, it aims to respect the rigor of human and professional value in each case.

One observation that cannot be omitted because it displeases justifiably many biologists confreres from Romania, is the expressed disparity between the title of the book and its content, in the sense that it is devoted preferably to the biologists from Iași, on their whole, not including a wide pleiad of genuine biologists from other university centres and research institutions in our country.

Let's look further at the content of the book on chapters.

Romanian biologists

The Romanian biologists presented in the book are - as it was a forementioned - in the big majority, from Iasi, or illustrious biologists of Moldavian origin, active in various university centres in Romania. Some of them are famous naturalists from abroad, established in Iași, where they made efforts to develop the Romanian biology (teaching and scientific) at its beginnings; we quote them in this sense: Wilhelm Knechtel, Czech (1835-1924), his son, born in Romania, Karl Knechtel (1884-1967, entomologist) and Arnold-Lucien Montandon, French (1852-1922).

It follows the presentation of illustrious Romanian naturalists, world-renowned scientists who laid the foundation of some biological disciplines in science or in Romania, such as Aristide Caradja (1861-1955, the creator of Entomology in Romania), Nicolae Leon (1862-1931, zoologist), Grigore Antipa (1867-1944, hydrobiologist, zoo-museologist), Paul Bujor (1867-1944, zoologist), Emil Racoviță (1868-1947, the creator of Biospeleology), Marcel Brândză (1868-1934, botanist), Eugen Botezat (1871-1964, zoologist), Ioan Borcea (1879-1936, legendary zoologist, the true creator of the Zoological Marine Station from Agigea), Ion Scriban (1879-1937, who became the first professor of Zoology at the King Ferdinand Romanian University in Cluj), Constantin Motaș (1891-1980, the father of

Phreatic Biology), Ioan Botez (1892-1937, anthropologist), Mihai Constantineanu (1894-1993, renowned entomologist).

All these great Moldavian biologists studied at prestigious universities or specialized at prestigious universities in western and central Europe (Paris, Toulouse, Monaco, Vienna, Berlin, Jena, Prague, etc.), under the guidance of the most famous biologists of the time, as they were: Ernest Haeckel, Ch. Vogt, A. Lang, Gaston Bonnier, Alfred Girard, Yves Delage, R. Hesse and others.

And so, the Romanian biology has developed many of its directions beginning with the nineteenth century, in the "Market of Iași" due to some well-informed minds, trained under the guidance of some world great personalities in Western Europe.

The biggest part of the Moldavian biologists born after the year 1900 studied at the University of Iași, founded by Alexandru Ioan Cuza in 1860, having as magistrates the renowned biologists mentioned before. However, many of them followed specializations in western countries with strong traditions in biological sciences. We recall in this regard a few: Academician Mihail Ionescu (1900-1988, entomologist), Zicman Feider (1903-1979, acarologist), Academician Petru Jitaru (1905-1989, physiologist), Sergiu Cărăușu (1907-1997, marine zoology), Acad. Mihai Băcescu (zoologist of rare complexity), Acad. Olga Necrasov (1910-2000, anthropologist, comparative anatomy), Paul Borcea (1919-1992, marine zoology), Acad. Petru Bănărescu (1921-2009, zoogeographer, taxonomist, systematician) Mărioara Godeanu (1938-2014, botanist-ecologist, with cares in the energy of the living systems), etc. It results the extraordinary creative power of Iași biology school.

Aspects of the life and work of some foreign biologists

Among the famous figures, notorious participants to the development of world biology in the eighteenth and nineteenth centuries, when the foundations of this science had been laid, the personalities illustrated in the book of the two authors who highlighted their deeds and erudition. Thus, there are presented, the following celebrities:

Georges Louis Leclerc de Buffon (1707-1788) - "the most beautiful pen of the eighteenth century", as stated J.J. Rouseau – a complete naturalist for his time (geologist, palaeontologist, zoologist, etc.). *C. Linnaeus* (1707-1778), the godfather of the living nature, respectively, the baptism parent of plants and animals, continuing on the ancient Aristotle, remaining a unique manner to these days. *Jean Baptiste Pierre Antoine de Monet, knight of Lamarck* (1744-1829, exceptional botanist. I remembered one of his assertions, on which there must reflect everyone who does science: "The true scientist does not remain in the empiricist field of his research, but he must rise to generalizations, to interdependent vision of phenomena that shapes the whole in all fields of science" (Lamarck). *Johan Wolfgang Goethe* (1809-1882, universal scientist of his time, particularly a philosopher and naturalist (mineralogist, botanist). *Charles Darwin* (1809-1882), the father of evolution, based on his own observations, but also of the transformism theory of Buffon and Lamarck. *Ernst Haecke*l (1834-1919, renowned evolutionary biologist. *Rabindranath Tagore* (1861-1941), a philosopher who studied the origin, evolution and migration of early humans, including their relations with the social environment.

Analysing the scientific contributions of these titans, enlightened minds and philosophers of world biology – recognized to be authentic parents of some new fields of natural sciences, – the authors of the discussed book realize an embracing incursion about

the works of these creators of Biosciences. Thus, the book leads us skilfully through the theory of transformism, of evolution, following the succession in time of different biological concepts developed by the great founders of biology. The essence of evolutionary theory (Darwinism) remains a basic concept in biology, argued by the investigations of modern biology too, even if certain improvements imposed by new scientific achievements have been made.

Anniversaries

Chapter anniversaries – realized entirely by Gheorghe Mustață, includes, naturally, contemporary personalities of the author, who honours them with one word portrait tablet, in an anniversary context at Iasi. We mention here the vivid character of Professor Gheorghe Mustață, his spiritual exaltation and soul dedication, rare appointed, to always be with peers, regardless of the age of the celebrated persons at round figures. There are exhibited on this occasion, for posterity, 15 portraits of some deserving biologists of Iasi, who were his professors or colleagues. We mention the interventions of Mr. Mustață about the following personalities: Professor Doc. Perju Theodosie, PhD (entomologist, a former professor at the Agricultural University of Cluj), Professor PhD Matilda Lăcătușu (entomologist), Professor Victor Ciochia, PhD (ornithologist, ichneumonologist), Professor Ionel Andriescu, PhD (entomologist), Acad. Constantin Toma (botanist), etc.

Obituaries

Professor Gheorghe Mustață took a final farewell, on the way of obituaries – as the discussed book informs us – from two personalities of the University of Iași, closed to him, both as colleagues and friends; they are Professor Gheorghe Dimitriu (physiologist) and Professor Pierre Jeanrenaud (geologist), “deeply anchored in the realities of scientific life”, according to the author.

Lapidary references on the authors

Professor Gheorghe Mustață is undoubtedly a good psychologist, an experienced observer of the phenomena of the living nature at whose deciphering he put his mind and the powers of his whole life, but also of the human characters, observing their behaviour, the qualities as a whole, no less the creative capacity, achievements. Thus, we admit, with no sign of restraint, the chance to be endowed with real qualities, this master of deep biological analysis and synthesis, University professor Gheorghe Mustață, PhD, with nothing less than a true academician. Those who want to find the real spirit of his observation and especially to know the spiritual sensitivity and craftsmanship of his writing, should read the portraits outlined by him in the book we are discussing about; we mention, for example, that referring to Matilda Lăcătușu (p. 627).

“Locus geniuses”

We consider important to mention Professor Gh. Mustață bringing in actuality – in the discussed book – of an interesting and unexplained issues that concerned, over the years, many reasoning minds everywhere (for example, Ernst Haeckel), even from us, the great Nicolae Iorga, Nicolae Leon from Iași. The latter resembles Iasi with Jena, an European centre of authorities and geniuses, having some common elements: what is Jena for Germany is Iași for Romania.

E. Haeckel considers *genius loci* as a traditional phenomenon of supreme commitment of the cultivated man, eager to study, of affirmation through work and untying the mysteries of science and culture: "But for me it is more precious the marvellous *Genius loci* of the University of Jena, than the advantages some universities offered me" (referring to the universities of Würzburg, Vienna, Strasbourg, where he was called (quote from the book Mustață, Mustață, 2014). In a historical approach and with deep biogenetic substrate, Mr. Mustață updates the problem of the "*Moldavian phenomenon"* or "*the genius of Moldovians",* considering it to be zonally contoured (Botoșani, Suceava). The observation addresses to the degree of intelligence and genius of many Moldavians (of the Romanian people), qualities expressed in various fields (literature, science, art).

So, the biologist of academic rank asks himself, naturally, what genes contribute to the emergence of so many highly creative minds of Moldavian origin? He does not stop asking, but he offers some known explanations and other personal ones, in addition, to attempt an explanation of what the renowned biologist from Iasi, Nicholas Leon called "*Locus geniuses".*

Regarding the problems discussed, we present the following considerations: Unquestionably, the frequency of super-gifted Moldavians, eloquently expressed throughout history, it is not the result of anemochory, seed reaching a fertile soil from which to develop a "miraculous plant". Maybe it is a special nation appeared spontaneously, developed and perpetuated in a particular place or region, fully achieved in favourable conditions for affirmation. No. The recalled Moldavian phenomenon has not developed on a family, genealogical branch, but at areal–regional level. Therefore, the mind can lead you to a relationship with the environment (natural, social), but this is difficult to put into an explicable and conclusive equation. That thesis can lead us to an analogy with the principles of Blaga's cultural philosophy.

May be that all is a natural given of Existence in which some people are born with a high degree of intellect and, very importantly, with the volitional faculty extremely powerful toward an adorable direction, felt since the juvenile age. The super-gifted Intellect orientated toward any field and the strong will of becoming anchors are the forces that gladden his existence, succeeding less or more, or in a degree that exceeds the human normal, reaching the genius in very rare cases. Because we all run in the marathon of Life - our life can be compared with a running sample of marathon, in which not all participants reach the finish line and just a few are ahead.

Why the discussed phenomenon is more common in certain areas, it is the question of questions. This keeps the human character of the individual, a quality, possibly genetically transmitted and acquired in different proportions on the way of social emulation. Or, in this regard the Moldavians are undisputedly people who can make their way; they accomplished themselves in great measure in the vast field of social activities, in spite of the material shortcomings experienced by them. If they would have and could express on the way of material and cultural act, the phenomenon of *Moldavian Locus geniuses* would have been more frequent numerically and spatially.

I return to the comment above started showing that I will not be biased, I will refer to the second author Associate Professor Mariana Mustață, PhD, a biologist specialized in the conservation and restoration of heritage values; a distinguished lady, physically and mentally, strong, steadfast character; her pen realizes an intelligible, smooth, pleasant and rational writing, mastering a more direct language, with a pronounced firmness, making us

understand: *this is the man, so I present him* with fewer stylistic flourishes or digressions in the spiritual labyrinth of her life.

We conclude, giving the following opinions: A book such as the present one is not only a tribute to the work and becoming, to the achievements of scientists, scholars, but also a lot of good and convincing examples submitted, as a testimony, to young generation, urging it to study and work for the benefit of science, of humanity, of our country and of their own persons, on the measure of the native resources and of endeavour. Education thorough the book is solid, convincing and accessible to all alike.

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