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THE PREVALENCE OF SOME INTESTINAL COMMENSAL PROTOZOA IN HUMAN POPULATION FROM IAȘI COUNTY (ROMANIA) AND THE *BLASTOCYSTIS HOMINIS* INCIDENCE

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Abstract. The potentially pathogenic commensal protozoa are nowadays a major concern of the worldwide parasitologists, due to their increasing and frequent involvement in the clinical pathology, by the evidence of the intrinsic pathogenicity (i.g. *Blastocystis hominis*), and due to the higher receptivity of the human host. The protozoan species studied in this purpose are: *Blastocystis hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba hartmanii* and *Chilomastix mesnili*, commonly found in feces and observed by microscopic examination. The study was conducted between the January 1st, 2011, and the August 1st, 2012, and comprised 8300 adults and children. The cumulative prevalence of the commensals protozoan was 12.89%, and the *Blastocystis hominis* has the highest incidence - 4.93%, followed by the *Endolimax nana* - 2.54%, *Entamoeba coli* - 1.92%, *Entamoeba hartmanii* - 1.82%, and *Chilomastix mesnili* - 1.6%. The determinations were performed in samples of feces spontaneously emitted, without administration of a purgative, in a wet smear. The used method involves a direct microscopic examination of the feces with a 1% Lugol solution. The clinical manifestations were found to begin and evolve when the number of parasitic elements (cysts, trophozoites) exceeds 5 per microscopic field (400x) - following the quantitative criterion. The manifestation could be transient, or, as in the *Blastocystis hominis* case - granular and amiboidal forms - entering in the etiology of colitis and IBS (Irritable Bowel Syndrome), when they become complex and long lasting. Commensal protozoa do not cause hypereosinophilia constantly, being also rarely in *Blastocystis* sp. infection. The study was performed at the DSP - Public Health Diagnostic Laboratory for asymptomatic adults or with transient symptoms in the context of periodic medical examination, and the “Investigatii Medicale Praxis” Laboratory, for children and adults, having a referral from a clinician or a gastroenterologist.

Keywords: commensal protozoa, prevalence, incidence, *Blastocystis hominis*, hypereosinophilia.

Rezumat: Prevalența unor protozoare comensale intestinale în populația umană din județul Iași (România) și incidența speciei *Blastocystis hominis*. Protozoarele comensale - cu potențial patogen - constituie astăzi o preocupare majoră a parazitologilor din întreaga lume, din cauza implicării acestora din ce în ce mai frecvent în patologia clinică, prin dovezi de patogenitate intrinsecă (de exemplu, *Blastocystis hominis*), iar pe de altă parte din cauza receptivității din ce în ce mai ridicată a gazdei umane. Speciile de protozoare urmărite sunt: *Blastocystis hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba hartmanii* și *Chilomastix mesnili*, cel mai frecvent întâlnite în materiile fecale și evidențiate prin examen microscopic. Studiul s-a desfășurat în perioada 01.01.2011 - 01.08.2012 și a cuprins un număr de 8300 adulți și copii. Prevalența cumulată a comensalilor a fost de 12,89%, din care *Blastocystis hominis* deține incidența cea mai ridicată - 4,93%, urmat de *Endolimax nana* - 2,54%, *Entamoeba coli* - 1,92%, *Entamoeba hartmanii* - 1,82% și *Chilomastix mesnili* - 1,68%. Determinările s-au efectuat din probe de materii fecale emise spontan, fără administrare de purgativ, în preparat nativ. Metoda utilizată presupune examenul microscopic direct al materiilor fecale, cu soluție Lugol 1%. S-a constatat că manifestările clinice încep și pot evolua atunci când numărul elementelor parazitare (chisturi, trofozoizi) depășește 5/câmp microscopic (400x) - când se îndeplinește criteriul cantitativ. Ele pot fi pasagere sau, în particular pentru *Blastocystis hominis*, formele granulare și amiboidale, care intră în etiologia colitelor și SCI (Sindromul Colonului Iritabil), devin complexe și de lungă durată. Protozoarele comensale nu provoacă constant hipereozinofilie, foarte rar aceasta constatându-se la

infecțarea cu *Blatocystis* sp. Studiul s-a realizat în cadrul controlului medical periodic desfășurat la DSP - Laboratorul de Diagnostic în Sănătate Publică, pentru persoanele adulte asimptomatice sau cu simptomatologie pasageră și Laboratorul "Investigații Medicale Praxis", pentru copiii și adulții care s-au prezentat la recomandarea medicului de familie sau gastroenterolog.

Cuvinte cheie: protozoare comensale, prevalență, incidență, *Blastocystis hominis*, hipereozinofilie.

Introduction

The implication of potentially pathogenic commensal protozoa in clinical pathology is nowadays a major concern of parasitologists in the whole world. This is due to their frequent involvement in clinical pathology - the evidence of intrinsic pathogenicity (*Blastocystis hominis*), and also due to increasing receptivity of human host. The motivation for this study was the large number of commensal protozoa detected by microscopic examination of feces, followed by the natural question: do they have clinical significance? The fact that these parasites can cause intestinal troubles, or could be etiological agents for diarrheal disease requires an insight into their biology (Aspöck *et al.*, 2007). Highlighting of the link between parasitic elements and disturbances of the feces leads to the conclusion that if the number is over 5 per one microscopic field, clinical manifestations could appear. The protozoan species studied are: *Blastocystis hominis*, *Endolimax nana*, *Entamoeba coli*, *Entamoeba hartmanii*, *Chilomastix mesnili*, which were most commonly found in feces and emphasized by fecal examination.

The aim of this investigation is the assessment of the prevalence of protozoa with pathogenic potential, from human colon in the periodic medical examination from nurseries, kindergartens, catering facilities and hospitals, and detection of healthy carriers that can spread the parasites in pediatric communities and in the adult population.

The incidence of the *Blastocystis hominis*, the most frequently commensal protozoan involved in clinical manifestations, was also established.

Material and Methods

The study was carried-out between the January 1st, 2011, and the August 1st, 2012, and comprised 8300 adults and children, at the DSP - Public Health Diagnostic Laboratory for asymptomatic adults in the context of periodic medical examination, and at the "Investigații Medicale Praxis" Laboratory for children and adults with transient symptoms, or having a referral from a clinician or a gastroenterologist.

In the Public Health Diagnostic Laboratory there were 3892 patients and adults without clinical symptoms, working in nurseries, kindergartens, catering facilities, canteens, and who asked the laboratory to perform mandatory periodic medical examination.

In "Investigații Medicale Praxis" Laboratory, 4408 patients were investigated, adults and children who requested fecal examination. The determinations were performed in samples of feces spontaneously emitted, without administration of a purgative, in wet smear. The used method involves direct microscopic examination of feces with Lugol solution (Rădulescu *et al.*, 1994).

By its properties (affinity for polysaccharide structures and lipoprotein), the Lugol solution shows a very good shape of internal structure of parasitic elements, making them easy to be distinguish (Rădulescu *et al.*, 1994).

The concentration method was not necessary, because protozoan cysts and/or trophozoites are numerous (direct division ensuring this) to be easily detected, and the quantitative criterion of commensal parasites does not involve concentration methods.

The method used for determining the eosinophils was the fluorescent flow cytometry on an automatic analyzer Sysmex XT 1800.

Results and Discussion

On the microscopic examination of 8300 stool samples, the following results were obtained (Fig. 1). The cumulative prevalence of the commensal protozoa was of 12.89%, which means 1064 persons, with 5 or over 5 parasitic elements viewed on the microscopic field (400x). The *Blastocystis hominis* has the highest incidence - 4.94% (410 persons) - followed by *Endolimax nana* with 2.55% (212), *Entamoeba coli* - 1.93% (160), *Entamoeba hartmanii* - 1.81% (150) and *Chilomastix mesnili* - 1.59% (132).

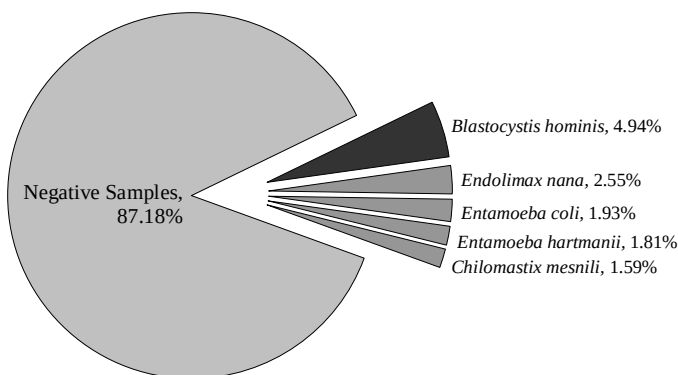


Figure 1. Commensal protozoa prevalence and species incidence.

In the case of the *Blastocystis hominis*, from the 8300 samples, 410 were positive. The dominant morphological form was the vacuolar, in 387 from the positive samples, or in combination with the granular form (in the other 23 samples).

For *Endolimax nana*, from a total of 8300 samples, 212 were found positive, 176 positive cases presented the cyst form, and 36 cases presented both forms (trophozoite and cyst).

For *Entamoeba coli*, from 160 positive samples, 118 contain only cyst form, and both trophozoite and cyst were found in 42 cases.

The fourth commensal parasite observed, *Entamoeba hartmanii*, was found in 150 cases, from which mostly cysts (138 samples), and trophozoites and cysts in 12 cases.

The *Chilomastix mesnili* was found in 132 positive cases, 120 with cysts, and only 12 with both morphological forms.

Blastocystis hominis has the highest incidence 4.93% (Fig. 1) from total number of analyzed samples and 38.53% from the positives (Fig. 2).

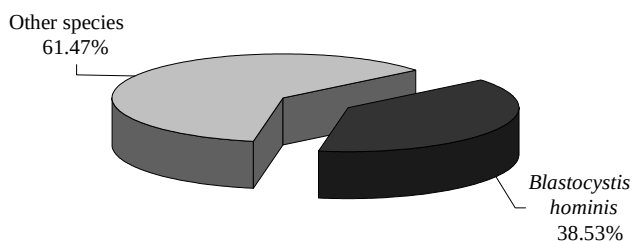


Figure 2. Incidence of *Blastocystis hominis* in the positive group.

Previous studies have shown that the incidence of the *Blastocystis hominis* is higher in developing countries than in developed countries. The reported incidence in developing countries was from 30% to 50% (Ashford & Atkinson, 1992; Guimaraes & Sogayar, 1993; Mercado & Arias, 1991; Puga *et al.*, 1991; Torres *et al.*, 1992) while the incidence of parasites in developed countries is between 1.5% and 10% (Doyle *et al.*, 1990; Gugliemetti *et al.*, 1993; Logar *et al.*, 1994; Senay & MacPherson, 1990; Yamada *et al.*, 1987; Zuckerman *et al.*, 1990). This is due to dietary habits, traditions, chronic diseases etc.

For the *Blastocystis hominis*, the parasite with the highest incidence, clinical significance is interpretable: the presence only of the vacuolar forms produces just transient intestinal discomfort, and the presence of both, vacuolar and granular form, induce clinical manifestations.

For a better statistical evaluation, the patients were divided in four age groups: 1-5, 6-17, 18-35 and 35-56 years. The results obtained are included in the Table 1.

Table 1. Incidence of commensal protozoa by age category.

Species	Age category			
	1-5 years	6-17 years	18-35 years	36-56 years
	Number of positive samples			
<i>Blastocystis hominis</i>	48	16	88	258
<i>Endolimax nana</i>	15	48	58	91
<i>Entamoeba coli</i>	47	48	37	28
<i>Entamoeba hartmanii</i>	30	39	39	42
<i>Chilomastix mesnili</i>	41	30	25	36
Total number of samples (8300)	1828	1198	1962	3318

From 8300 samples, 5280 were adults (18-56 years old). From the positive samples, 84% belong to women, and 16% to men. The other 3020 belong to children and young people (1-18 years old) (Fig. 3).

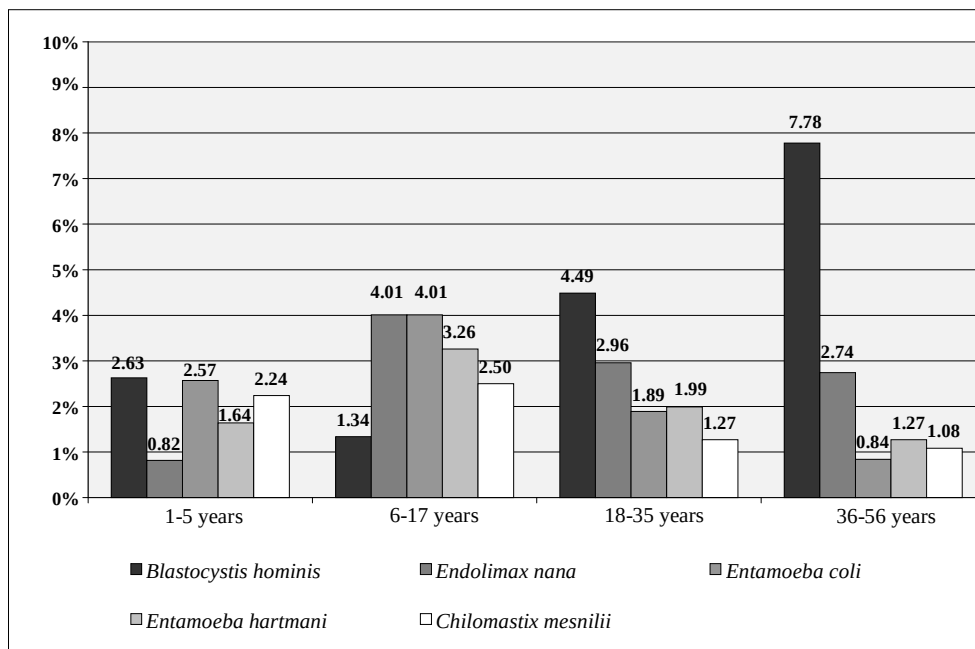


Figure 3. Incidence of commensal protozoa by the age category.

The positive subjects showed slight symptoms, manifested by bloating and diarrhea.

Clinical manifestations were the most obvious in the case of the presence of the *Blastocystis hominis*, characterized by diarrhea, abdominal pain, flatulence, nausea, and loss of appetite, especially in children.

The treatment required administration of the Metronidazole during 7 days, and sometimes accompanied by diet (Steriu, 1999). After the treatment, we tested the efficiency of medication, and all the samples were negative.

Commensal parasite biology is still less studied, because they apparently do not produce changes in the clinical state of subjects. For this reason, they were considered nonpathogenic (Rădulescu *et al.*, 1994; Steriu, 1999). At the beginning of their study, many other organisms could not fulfill Koch's postulates.

Blastocystis hominis was employed until recently in uncertain taxonomy pests, but starting with 1998 (Cavalier & Smith), based on molecular biology tests, it was classified in the *Stramenopiles* group.

The form most frequently encountered is the vacuolar form, but is present also in the granular, amoeboid, and cystic form. Granular and amoeboid forms give similar symptoms, and almost in all the cases they are accompanied by intestinal discharge. The cystic form involved only in spreading and infection.

This polymorphism obviously opens a broad framework for discussions, especially since the granular form is accepted as the etiologic agent of colitis.

The morphological type is likely responsible for the clinical manifestations as follows: the vacuolar form produces transient intestinal discomfort, and the amoeboid and granular forms are responsible for IBS, or diarrheal stool. Depending on local microbiota, pH variations, alimentation, transitions from vacuolar to granular and amoeboid form occur, the last one being always near to the intestinal wall.

Clinical manifestations appear when the number of parasites is higher than 5/microscopic field (400x). Only the presence of this parasite as a single etiologic agent in diarrheal disease in subjects with competent immune status leads to the conclusion that the *Blastocystis hominis* has a pathogenic potential. Also, the most significant clinical manifestations were signaled in *Blastocystis* infection. In several cases the treatment involved a long period of medication and diet.

The most affected group from the point of view of clinical manifestation was the 1-5 years old category, where acute manifestations appear, but they respond quickly to the treatment. In the case of adults, the clinical manifestations are not so evident, but the treatment requires to repeat or to change the medication.

The highest incidence for the *Blastocystis* was in the 36-56 years old group, maybe because of nonhealty alimentation, or cumulative effects of bad diet, fatigue, stress and metabolic diseases.

It is known that protozoa do not produce hypereosinophilia. In literature there are cases of hypereosinophilia caused by the *Blastocystis*. In this study, a high level of eosinophiles was not identified. Even for children in the acute period the increase of eosinophiles was not signaled in percentage and, in absolute value simultaneously, sometimes the percentage was a little bit higher, but not significantly. The method used for highlight eosinophils was the fluorescent flow cytometry on the automatic analyzer Sysmex XT 1800.

Commensal amoebas *Entamoeba coli*, *Entamoeba hartmanii* and *Endolimax nana* are rather indicators of fecal pollution of drinking water and food, or due to precarious hand hygiene. Their presence indicates a potential contamination with other classes of parasites which are transmitted by the fecal-oral way after the ingestion of food and water with fecal contamination. Their involvement in the development of some intestinal discomfort is also related to the presence in a number of 5 or more parasitic life forms/ microscopic field (400x).

In the stool, the predominant form is the cyst for the amoebas, and vacuolar form for *Blastocystis hominis*. The *Blastocystis sp* is often surprised in division in feces, and the process is the shortest and the quickest as compared to others protozoa. This is perhaps the reason for the incidence and clinical manifestations of parasitosis with *Blastocystis*, ranked as the first one in adults and children.

Conclusions

Compared with other commensal protozoa, *Blastocystis hominis* has the highest incidence and is the most frequently involved in clinical manifestations.

Compared with other studies, this study places our region in those with a low incidence of *Blastocystis hominis* parasitosis (from 1.5 to 10%).

The most clinically affected group is 1-5 years category, with acute symptoms and response to treatment, while adults (36-56 age group) had chronic symptoms requiring "in cascade" treatment. The treatment consists in the administration of the Metronidazole during 7 days, sometimes accompanied by a specific diet.

Clinical manifestations are related to the number of parasites on microscopic field (5 or more parasitic elements).

Intestinal commensal protozoa do not cause a hypereosinophilia.

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IN VITRO DIVISION MODALITIES DEVELOPED BY *BLASTOCYSTIS HOMINIS* EXAMINED WITH THE ACRIDINE ORANGE STAIN

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Abstract. *Blastocystis hominis* is a common enteric protozoan in humans and animals, with a high rate of zoonotic transmission. The morphology and the division modalities of *Blastocystis hominis* parasite have been studied both *in vitro* and *in vivo*, between the two media being differences on the division modalities developed by this parasite. This study reveals that this common parasite exploits in a different manner the environmental resources, adapting it to the existing conditions. From our study resulted that on the medium used *in vitro*, Gibco®RPMI 1640, the budding division is predominant, with formation of one or more daughter cells (asymmetrical division), while *in vivo*, in the feces multiplication, the dominant form is the binary division, resulting two identical daughter cells (symmetrical division). In order to emphasize the division forms present in the culture and feces, we used Acridine-Orange (AO) staining. AO is a cell-permeant nucleic acid binding dye that emits a green fluorescence bounding dsDNA and a red fluorescence bounding ssDNA or RNA. This unique characteristic makes the AO stain useful for cell-cycle studies and particularly for our study, showing the structural differences determined by the cell division.

Keywords: *Blastocystis hominis*, Acridine Orange (AO), binary division, daughter cells.

Rezumat. Modalități de diviziune *in vitro* dezvoltate de *Blastocystis hominis* examinate cu colorația Acridin Orange. *Blastocystis hominis* este un protozoar enteric comun la om și animale, cu rată înaltă de transmitere zoonotică. Morfologia și modalitățile de diviziune ale parazitului *Blastocystis hominis* au fost studiate atât *in vitro* cât și *in vivo*, între cele două medii de viață existând diferențe din punct de vedere al modalităților de înmulțire pe care le dezvoltă parazitul. Studiul evidențiază că acest parazit comun exploatează în mod specific resursele de mediu, adaptându-se la condițiile de viață existente. *In vitro*, pe mediul utilizat în acest studiu, (Gibco®RPMI 1640), predomină înmulțirea prin înmugurire, cu formare de celule fiice (diviziune asimetrică), în timp ce *in vivo*, în fecale, forma dominantă de înmulțire este diviziunea binară, rezultând două celule identice (diviziune simetrică). Pentru evidențierea modalităților de diviziune prezente în materiile fecale și în cultură, s-a utilizat colorația Acridin Orange (AO), colorație a acizilor nucleici, împreună cu care emite fluorescență verde atunci când se leagă de dsADN și fluorescență roșie atunci când se leagă de ssADN sau ARN. Această caracteristică unică face colorația Acridin Orange utilă pentru studiul ciclului celular și evidențiază, particular în acest studiu, diferențele structurale determinate de diviziune.

Cuvinte cheie: *Blastocystis hominis*, Acridin Orange (AO), diviziune binară, celule fiice.

Introduction

Blastocystis hominis represents even nowadays a challenge for the parasitologists. Morphologically, it is the protozoan with the highest polymorphism, and the most diverse division modalities observed both *in vivo* and *in vitro*. From its discovery, different

cultivation, staining and identification techniques were elaborated and even PCR genotyping (Noël *et al.*, 2005). Its reproduction was an enigma for a long time, at least four division modalities being described in the last decades: binary fission, plasmotomy, endogony, and schizogony (Zierdt, 1991).

The purpose of this study was to describe *in vitro* behavior of *Blastocystis hominis* cultivated on a liquid media, morphological and division characteristics and to compare with his division ways developed in feces. Consequently, we used xenic cultures on the Gibco®RPMI 1640 medium (Zhang *et al.*, 2012) and feces, with more than 5 parasites/microscopical field (400x). We used Acridine-Orange (AO) staining (Suresh *et al.*, 1993; Suresh *et al.*, 1994). This fluorochrome highlight the ADN concentration from cellular structures especially the nuclei and it is used for cell-cycle and detection of various stages of development of cells. In our study we use the AO to highlight the *Blastocystis* cells division.

Material and Methods

The origin of isolates

The isolates for the culture and also from feces were provided by patients with irritable colon syndrome (IBS) and colitis, and also by asymptomatic patients, where the parasite meets the quantitative criterion (over 5 parasites/microscopical field (400X).

Work protocol

The Gibco®RPMI 1640 is a basic culture medium containing vitamins, aminoacids, salts, glucose, glutathione and a pH indicator. It does not contain proteins or growth agents. Therefore, it needs to be enriched, in order to become a “complete” medium.

The cultivation was realized in sterile test tubes with cotton stoppers, in which we distributed, with a sterile pipette, 5 ml Gibco®RPMI 1640 medium with an addition of fetal bovine serum (5 ml/100 ml RPMI medium) and antibiotics (1 ml mix of penicillin and streptomycin/100 ml RPMI medium). The cultivation was made in the aerobiosis.

The inoculation was realized by adding directly feces in the culture medium, obtaining a xenic culture due to the dependence of *Blastocystis* on the commensal flora. The culture was kept in a thermostat at 37°C, and it has been monitored for 14 days, with a daily agitation.

The readings were realized daily, after 48 hours from the inoculation.

We notice if the parasites from the inoculation preserved their characteristics (shape, dimensions) and, if they divided, how their division modalities were.

For the microscopic evaluation of the parasite in direct fecal examination and also from culture we used AO stain.

Wet preparations from feces and culture suspension were stained with Acridine-Orange, which we examined under the fluorescence microscope (Leica microscope - 5500Q TCS SPE with a DFC 290 camera). This fluorochrome has affinity for DNA, staining bright yellow the DNA concentrations from the nuclei (Suresh *et al.*, 1994).

Acridine-Orange staining

Acridine-Orange (AO) is a specific staining for the nucleic acids, selectively used to determine the cell cycle. AO interacts with the DNA and RNA by intercalation, or electrostatic attraction, respectively: DNA intercalated with AO – green fluorescence (525 nm); RNA with electrostatic attraction to AO – red fluorescence (>630 nm). There is a

distinction between the passive and the activated, proliferating cells, and also differentiated cells in the G1 phase can be detected. AO can also be useful as a method to identify the apoptosis, and to detect the intracellular pH gradients, and to measure the activity of protons pump related to the age and live activity of the *Blastocystis* organism.

In our study we used the AO stain for highlight the division modalities developed by the *Blastocystis hominis* *in vitro* and *in vivo*.

The solution prepared was stored at room temperature into dark bottles. We place on each microscopic slide 25 μ l of the feces suspension containing *Blastocystis*, and 25 μ l of AO solution or 50 μ l AO and a small quantity of feces. We cover it with the 22x22 mm coverslips, waiting for 3-5 min, and then we examined the preparation under the fluorescence microscope (400x) and with immersion (Tan & Suresh, 2006).

At fluorescence, the central body forms have yellow cytoplasm, green vacuoles and bright yellow nuclei.

Results and Discussion

At a direct examination with AO stain, after 48 hours in the culture medium, the parasites was perfectly round, with a big and light green central vacuola, with a tight peripheral cytoplasm, and bright yellow nuclei being situated mainly at the periphery of the parasite cell (Fig. 1).

Only the vacuolar form was observed. We interpreted this fact by the adaptation of this population to the environmental stress. Concerning the dimensions, the parasite maintained its pleomorphic characteristics with sizes varying from 5 to 20 μ m. With the AO stain, we showed a lot of morphological and division details.

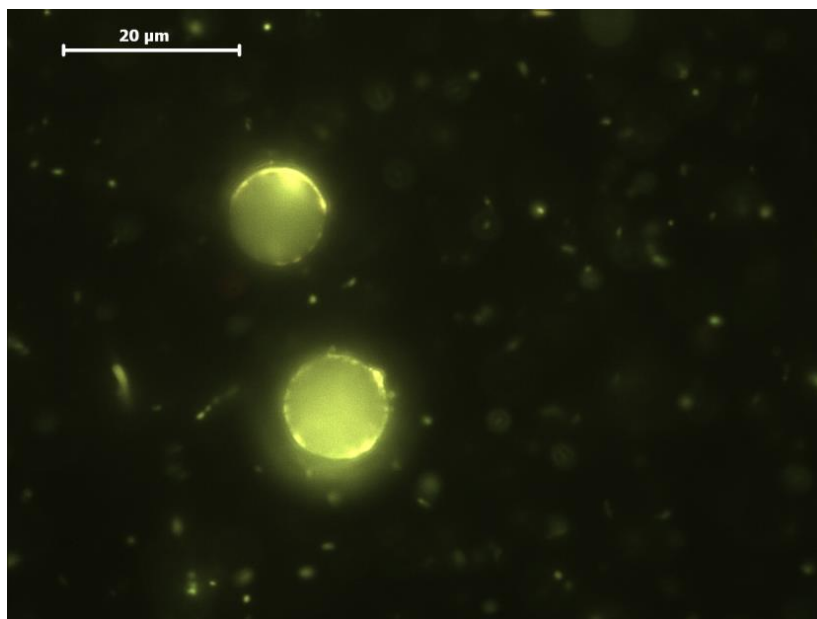


Figure 1. Xenic culture of *Blastocystis hominis* -vacuolar forms with large central vacuola and tight peripheral cytoplasm and bright light nuclei.

The most frequent *in vitro* division modality is the burgeoning, with the appearance of one or more daughter cells, oriented towards the exterior of the parasite (Figs. 2a-d), while *in vivo* studies, using the same staining, we noticed that the binary division was the main modality.

The formation of the daughter cells is realized by accumulation and differentiation of the cytoplasm at the periphery of nuclei, followed by the appearance of the membrane.

Another asexual reproduction modality was the endogony, with the formation of a division bag inside the parasite, where the daughter cells could be seen (Fig. 2f). Simultaneously, the binary division of the protozoan which already presented daughter cells was also emphasized (Fig. 2e).

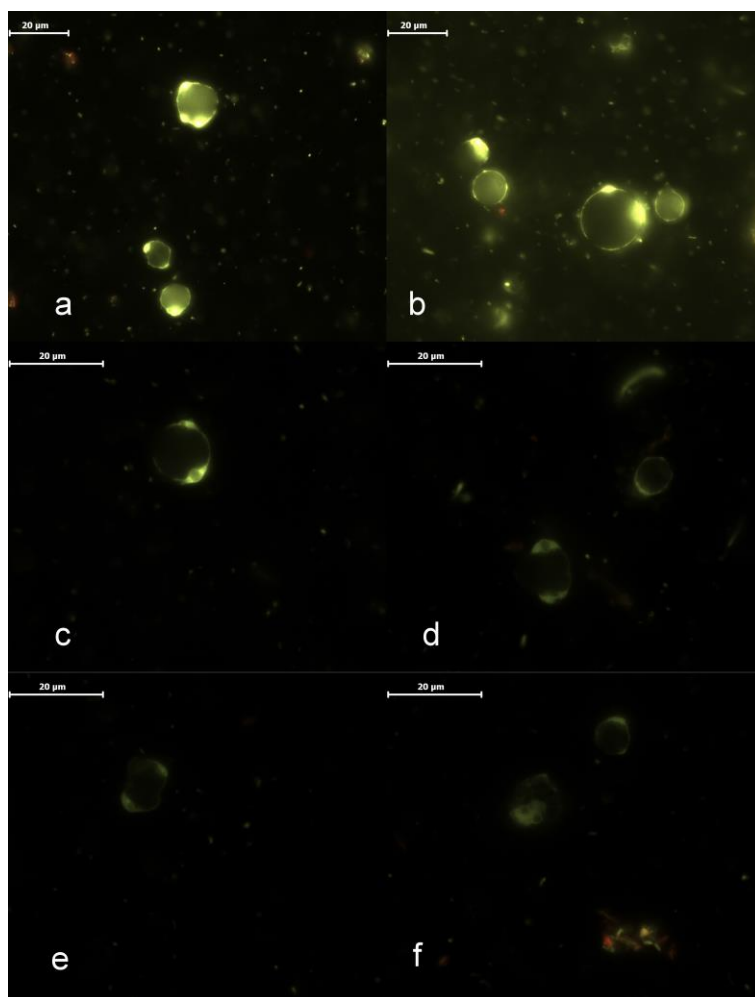


Figure 2. *In vitro* xenic culture-division modalities emphasized with AO staining: a. *Blastocystis hominis* with peripheral undifferentiated daughter cells; b. burgeoning forms and young vacuolar forms; c. burgeoning forms with differentiated daughter cells; d. *Blastocystis* with daughter cells and vacuolar degradation; e. binary division and burgeoning simultaneously developed; f. endogony with division bag.

In the feces we notice the binary division predominance with elongation stages and the segregation in two daughter cells (Fig. 3a, b).

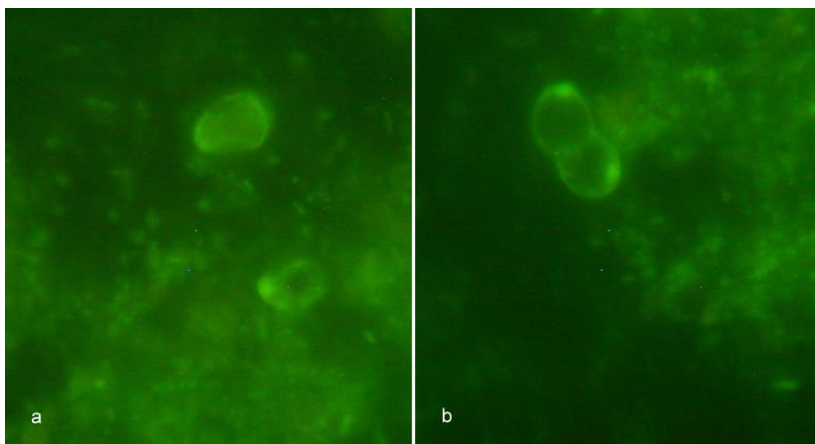


Figure 3. *Blastocystis hominis* in feces: elongation stage (a) and binary division (b).

The AO staining has the advantage that it emphasizes several development stages of the parasite, especially *in vivo*, allowing to differentiate the life forms, especially the cyst, whose reporting is difficult in common staining. In our study, this fluorochrome emphasizes the presence of daughter cells by burgeoning or endogony like dominant division modality *in vitro* and evidence of the predominance of binary division *in vivo*.

Conclusions

In vitro, in RPMI medium, only vacuolar forms was detected.

The main *in vitro* reproduction modality is the appearance of one or several daughter cells.

In vivo binary division was observed predominantly.

The life environment influences the division modality, *in vivo* - binary division, while *in vitro* – the budding with daughter cell is predominant.

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CLADOCERAN (CRUSTACEA, BRANCHIOPODA, CLADOCERA) BIODIVERSITY AND DYNAMICS IN TINERETULUI LAKE, BUCHAREST

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Abstract. The present paper presents the cladocerans biodiversity and dynamics for the Tineretului Lake of Bucharest, based on the research performed during 2007-2009. 15 taxa were identified, belonging to 11 genera, 6 families and two orders. In order to clarify the role of each species in the ecological complex, the authors proceeded to the synecological analysis of the cladocerans, comprising the species abundance, frequency, dominance and ecological significance index. The dynamics of these species is presented in charts scaling time and space data. Some considerations on the ecological significance of the cladocerans in the investigated water body are also presented.

Keywords: zooplankton, cladocerans, biodiversity, population dynamics, sinecology.

Rezumat. Biodiversitatea și dinamica cladocerelelor din Lacul Tineretului, București. În lucrarea de față ne propunem să prezentăm biodiversitatea și dinamica cladocerelelor din Lacul Tineretului, București pe baza cercetărilor efectuate în perioada 2007-2009. Au fost identificați 15 taxoni, încadrați în 11 genuri, 6 familii și două ordine. Pentru a elucida rolul fiecărei specii în acest complex ecologic am realizat o analiză sinecologică, în care am urmărit: abundența, constanța, dominanța și indicele de semnificație ecologică. Pe baza unor grafice și ciclograme prezentăm dinamica acestor specii în timp și spațiu. Facem unele considerații privind semnificația ecologică a cladocerelelor în acest bazin acvatic.

Cuvinte cheie: zooplancton, cladocere, biodiversitate, dinamica populațiilor, sinecologie.

Introduction

The Tineretului Lake in Bucharest (Fig. 1) is a poorly known urban lake, in spite of the rich biocenosis that inhabits it (Hurdugan-Irimia, 2013). Although an artificially modelled lake, it is fed by natural sources, meaning several subterranean springs in its narrow NW end as well as precipitations. It discharges through a pipeline into the collector stream of Dâmbovița at an estimated flow of 24 911.66 ft³/h (6.855 m³/s). The lake has a surface of approximately 13 ha and an average depth of 1.9 m, with measured depths ranging from 0.5 m to 3.1 m. From October 2007 to October 2009 monthly sampling campaigns took place, measuring the physical and chemical parameters and identifying the cladoceran fauna of the lake.

Material and Methods

The cladoceran fauna was sampled by qualitative methods, with the use of a planktonic net, Ø17 cm, 35 cm long, with a 0.65 mm mesh, in different fixed sampling stationaries as well as in transects of the superficial layer carried on the entire length of the lake (1070 m).

The fixed stationaries were chosen for different ecological qualities: macrophytic submerged vegetated substrata, barren muddy substrata, floating trunks used as resting space by waterfowl and turtles, populated by filamentous algae, barren concrete lake banks, also populated by filamentous algae.

In order to sample the vertical profiles and the muddy substrata, we used a weight-pulled planktonic net. Each sample is formed of 3 consecutive complete profiles of the same stationary, from the bottom up to the surface. For the floating trunks and the concrete banks we used a plastic scraper to scrape patches of approximately 10-15 cm² of the filamentous algae that were swapped on the planktonic net and bottled. The macrophytic vegetation was collected (2-3 entire plants, up to 2 m long) and washed in the planktonic net. We also collected floating debris, like feathers, dead leaves, empty plastic containers that were washed in the net separately. We also sampled the temporary water pools from the two main islands of the lake, 10-20 cm deep, situated on rich humic substrata. All the samples were fixed with formaldehyde 40% used to obtain a final concentration of 4% formaldehyde.

The identification of the species was made according to the identification keys of Negrea (1983) and Van Damme *et al.* (2010) for the *Alona* genus and the classification is according to Dumont & Negrea (2002).



Figure 1. Tineretului Lake of Bucharest: map of Google-Imagery©2011, DigitalGlobe©2011.

Results and Discussion

During the study of the aquatic ecosystem of Tineretului Lake of Bucharest 12792 individuals of the superorder *Cladocera* were collected. The samples were investigated in laboratory and 15 species were identified. The accuracy of the determinations was

confirmed by the prominent cladocerologist, dr. Ștefan Negrea, whose expertise is here acknowledged. The identified taxa are presented as follows:

Phylum Arthropoda

Subphylum Crustacea

Class Branchipoda

Superorder Cladocera

A. Order Ctenopoda

I. Fam. Sididae

1. *Sida crystalina* O.F. Müller

B. Order Anomopoda

II. Fam. Daphniidae

2. *Simocephalus exspinosus* (Koch)
3. *Simocephalus vetulus* (O.F. Müller)

III. Fam. Bosminidae

4. *Bosmina longirostris* O.F. Müller

IV. Fam. Illiocyptidae

5. *Ilyocyptus agilis* Kurz.

III. Fam. Macrothricidae

6. *Macrothrix laticornis* Fischer

IV. Fam. Chydoridae

Subfamily Aloninae

7. *Alona costata* Sars
8. *Alona quadrangularis* O.F. Müller
9. *Alona affinis* Leydig
10. *Coronatella rectangula* Sars
11. *Camptocercus rectirostris* Schoedler
12. *Leydigia acanthocercoides* (Fischer)

Subfamily Chydorinae

13. *Chydorus sphaericus* O.F. Müller
14. *Chydorus sphaericus caelatus* Schoedler
15. *Pleuroxus aduncus* Jurine

The cladocerans species richness, of course, varies greatly from one period to another and from one stationary to the other. Table 1 presents the occurrence and the richness of the cladoceran species in the Tineretului Lake of Bucharest during 2007-2009.

Based on the overall data, Figure 2 pictures the ratio between the identified cladoceran species. The species occurrence being extremely varied, from 6524 individuals in *Bosmina longirostris* to one individual for *Camptocercus rectirostris* and *Macrothrix laticornis* species, we proceeded to the synecological analysis of the species clarifying the abundance, the frequency, the dominance and the ecological significance index. Table 2 presents the identified species in the order of the abundance index. As one can notice, two species come in great numbers on individuals (*Bosmina longirostris* – 6524 and *Chydorus sphaericus* - 5664), followed, at great distance by *Alona affinis* with 292 individuals and *Pleuroxus aduncus* with 166 individuals; five species come in dozens of individuals, the other species registering only two individuals or less.

Table 1. Presence and diversity of cladocerans species from Tineretului Lake Bucharest, between 2007-2009.

	DATE	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL	%	
			<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectirostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronella rectangularis</i>	<i>Ilyocryptus agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystallina crystallina</i>	<i>Simoccephalus exspinosus</i>	<i>Simoccephalus vetulus</i>			
1	28.10 2007	Sălci între insule	3	-	2	1	-	2	20	-	2	-	-	4	-	-	-	34	0.26	
		%	8.82	-	5.88	2.94	-	5.88	58.82	-	5.88	-	-	11.76	-	-	-			
2	07.03 2008	Oala mică	1	-	-	5	-	-	13	-	1	-	-	-	-	-	-	20	0.15	
3		Bușteni 1	-	-	-	-	-	-	20	-	-	-	-	1	-	1	-	22	0.17	
4		Pescărie	-	-	-	-	-	-	4	-	-	-	-	1	-	-	-	5	0.03	
5		Bușteni 2	1	-	-	-	-	-	153	-	-	-	-	1	-	-	-	155	1.21	
6		Golf	4	-	2	-	-	-	38	-	1	-	-	-	-	-	6	14	65	0.50
7		Vana TA	1	-	-	2	-	-	11	-	-	-	-	-	-	-	-	-	14	0.10
8		Transect oala mică-pod	-	1	-	1	-	-	90	5	-	-	-	-	-	-	1	-	98	0.76
9	Transect pod. vana TA	-	-	2	11	-	-	57	-	1	-	1	-	-	-	-	-	72	0.56	
TOTAL 7.03.2008			7	1	4	19	-	-	386	5	3	-	1	3	-	8	14	451	3.52	
			1.55	0.22	0.88	4.21	-	-	85.58	1.10	0.66	-	0.22	0.66	-	1.77	3.10	%		
10	20.04 2008	Oala mică	1	-	-	-	-	-	496	-	-	-	-	1	-	3	1	502	3.92	
11		Bușteni 1	-	-	-	-	-	-	15	-	-	-	-	-	-	1	-	16	0.12	
12		Pescărie	-	-	-	-	-	-	15	-	-	-	-	2	-	-	-	17	0.13	
13		Insula mare	-	-	-	-	-	-	113	-	-	-	-	-	-	2	4	-	119	0.93
14		Golf	-	-	1	-	-	-	112	-	-	-	-	-	-	-	6	-	119	0.93
15		Vana TA	1	-	1	-	-	-	1477	-	-	-	-	-	-	-	1	1	1481	11.57
16		Transect oala mică - pod	1	-	1	2	-	-	47	-	-	-	-	-	-	-	1	-	52	0.40
17	Transect pod. vana TA	-	-	-	-	-	-	100	-	-	-	-	-	10	-	-	-	110	0.86	
TOTAL 20.04.2008			3	-	3	2	-	-	2375	-	-	-	-	13	2	16	2	2416	18.88	
			0.12	-	0.12	0.08	-	-	98.30	-	-	-	-	0.53	0.08	0.66	0.08	%		
18	28.04 2008	Oala mică	1	-	-	-	-	-	2	-	-	-	-	1	-	-	-	4	0.03	
19		Oala mică - pod	1	-	-	-	-	-	105	-	-	-	-	1	-	-	-	107	0.83	
TOTAL 28.04.2008			2	-	-	-	-	-	107	-	-	-	-	2	-	-	-	111	0.86	
			1.80	-	-	-	-	-	96.39	-	-	-	-	1.80	-	-	-	%		
20	31.05 2008	Oala mică	-	-	-	-	-	-	75	-	-	-	-	3	-	-	15	93	0.72	
21		Insula mare	-	-	-	-	-	-	67	-	-	-	-	3	3	-	-	73	0.57	
22		Bușteni 2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.01	
23		Transect oala mică - pod	-	-	-	4	-	-	3	-	-	-	-	-	-	-	-	-	7	0.05
24		Transect pod. vana TA	-	-	-	112	-	-	4	-	-	-	-	-	-	-	-	-	116	0.90
TOTAL 31.05.2008			-	-	-	116	-	-	150	-	-	-	-	6	3	-	15	290	2.26	
			-	-	-	40.00	-	-	51.72	-	-	-	-	2.06	1.03	-	5.17	%		
25	12.07 2008	Oala mică	-	-	-	102	-	-	2	-	-	2	-	-	-	-	-	106	0.82	
26		Bușteni 1	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	4	0.03	
27		Vana TA	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	0.01	
28		Transect oala mică - pod	2	-	2	-	-	-	136	-	-	-	-	-	-	-	-	-	140	1.09
29		Transect pod. vana TA	1	-	-	3	-	-	17	-	-	-	-	-	-	-	-	-	21	0.16
TOTAL 12.07.2008			3	-	2	105	-	-	161	-	-	2	-	-	-	-	-	273	2.13	
			1.09	-	0.73	38.46	-	-	58.97	-	-	0.73	-	-	-	-	-	%		

Table 1. (Continued)

	DATE	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL	%	
			<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectrostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronella rectangularis</i>	<i>Ilyocypris agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystalina crystalina</i>	<i>Simoecephalus exspinosus</i>	<i>Simoecephalus vetulus</i>			
30	22.08 2008	Oala mică	-	-	3	5	-	-	2	-	-	-	-	-	-	-	-	10	0.07	
31		Bușteni 1	1	-	2	-	-	-	118	-	-	-	-	92	-	-	-	213	1.66	
32		Pescărie	6	-	-	-	-	-	9	-	-	-	-	2	-	-	-	17	0.13	
33		Insula mare	-	-	-	-	-	-	129	-	-	-	-	-	-	-	-	-	129	1.00
34		Bușteni 2	-	-	-	-	-	-	7	-	-	-	-	3	-	-	-	-	10	0.07
35		Vana T A	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	2	0.01
36		Transect oala mică - pod	-	-	-	6	-	-	2	2	-	-	-	-	-	-	-	-	10	0.07
37	Transect pod. vana TA	-	-	-	4	-	-	2	2	-	-	-	-	-	-	-	-	8	0.06	
TOTAL 22.08.2008			7	-	5	15	-	-	270	4	1	-	-	97	-	-	-	399	3.11	
			1.75	-	1.25	3.75	-	-	67.66	1.00	0.25	-	-	4.31	-	-	-	%		
38	04.10 2008	Oala mică	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-	3	0.02	
39		Pescărie	-	-	-	-	1	-	12	2	-	-	-	1	-	-	-	16	0.12	
40		Insula mare	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	5	0.03	
41		Bușteni 2	1	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	8	0.06
42		Vana TA	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3	0.02
43		Baltă temporară	-	-	-	-	-	-	4	-	-	-	-	2	-	-	2	8	0.06	
44		Sălcii între insule	-	-	-	-	-	-	425	-	-	-	-	-	-	-	-	-	425	3.32
45	Transect oala mică - pod	1	-	-	-	-	-	5	-	-	-	-	-	-	1	-	1	8	0.06	
46	Transect pod. vana TA	1	-	-	1	-	-	3	-	-	-	-	-	-	-	-	-	5	0.03	
TOTAL 4.10.2008			4	-	-	4	1	-	462	2	-	-	-	4	1	-	3	481	3.76	
			0.83	-	-	0.83	0.20	-	96.05	0.41	-	-	-	0.83	0.20	-	0.62	%		
47	06.12 2008	Vana TA	5	1	-	-	-	-	2	-	-	-	-	1	-	-	-	9	0.07	
48		Baltă temporară	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.01	
49		Sălcii între insule	9	-	-	89	-	-	102	-	-	-	-	-	-	4	-	204	1.59	
TOTAL 6.12.2008			14	1	-	90	-	-	104	-	-	-	-	1	-	4	-	214	1.67	
			6.54	0.46	-	42.05	-	-	48.59	-	-	-	-	0.46	-	1.86	-	%		
50	24.01 2009	Oala mică	6	-	-	6	-	-	258	-	-	-	-	6	-	5	-	281	2.19	
51		Insula mare	5	-	-	-	-	-	26	1	-	-	-	12	-	1	-	45	0.35	
52		Vana TA	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.01	
53		Pod beton	-	-	2	-	-	-	12	-	-	-	-	5	-	1	-	20	0.15	
TOTAL 24.01.2009			11	-	2	6	-	-	297	1	-	-	-	23	-	7	-	347	2.71	
			3.17	-	0.57	1.72	-	-	85.59	0.28	-	-	-	6.62	-	2.01	-	%		
54	12.02 2009	Oala mică	-	-	-	-	-	-	11	-	-	-	-	1	-	-	-	12	0.09	
55		Vana TA	1	-	-	-	-	-	5	-	-	-	-	-	-	-	-	6	0.04	
56		Pod beton	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.01	
TOTAL 12.03.2009			1	-	-	-	-	-	17	-	-	-	-	1	-	-	-	19	0.14	
			5.26	-	-	-	-	-	89.47	-	-	-	-	5.26	-	-	-	%		
57	08.04 2009	Oala mică	-	-	-	241	-	-	5	-	-	-	-	-	-	-	-	246	1.92	
58		Bușteni	-	-	-	3	-	-	-	-	-	-	-	-	-	1	-	4	0.03	
59		Vana TA	-	-	-	-	-	-	51	-	-	-	-	-	-	-	-	51	0.39	
60		Transect oala mică - pod	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	3	0.02	
61	Transect pod. vana TA	-	-	-	-	-	-	855	-	-	-	-	-	-	-	-	-	855	6.68	
TOTAL 08.04.2009			-	-	-	247	-	-	911	-	-	-	-	-	-	1	-	1159	9.06	
			-	-	-	21.31	-	-	78.60	-	-	-	-	-	-	0.08	-	%		

Table 1. (Continued)

	DATE	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL	%	
			<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectirostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronatella rectangula</i>	<i>Ilyocryptus agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystalina crystalina</i>	<i>Simocephalus exspinosus</i>	<i>Simocephalus vetulus</i>			
62	14.05 2009	Oala mică	1	-	-	2	-	-	1	-	-	-	-	-	-	3	-	7	0.05	
63		Pescărie	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-	6	0.04	
64		Insula mare	15	-	-	-	-	-	19	-	-	-	-	4	-	-	-	38	0.29	
65		Vana TA	2	-	-	-	-	-	34	-	-	-	-	2	-	7	-	45	0.35	
66		Balta temporară	2	-	-	-	-	-	5	-	-	-	-	-	1	-	-	8	0.06	
67		Sălcii între insule	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	4	0.03
TOTAL 14.05.2009			24	-	-	4	-	-	62	-	-	-	-	6	2	10	-	108	0.84	
			22.22	-	-	3.70	-	-	57.40	-	-	-	-	5.55	1.85	9.25	-	%		
68	29.05 2009	Oala mică	-	-	-	-	-	-	17	-	-	-	-	2	-	1	-	20	0.15	
69		Vana TA	4	1	-	-	-	-	24	-	-	-	-	-	-	-	-	29	0.22	
70		Balta temporară	-	2	-	-	-	-	3	-	-	-	-	-	-	-	-	5	0.03	
TOTAL 29.05.2009			4	3	-	-	-	-	44	-	-	-	-	2	-	1	-	54	0.42	
			7.40	5.55	-	-	-	-	81.48	-	-	-	-	3.70	-	1.85	-	%		
71	28.07 2009	Oala mică	-	-	-	3954	-	-	-	-	-	-	-	-	-	1	-	3955	30.91	
72		Bușteni	-	2	-	-	-	-	15	-	-	-	-	4	-	-	-	21	0.16	
73		Vana TA	5	-	-	1938	-	-	-	-	-	-	-	-	1	-	-	1944	15.19	
74		Pod beton	204	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	208	1.62
75		Transect oala mică - pod	-	-	--	23	-	-	265	-	-	-	-	-	-	2	-	-	290	2.26
76		Transect pod. vana TA	-	-	--	-	-	-	18	-	-	-	-	-	-	-	-	-	18	0.14
TOTAL 28.07.2009			209	2	-	5915	-	-	-	-	-	-	-	-	-	1	-	6436	-	
			3.24	0.03	-	91.90	-	-	4.63	-	-	-	-	0.06	0.10	0.01	-	%		
TOTAL GENERAL			292	7	18	6524	1	2	5664	12	6	2	1	166	15	48	34	12792	100	
			2.28	0.05	0.14	51.00	0.01	0.01	44.27	0.09	0.04	0.01	0.01	1.29	0.11	0.37	0.26	100	%	

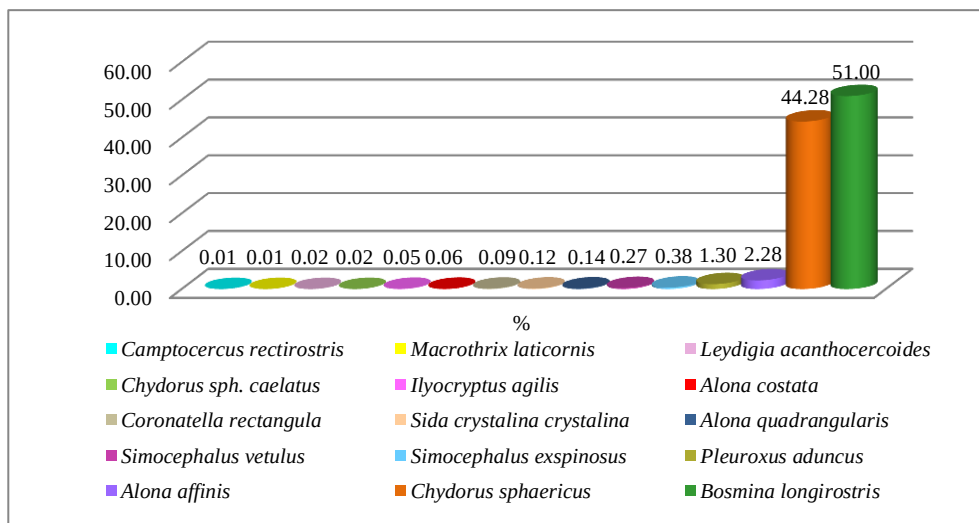


Figure 2. The ratio of cladocerans species from Tineretului Lake Bucharest, between 2007-2009.

Table 2. Sinecologic analysis of cladocerans species from Tineretului Lake Bucharest, between 2007-2009.

Nr.	Specie	Abundance	Constance		Dominance		Ecological significance index	
1	<i>Bosmina longirostris</i>	6524	45	C ₂	51.00	D ₅	22.95	W ₅
2	<i>Chydorus sphaericus</i>	5664	91	C ₄	44.27	D ₅	40.28	W ₅
3	<i>Alona affinis</i>	292	43	C ₃	2.28	D ₃	0.98	W ₂
4	<i>Pleuroxus aduncus</i>	166	33	C ₂	1.29	D ₂	0.42	W ₂
5	<i>Simocephalus exspinosus</i>	48	24	C ₁	0.37	D ₁	0.08	W ₁
6	<i>Simocephalus vetulus</i>	34	8	C ₁	0.26	D ₁	0.02	W ₁
7	<i>Alona quadrangularis</i>	18	13	C ₁	0.14	D ₁	0.01	W ₁
8	<i>Sida crystalina crystalina</i>	15	10	C ₁	0.11	D ₁	0.01	W ₁
9	<i>Coronatella rectangula</i>	12	6	C ₁	0.09	D ₁	0.005	W ₁
10	<i>Alona costata</i>	7	5	C ₁	0.05	D ₁	0.002	W ₁
11	<i>Ilyocryptus agilis</i>	6	6	C ₁	0.04	D ₁	0.002	W ₁
12	<i>Chydorus sph. caelatus</i>	2	1	C ₁	0.01	D ₁	0.0001	W ₁
13	<i>Leydigia acanthocercoides</i>	2	1	C ₁	0.01	D ₁	0.0001	W ₁
14	<i>Campocercus rectirostris</i>	1	1	C ₁	0.007	D ₁	0.0001	W ₁
15	<i>Macrothrix laticornis</i>	1	1	C ₁	0.007	D ₁	0.0001	W ₁

Figure 3 presents the frequency, the dominance and the ecological significance index. Regarding the frequency (Fig. 3a) only one species, *Chydorus sphaericus*, is truly constant; another species, *Alona affinis*, is constant; the *Bosmina longirostris* and *Pleuroxus aduncus* species are accessory, all the other species acting as accidental.

Regarding the dominance (Fig. 3b), *Bosmina longirostris* and *Chydorus sphaericus* are eudominant species; *Alona affinis* is subdominant, and *Pleuroxus aduncus* is recedent; all the other species are subrecedent.

The ecological significance index is maximum (W₅) for *Bosmina longirostris* and *Chydorus sphaericus*, these species being characteristic for the biocenotic complex; *Alona affinis* and *Pleuroxus aduncus* have W₂ ecological significance rating, acting as accidental species (Fig. 3c).

It is easy to understand that the cladoceran species richness varies in quite large limits from one period of time to another and from one stationary to the other. In order to illustrate this fact, Figure 4 presents the species ratio registered in Tineretului Lake for the samples taken in 28th of October 2007. *Chydorus sphaericus* has a percentage of 58.82%, followed by *Bosmina longirostris* with 11.77% and *Alona affinis* with 8.82% followed by 3 species with the same percentage. The situation appears to be similar although 10 species are identified in the samples of 07th of March 2008 (Fig. 5). *Chydorus sphaericus* is largely the most abundant for this date too, making for 85.59%. In 20th of April 2008, *Chydorus sphaericus* makes for 98.30% (Fig. 6).

A spectacular change in the ratio is registered for the main species for the 28th of July 2009 when *Bosmina longirostris* registers 91.91% of the present individuals, while *Chydorus sphaericus* only reaches 4.63% (Fig. 7).

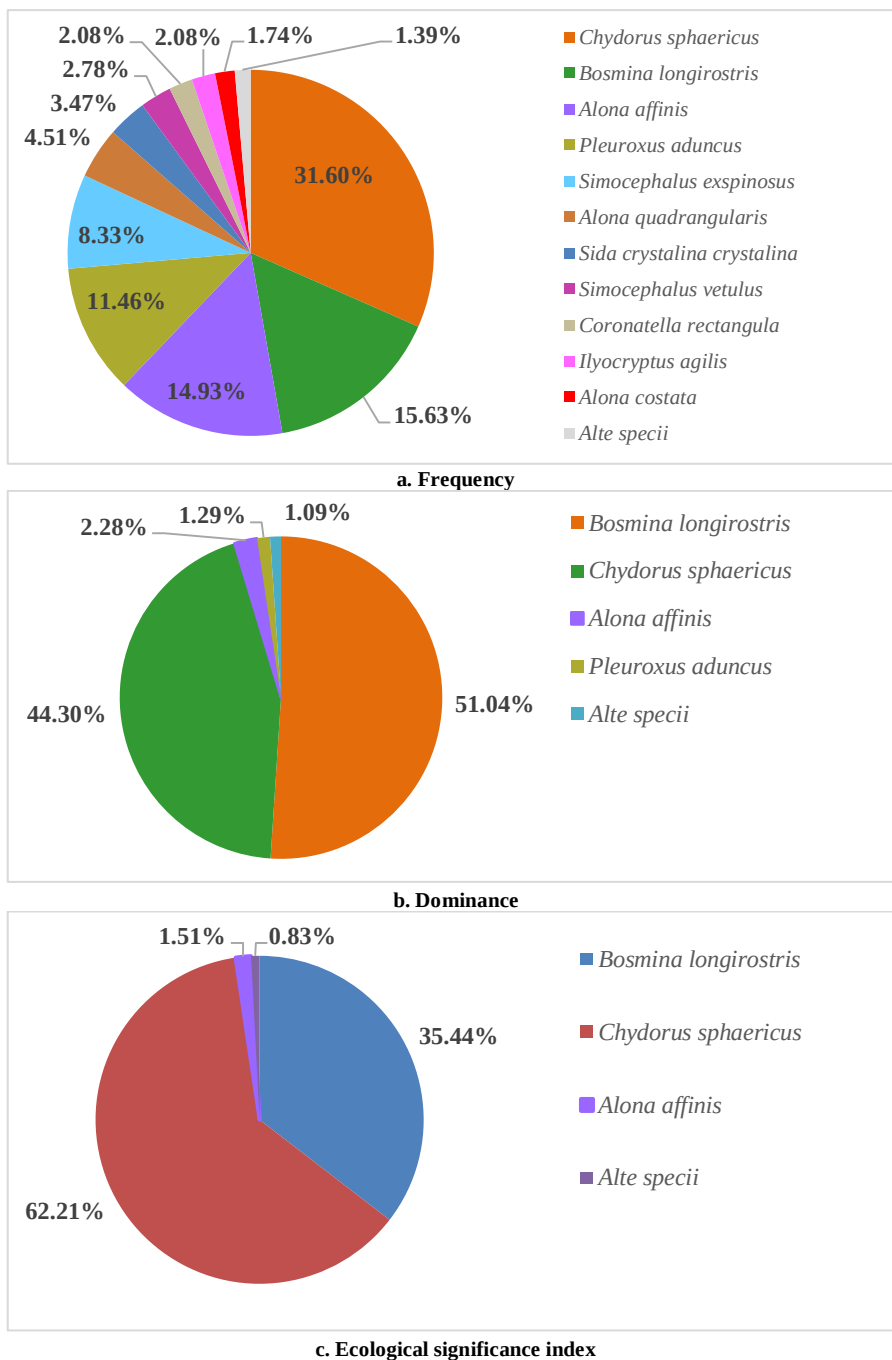


Figure 3. Synecologic analysis of cladocerans species from Tineretului Lake Bucharest, between 2007-2009.

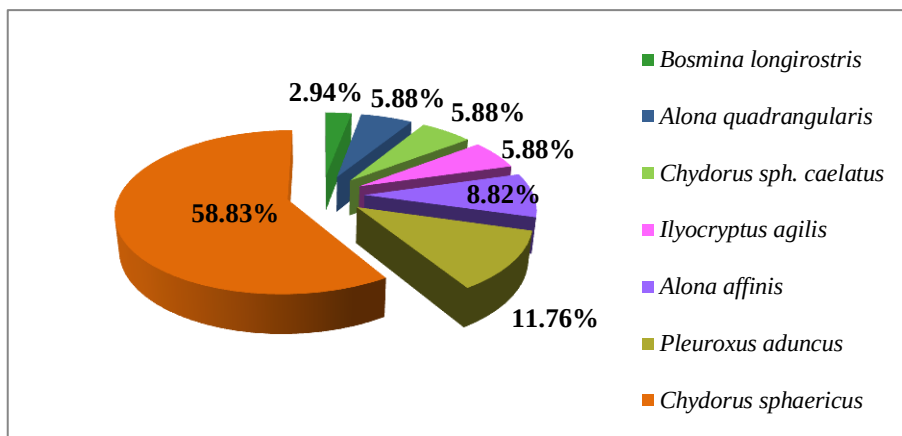


Figure 4. Distribution of cladocerans species from Tineretului Lake Bucharest on 28.10.2007.

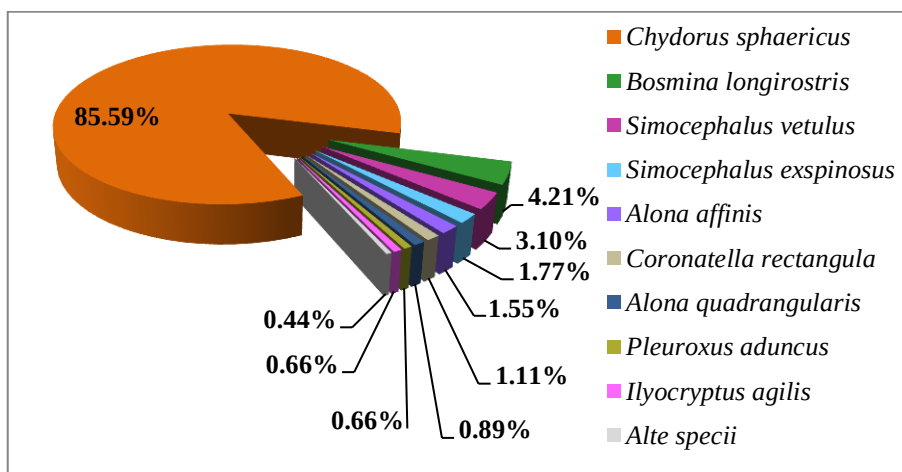


Figure 5. Distribution of cladocerans species from Tineretului Lake Bucharest on 07.03.2008.

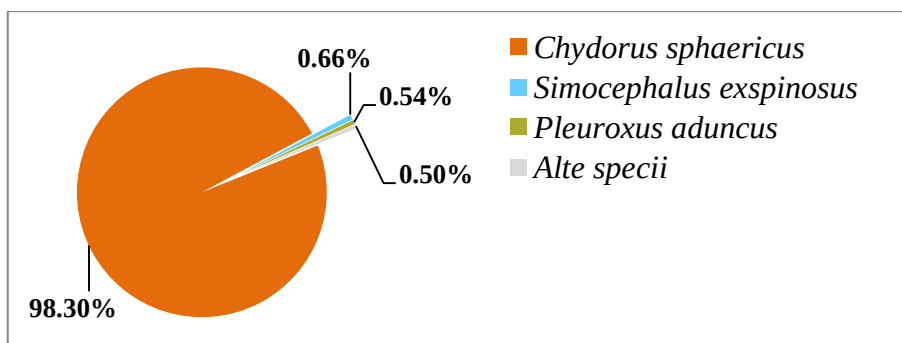


Figure 6. Distribution of cladocerans species from Tineretului Lake Bucharest on 20.04.2008.

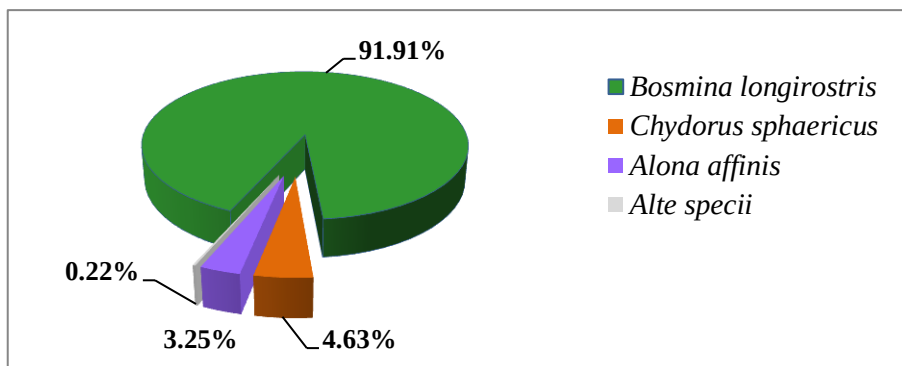


Figure 7. Distribution of cladocerans species from Tineretului Lake Bucharest on de 28.07.2009.

In order to have a clearer picture of the evolution of the main species abundance, Table 3 presents the percentages registered by *Chydorus sphaericus*, *Bosmina longirostris* and *Alona affinis* during the sampling campaigns. As Figure 8 pictures, *Chydorus sphaericus* has very high values, the reached percentages varying in very large limits. A point of interest is the strong decline of the above mentioned species on the 28th of July 2009. This decline is easily explained through the surprising rise of the *Bosmina longirostris* species. This chart clearly presents the competition between the two species; the declines of the *Chydorus sphaericus* are perfectly correlated with the ascensions of *Bosmina longirostris*. *Alona affinis* although in small numbers, is present in almost the entire studied period.

Table 3. Percentage realised by *Chydorus sphaericus*, *Bosmina longirostris* and *Alona affinis* species between 2007-2009.

Sampling date	Name of Species		
	<i>Chydorus sphaericus</i>	<i>Bosmina longirostris</i>	<i>Alona affinis</i>
28.10.2007	58.82	2.94	8.82
07.03.2008	85.58	4.21	1.55
20.04.2008	98.30	0.08	0.12
28.04.2008	96.39	0.00	1.80
31.05.2008	51.72	40.00	0.00
12.07.2208	58.94	38.46	1.09
22.08.2008	67.66	3.75	1.75
04.10.2008	96.05	0.83	0.83
06.12.2008	48.59	42.05	6.54
24.01.2009	85.59	1.72	3.17
12.02.2009	89.47	0.00	5.26
08.04.2009	78.60	21.31	0.00
14.05.2009	57.40	3.70	22.22
29.05.2009	81.48	0.00	7.40
28.07.2009	4.63	91.90	3.24

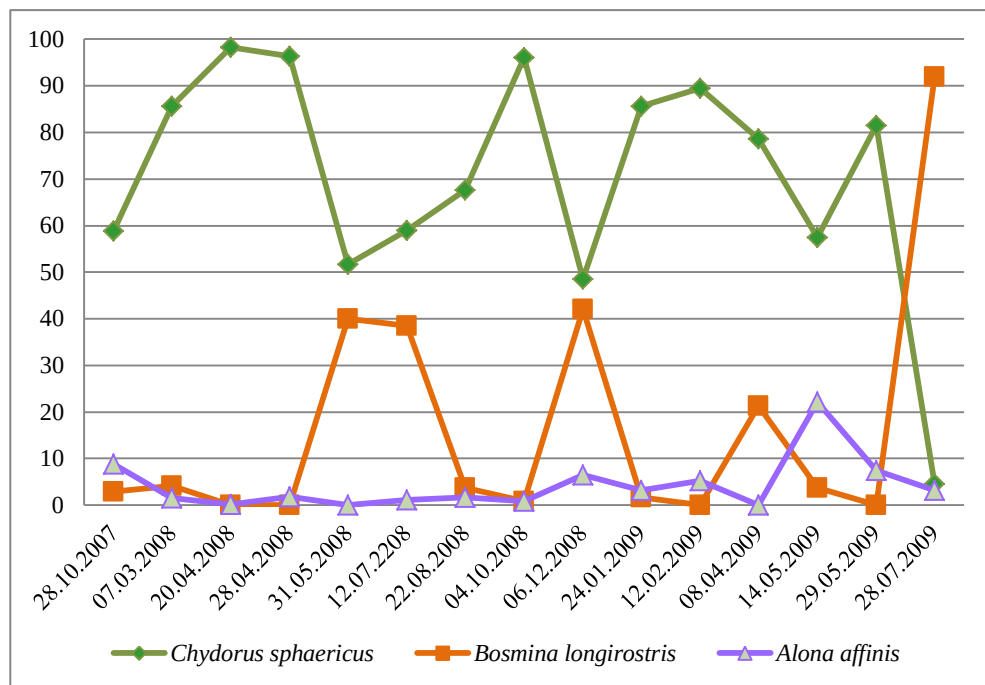


Figure 8. Dynamic of *Chydorus sphaericus*, *Bosmina longirostris* and *Alona affinis* species from one period to another.

It is easy to understand that, within each stationary there is a numeric dynamics present from one period to another. Table 4 presents the data obtained from the samples of the Oala Mică stationary during 2008-2009. The species ratio is illustrated in Figure 9. The dominant species is *Bosmina longirostris* with 82.11% of the identified individuals, followed by *Chydorus sphaericus* with 16.80% of the identified individuals. The values for the other species are insignificant.

For the stationary of Vana T.A. *Chydorus sphaericus* and *Bosmina longirostris* rich high and somewhat close percentages (Table 5 and Fig. 10).

The data recorded for the Insula Mare stationary (Table 6 and Fig. 11) is evidentiating the dominance of the *Chydorus sphaericus* species, followed at large distance by *Alona affinis* and *Pleuroxus aduncus*, the other species registering very low values.

Table 7 presents the ratio between the cladoceran species for each stationary for the entire studied period. Following the species dynamics in Figure 12 the presence of the accessory and characteristic species in almost every stationary varies within large limits. The dynamics and the competition between *Chydorus sphaericus* and *Bosmina longirostris*, manifesting as characteristic species for the biocoenotic complex can be easily traced. The accidental species cannot be represented by the hereby illustration; that does not mean that they do not have their role within the ecological complex. Their presence signifies that the entire biocoenotic complex works as a whole and owns potential resources insuring its functionality through a permanent dynamics of the component species. That means that the ecological system is open to accepting new species and enriching its biodiversity.

Table 4. Dynamic of cladocerans species in Oala mică station from Tineretului Lake, between 2008-2009.

Nr. crt.	Date	<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectirostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronataella rectangula</i>	<i>Ilyocryptus agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystalina crystalina</i>	<i>Simocephalus exspinosus</i>	<i>Simocephalus vetulus</i>	Total
	Oala mică	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	07.03.2008	1	-	-	5	-	-	13	-	1	-	-	-	-	-	-	20
2	20.04.2008	1	-	-	-	-	-	496	-	-	-	-	1	-	3	1	502
3	28.04.2008	1	-	-	-	-	-	2	-	-	-	-	1	-	-	-	4
4	31.05.2008	-	-	-	-	-	-	75	-	-	-	-	3	-	-	15	93
5	12.07.2008	-	-	-	102	-	-	2	-	-	2	-	-	-	-	-	106
6	22.08.2008	-	-	3	5	-	-	2	-	-	-	-	-	-	-	-	10
7	04.10.2008	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-	3
8	24.01.2009	6	-	-	6	-	-	258	-	-	-	-	6	-	5	-	281
9	12.03.2009	-	-	-	-	-	-	11	-	-	-	-	1	-	-	-	12
10	08.04.2009	-	-	-	241	-	-	5	-	-	-	-	-	-	-	-	246
11	05.2009	-	-	-	2	-	-	1	-	-	-	-	-	-	3	-	6
12	29.05.2009	-	-	-	-	-	-	17	-	-	-	-	2	-	1	-	20
13	28.07.2009	-	-	-	3954	-	-	-	-	-	-	-	-	-	1	-	3955
Total		9	-	3	4316	-	-	883	-	1	2	-	15	-	13	16	5258
%		0.17	-	0.05	82.11	-	-	16.80	-	0.01	0.03	-	0.29	-	0.24	0.30	100

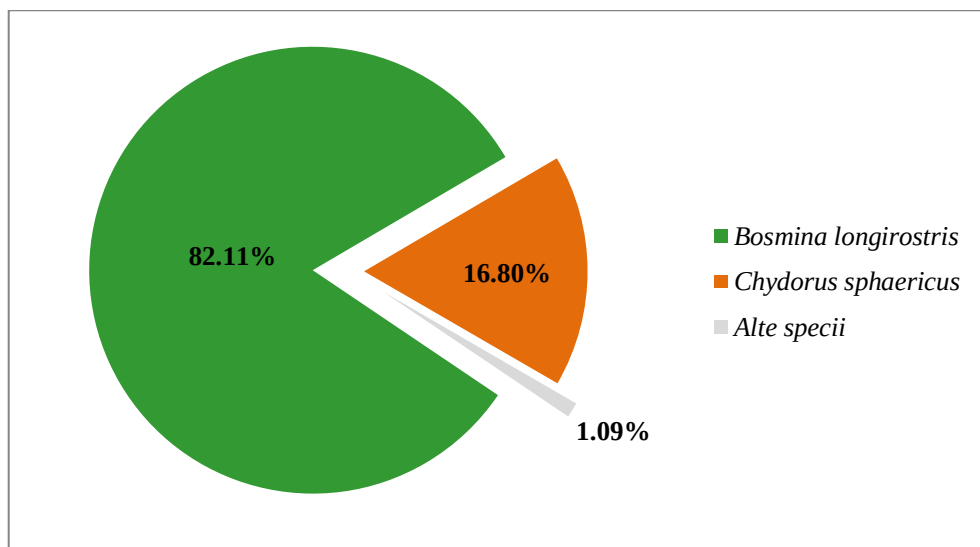
**Figure 9.** Dynamic of cladocerans species in Oala mică station from Tineretului Lake, between 2008-2009.

Table 5. Dynamic of cladocerans species in Vana TA station from Tineretului Lake, between 2008-2009.

Nr. crt.	Date	<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectirostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronatiella rectangularis</i>	<i>Ilyocryptus agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystalina crystalina</i>	<i>Simocephalus exspinosus</i>	<i>Simocephalus vetulus</i>	Total
	Vana TA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	07.03.2008	1	-	-	2	-	-	11	-	-	-	-	-	-	-	-	14
2	20.04.2008	1	-	1	-	-	-	1477	-	-	-	-	-	-	1	1	1481
3	12.07.2008	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2
4	22.08.2008	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	2
5	04.10.2008	1	-	-	-	-	-	7	-	-	-	-	-	-	-	-	8
6	06.12.2008	5	1	-	-	-	-	2	-	-	-	-	1	-	-	-	9
7	24.01.2009	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
8	12.03.2009	1	-	-	-	-	-	5	-	-	-	-	-	-	-	-	6
9	08.04.2009	-	-	-	-	-	-	51	-	-	-	-	-	-	-	-	51
10	14.05.2009	2	-	-	-	-	-	34	-	-	-	-	2	-	7	-	45
11	29.05.2009	4	1	-	-	-	-	24	-	-	-	-	-	-	-	-	29
12	28.07.2009	5	-	-	1938	-	-	-	-	-	-	-	-	1	-	-	1944
Total		20	2	1	1940	-	-	1615	-	1	-	-	3	1	8	1	3592
%		0.55	0.05	0.02	54.01	-	-	45.01	-	0.02	-	-	0.08	0.02	0.22	0.02	

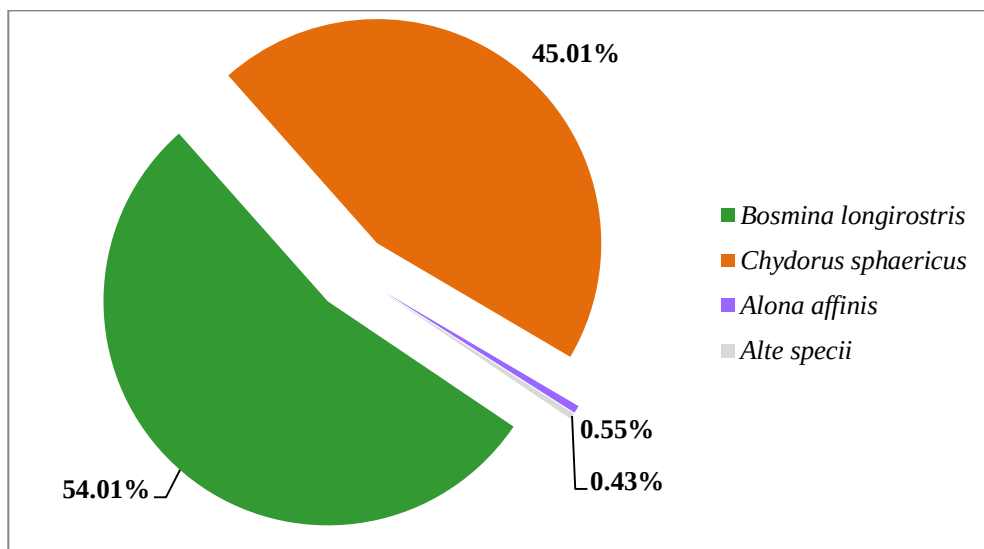


Figure 10. Dynamic of cladocerans species in Vana TA station from Tineretului Lake, between 2008-2009.

Table 6. Dynamic of cladocerans species in Insula mare station from Tineretului Lake, between 2008-2009.

Nr. crt.	Date	<i>Alona affinis</i>	<i>Alona costata</i>	<i>Alona quadrangularis</i>	<i>Bosmina longirostris</i>	<i>Camptocercus rectirostris</i>	<i>Chydorus sph. caelatus</i>	<i>Chydorus sphaericus</i>	<i>Coronatella rectangularis</i>	<i>Ilyocryptus agilis</i>	<i>Leydigia acanthocercoides</i>	<i>Macrothrix laticornis</i>	<i>Pleuroxus aduncus</i>	<i>Sida crystalina crystalina</i>	<i>Simocephalus exspinosus</i>	<i>Simocephalus vetulus</i>	Total
		Insula mare	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	20.04.2008	-	-	-	-	-	-	113	-	-	-	-	-	2	4	-	119
2	31.05.2008	-	-	-	-	-	-	67	-	-	-	-	3	3	-	-	73
3	22.08.2008	-	-	-	-	-	-	129	-	-	-	-	-	-	-	-	129
4	04.10.2008	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	5
5	24.01.2009	5	-	-	-	-	-	26	1	-	-	-	12	-	1	-	45
6	14.05.2009	15	-	-	-	-	-	19	-	-	-	-	4	-	-	-	38
	Total	20	-	-	2	-	-	357	1	-	-	-	19	5	5	-	409
	%	4.88	-	-	0.48	-	-	87.28	0.24	-	-	-	4.68	1.22	1.22	-	100

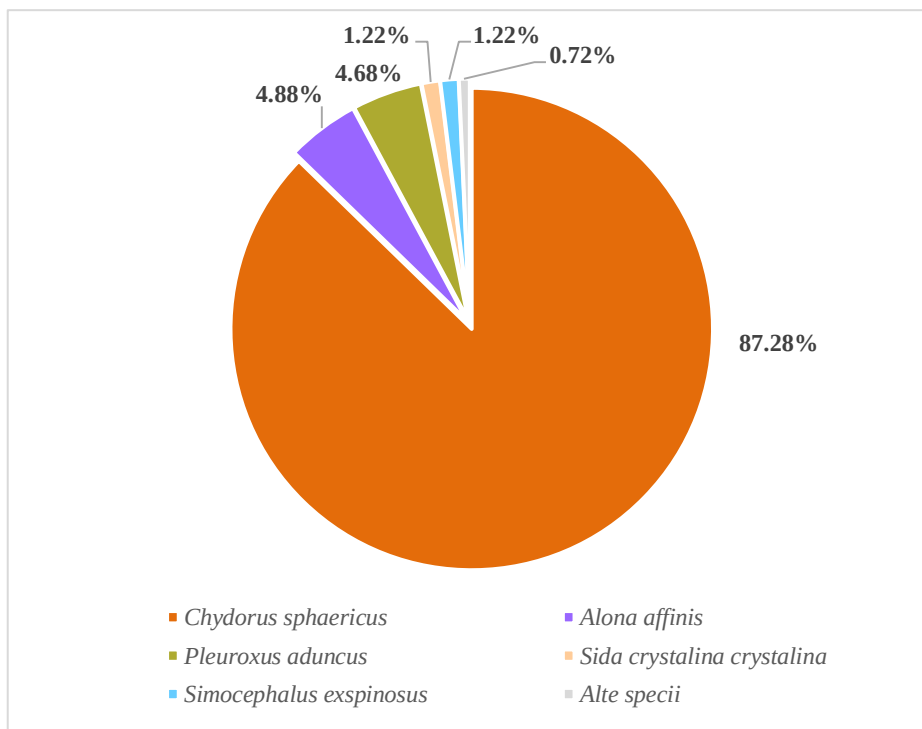
**Figure 11.** Dynamic of cladocerans species in Insula mare station from Tineretului Lake, between 2008-2009.

Table 7. The ratio of cladocerans species from Tineretului Lake, between 2008-2009.

Species	Station	Oala mică	Bușteni 1	Bușteni 1	Pescărie	Golf	Vana TA	Insula Mare	Baltă temporară	Sălcii între insule	Pod beton
<i>Alona affinis</i>	Nr.	9	-	1	8	4	20	20	-	3	204
	%	0.17	-	0.58	13.55	2.2	0.05	4.9	-	0.65	89.47
<i>Alona costata</i>	Nr.	-	2	-	-	-	2	-	-	-	-
	%	-	0.81	-	-	-	0.03	-	-	-	-
<i>Alona quadrangularis</i>	Nr.	-	-	-	-	2	1	-	-	2	2
	%	-	-	-	-	1.1	0.02	-	-	0.43	9.09
<i>Bosmina longirostris</i>	Nr.	4316	2	2	-	-	1940	2	-	1	-
	%	82.88	0.81	1.17	-	-	74.84	0.49	-	0.21	-
<i>Camptocercus rectirostris</i>	Nr.	3	-	-	1	-	-	-	-	-	-
	%	0.05	-	-	1.69	-	-	-	-	-	-
<i>Chydorus sph. caelatus</i>	Nr.	-	-	-	-	-	-	-	-	2	-
	%	-	-	-	-	-	-	-	-	0.43	-
<i>Chydorus sphaericus</i>	Nr.	833	147	163	43	150	1615	357	7	440	13
	%	15.99	60	95.88	72.88	82.87	29.95	87.5	70	96.06	5.7
<i>Coronatella rectangula</i>	Nr.	-	-	-	-	-	-	1	-	-	-
	%	-	-	-	-	-	-	0.24	-	-	-
<i>Ilyocryptus agilis</i>	Nr.	1	-	-	-	1	1	-	-	2	-
	%	0.01	-	-	-	0.55	0.02	-	-	0.43	-
<i>Leydigia acanthocercoides</i>	Nr.	2	-	-	-	-	-	-	-	-	-
	%	0.02	-	-	-	-	-	-	-	-	-
<i>Macrothrix laticornis</i>	Nr.	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-
<i>Pleuroxus aduncus</i>	Nr.	15	92	4	6	-	3	19	2	4	5
	%	0.28	37.55	2.35	10.16	-	0.08	4.65	21	0.87	2.19
<i>Sida crystalina crystalina</i>	Nr.	-	-	-	1	-	-	5	-	-	4
	%	-	-	-	1.69	-	0.02	1.22	-	-	1.75
<i>Simocephalus exspinosus</i>	Nr.	12	1	-	-	12	9	4	1	4	-
	%	0.23	0.4	-	-	6.62	0.25	0.98	10	0.87	-
<i>Simocephalus vetulus</i>	Nr.	16	-	-	-	14	1	-	-	-	-
	%	0.3	-	-	-	7.73	0.02	-	-	-	-
Total		5207	245	170	59	181	3592	408	10	458	228

Conclusions

Based on the researches made between 2007-2009 in the Tineretului Lake aquatic ecosystem, in Bucharest, regarding the biodiversity and dynamic of cladocerans (Crustacea, Branchiopoda, Cladocera), were gathered some data necessary for knowledge in an aquatory in which no researches of this type were made.

Based on an impressive number of samples taken in the period of research a number of 12792 cladocerans was obtained, belonging to a number of 15 taxons, placed in 11 genera, 6 families and two orders.

For understanding of the role of every species in this biocenotic complex a synecologic analysis was made in which the following were researched: abundance, frequency, dominance and ecological significance index. Based on some tabels, graphics and ciclograms the dynamics in time and space of this species was presented.

The gathered data regarding the biodiversity and dynamics of cladocerans from Tineretului Lake, in Bucharest, proves that the cladocerans coenosis works like an ecological system fully formed, like an open system that can accumulate new cladocerans species, in this way leading to the biological diversity enrichment of this taxonomic group.

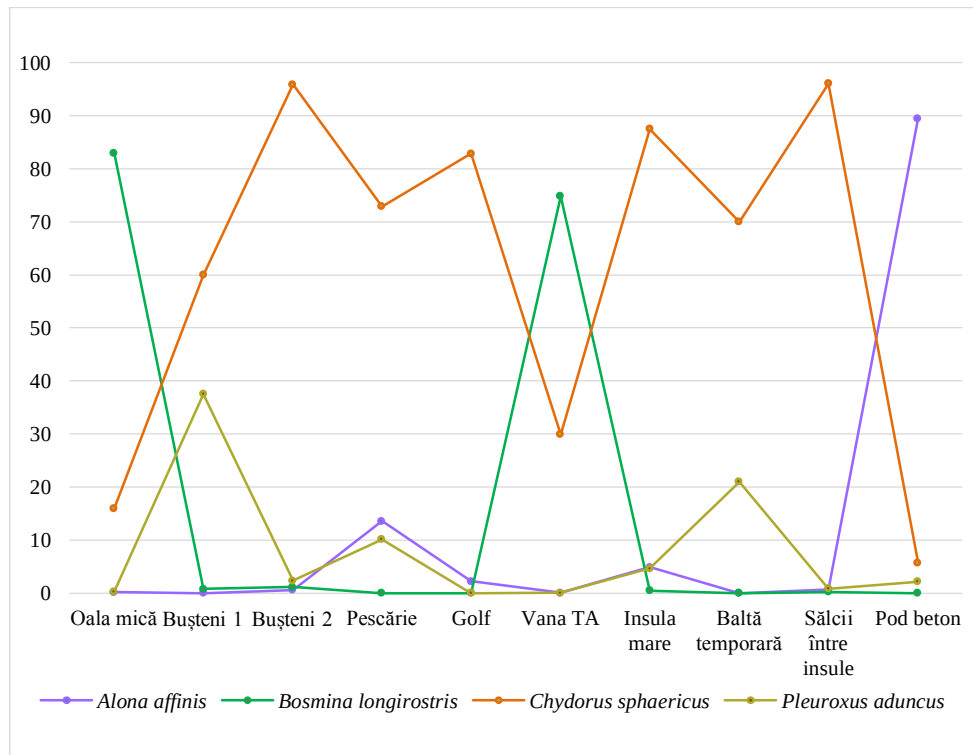


Figure 12. Dynamic of *Chydorus sphaericus*, *Bosmina longirostris* and *Alona affinis* species from one stationary to another, between 2007-2009.

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MICROMORPHOLOGICAL (SEM) ASPECTS OF WING SCALES OF SOME POLYOMMATINAE (LEPIDOPTERA: LYCAENIDAE) TAXA

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Abstract. The lycaenids, as well as other lepidopteran groups, present on the surface of the wings different types of scales, which perform various functions. Of these types, the scales producing structural colors generated a major interest, a inter- and intrageneric variability having been proved for these structures. The present paper analyses the shape and size of such scales with the aid of electronic microscopy in species of the *Cupido* (*C. argiades*, *C. decoloratus*, *C. alcetas*) and *Polyommatus* (*P. icarus*, *P. thersites*) genera. Qualitative (distal edge shape) and quantitative (scales width) differences were observed. The differences in sizes are statistically significant, proving the variability of investigated taxa at this level.

Keywords: wing scales, SEM, *Cupido*, *Polyommatus*.

Rezumat. Aspecte micromorfologice (SEM) la solzi de pe aripi ai unor taxoni ai subfamiliei Polyommatinae (Lepidoptera: Lycaenidae). În cadrul familiei Lycaenidae, ca și la celelalte grupe de lepidoptere, pe suprafața aripilor sunt prezente diferite categorii de solzi, cu diverse funcții. Dintre aceștia, solzii ce produc culori structurale au generat un interes deosebit, fiind demonstrată o variabilitate atât inter- cât și intragenerică. Lucrarea de față analizează forma și dimensiunile unor astfel de solzi, cu ajutorul microscopiei electronice, la specii ale genului *Cupido* (*C. argiades*, *C. decoloratus*, *C. alcetas*) și *Polyommatus* (*P. icarus*, *P. thersites*). Se constată diferențe calitative (forma marginii distale) și cantitative (lățimea solzilor). Diferențele dimensiunilor sunt statistic semnificative, probând variabilitatea taxonilor studiați la acest nivel.

Cuvinte cheie: solzi, aripi, SEM, *Cupido*, *Polyommatus*.

Introduction

The lepidopterans, as well as most insects, feature a variety of epidermal products, playing diverse roles, genetic and environmental factors influencing the development of such structures (Weatherbee *et al.*, 1999; Ghiradella & Butler, 2009). Among these structures, scales are prominently present, a single individual possessing several scale types on its wings. Scales serve different functions, such as thermoregulation, pheromone dispersal and color generation or predator escaping or cleaning (Kristensen & Simonsen, 2003; Reed, 2004). Scale arrangement is generally two-layered, with parallel orientation, however the positioning on the wing (peripheral, central, upper side or lower side of wing etc.) or the group to which the butterfly belongs to or even sexual polymorphism influences the pattern of scales (Kristensen & Simonsen, 2003; Kaaber *et al.*, 2009). The size of scales is also variable within butterflies, with lengths between 40 and 500 μm , in correlation with wing size (Simonsen & Kristensen, 2003), typical dimensions being around 100 x 50 x 1 μm values (Pizster *et al.*, 2011; Bálint *et al.*, 2012).

In the Lycaenidae family, several scale types are known, with flat-type and androconial the most well described. Androconial scales in Polyommatinae are club-shaped, with participation in scent dispersal (Downey & Allyn, 1975). Another type of

scales in Polyommatainae, as well as in Lycaenidae in general, is represented by those generating structural colors. This type of scales is classified into Morpho and Urania categories, with the general shape of a flattened sack, attached to the wing by a pedicle (Nijhout, 1985), with newer classifications based on tridimensional structuring existing (Prum *et al.*, 2006). The scales consist of a lower and an upper surface, with numerous and complex structures (ribs, ridges, ridge lamellae etc.) present on the upper layer. Several layers present between the surfaces generate structural colors in Morpho type scales, the same kind of colors being generated by the arrangement of ribs in Urania type scales (Tilley & Eliot, 2002). In Lycaenidae, Urania type scales exist, with a “pepper-pot” structure occurring as a particular feature (Eliot, 1973).

The optical properties of structural color scales were shown to be distinct among several species of butterflies from different families, the group of Lycaenidae being a prominent example. Such species include *Polyommatus daphnis*, *P. marcidus* (Bálint *et al.*, 2004), *P. icarus*, *P. coridon*, *P. dorylas*, *P. thersites* (Bálint *et al.*, 2012), *Celastrina argiolus*, *Plebejus icarioides* (Wilts *et al.*, 2009). Observed differences were correlated with the characteristics of microstructures of scales. The scales have been shown to be different among genera and species within Lycaenidae at the microstructures level, due to adaptive, ecological factors influence, thus with an evolutionary importance (Bálint *et al.*, 2004; Bálint *et al.*, 2007). Although above mentioned scales are well studied a from microstructural and physical properties point of view, we found no comparison of scales from related species concerning sizes or margin shape. The current paper analyses such aspects in scales possessing structural colors in three species of the *Cupido* genus and two species of the *Polyommatus* genus.

Material and Methods

The investigated taxa were represented by three species of the *Cupido* genus (*C. decoloratus*, *C. argiades*, *C. alcetas*) and two species of the *Polyommatus* genus (*P. icarus*, *P. thersites*). The material was collected between April and September 2012 from protected areas from Iasi county (Fânețele Seculare de la Valea lui David and Sărăturile de la Valea Ilenei). Butterflies were captured using a entomological net. Identification of taxa was done on the basis of external morphology and of male genitalia morphology.

Forewings were prepared for SEM analyses by placing on double-sided carbon tape and sputtering with Au layer. The microscope was operated at magnifications up to 50,000x. From each species, wings from five individuals were used for microscopic observations. Scales with structural colors from the center of the wings were identified by the presence of the pepper-pot structures under the superficial ridges and ribs.

The shapes of scales were observed with the unaided eye on SEM photographs. Scale sizes were measured using ImageJ software (ImageJ). The width of each analyzed scale (3 scales per each individual per species) was considered as the largest distance between scale margins in the upper third of the scale. The distances were statistically analyzed by calculating means and standard errors and by analysis of variance (ANOVA) for $p < 0.05$.

Results and Discussion

In the current paper the shape of the margin and the width of the scales were analyzed. The shape of the apical margins was found to be variable among the two genera,

with species of the *Polyommatus* genus having rounded margin while the species of the *Cupido* genus present scalloped margin (Fig. 1). The scales do not display obvious differences between the species of the same genus. Scales of *Polyommatus thersites* and *Polyommatus icarus* are both apically rounded (Fig. 1A, B), thus classifying as obtuse (Downey & Allyn, 1975). The scales of *Cupido argiades*, *Cupido decoloratus* and *C. alcetas* show variability in the number of tubercles, whose numbers can be 3, 4 or 5 on a single scale (Fig. 1C, D, E). Such a variability was noted for dentate scales by Downey and Allyn (1975), who consider that the region of the wing as well as environmental factors influence this character. All investigated scales presented the pepper-pot structure (Fig. 2) as this type of structure is characteristic for structural colors scales in Theclinae, Lycaeninae and Polyommatinae (Eliot, 1973). Figure 1(F) illustrates two scales from distinct layers, the scale from the upper layer (left side of image) with pepper-pot structure and the scale from the lower layer with empty cells.

The width of scales presents different values between congeneric species (Table 1). The scales of *P. icarus* are wider than those of *P. thersites*. In *Cupido* species, scales of *C. alcetas* are the largest, followed in order by scales of *C. argiades* and scales of *C. decoloratus*.

Table 1. Mean width of scales and statistical evaluation in Lycaenidae species.

Species	Width (μm)	F/F crit. (n=15)
<i>Polyommatus thersites</i>	45.634 $\pm$ 7.30	62.708/4.195
<i>Polyommatus icarus</i>	53.724 $\pm$ 7.14	
<i>Cupido argiades</i>	44.398 $\pm$ 7.29	24.45/3.219
<i>Cupido decoloratus</i>	38.799 $\pm$ 4.38	
<i>Cupido alcetas</i>	47.629 $\pm$ 13.12	

Scale size is also distinct between different scale types, with scales in the upper layer larger than those in the lower layer. However, scale layering is variable to some extent with the region of the wing (Kristensen & Simonsen, 2003). Differences in scale sizes is considered to occur due to different sizes of trichogen forming cells as described for scale length for a broad selection of lepidopteran species (Simonsen & Kristensen, 2003; Kristensen & Simonsen, 2003). The size of scales is influenced by genetic factors, which regulate the type of scales also (Nijhout, 1985). Thus, a difference in scale characteristics can be expected between different taxonomic groups.

Conclusions

By analysis of scales' morphology, the current paper reveals some differences among several taxa of Polyommatinae subfamily. The shape of the distal margin of scales with structural color is variable among two investigated genera, but is similar in species of the same genus. The width of structural color scales from the center of the wing is significantly variable among analyzed species. These results show a variability of Polyommatinae species at scales' level, which complements other results, such as differences in optical properties of scales.

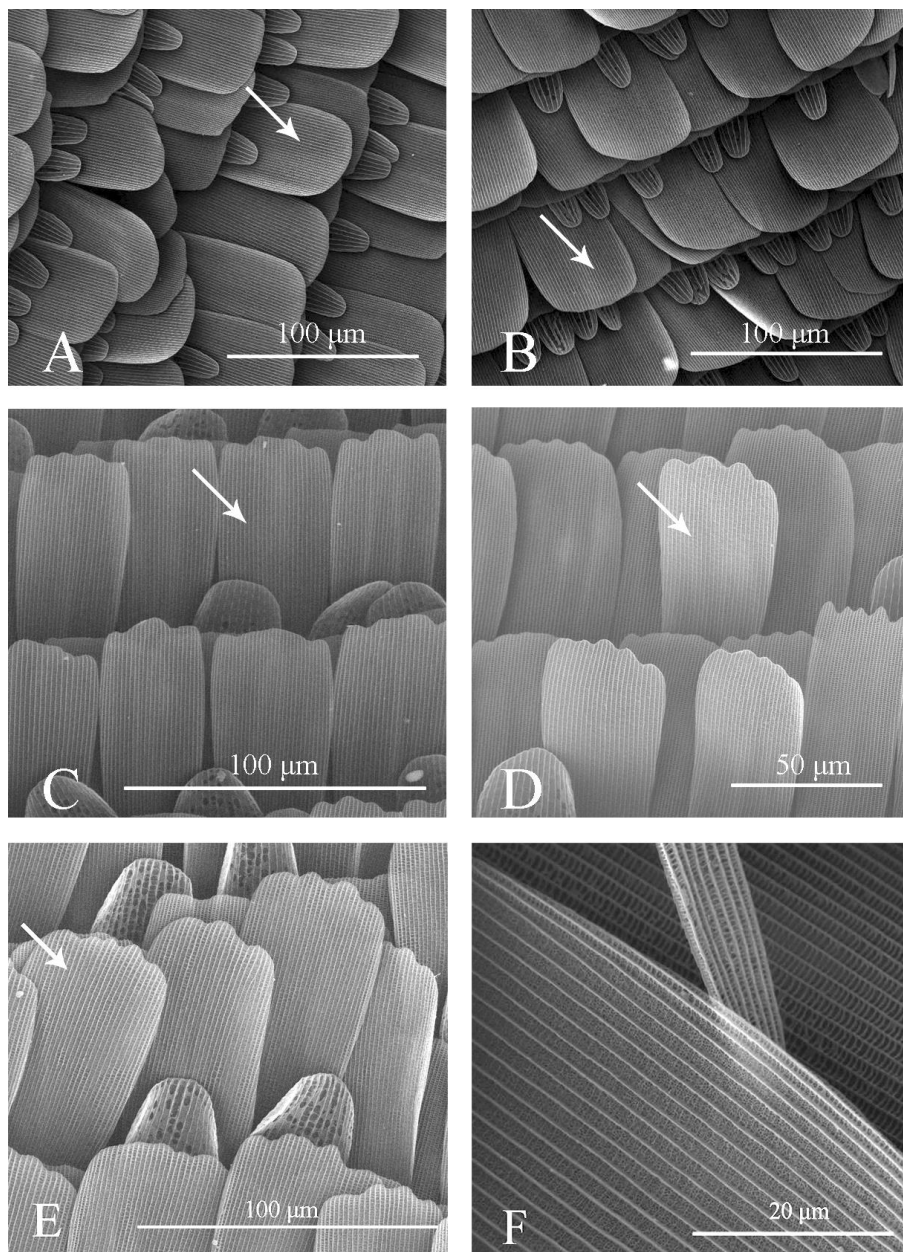


Figure 1. SEM images of wing scales - A. *Polyommatus thersites*; B. *Polyommatus icarus*; C. *Cupido argiades*; D. *Cupido decoloratus*; E. *Cupido alceas*; F. *Polyommatus icarus* - detail (arrows indicate structural color scales selected for measurements).

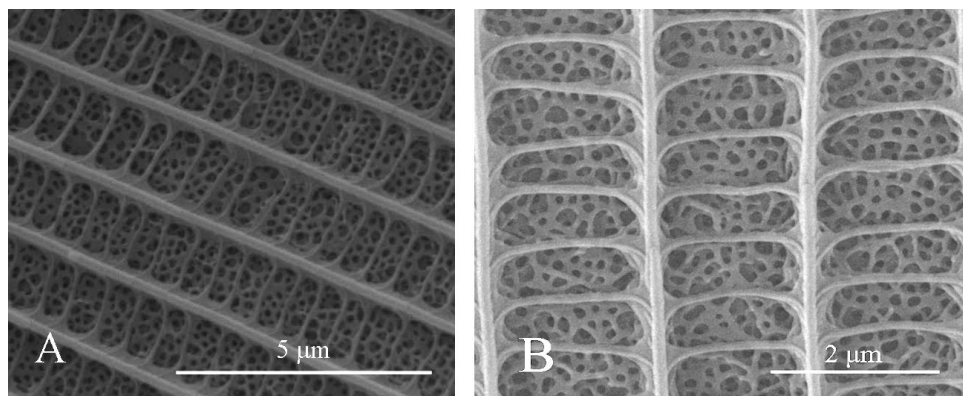


Figure 2. Pepper-pot structure in structural color scales - A. *Polyommatus thersites*; B. *Cupido argiades*.

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SPECIES AS A SWARM OF SWARMS IN THE INTERRELATIONS ESTABLISHED WITH OTHER SPECIES

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Abstract. An ecological principle according to which all depends on everything applies in nature. Biosphere is a unitary whole in which all the species depend in their existence on each other. No species can live in isolation. The relationships that are established among species are different: trophic, of reproduction, probiotic (cooperation, symbiosis, commensalism, ammensalism, etc) and antibiotic (competition, predatorism, parasitism or parasitism). From a trophic point of view, living beings are divided into three ecological categories: producers, consumers (phytophagous and zoophagous species) and decomposers. No link can miss in nature. In nature, every species depends in its existence on a multitude of other species that controls its existence and ensures their survival. In the place of its origin, each new appeared species entered into interrelationships with other species of the successive biocoenoses, and they could not have survived and evolved if there had not worked some self-adjustment mechanisms that do not allow the exponential growth of a species and the excision of others. The great geneticist Nicholas Vavilov considered that the world genetic centre of a species is the area in which the respective species occurred and could evolve with all the pressure exercised by other species. If a species of producer becomes the target of a swarm of phytophagous species, these cannot eliminate it from nature because they would put in danger their own existence on the one hand, and on the other hand, the populations of phytophagous species are also controlled by swarms of zoophagous species, ensuring a balance in nature. In other words, a species cannot live alone; it is surrounded by swarms of swarms of other species that control its existence and the individuals of that species depend in their turn on the respective species. In this respect, we bring evidences in this paper obtained from our research of nearly half a century referring to some pest species attacking the crops of *Brassica oleracea* var. *capitata* and the complexes of entomophages that control their population. According to the biosemiotic principle of Jasper Hoffmeyer a pluricellular organism is a swarm of swarms of cells that form a unitary whole, so a species is formed of a swarm of swarms that forms a unitary whole depending in their existence on each other.

Keywords: species, biosemiotics, swarm, parasitoid biocoenoses, entomophagous biocoenoses.

Rezumat. Specia ca un roi de roiuri în interacțiunile cu alte specii. În natură funcționează principiul după care totul depinde de tot. Biosfera este o unitate în care toate speciile depind în existența lor unele de altele. Nicio specie nu poate trăi în izolare. Relațiile care se stabilesc între specii sunt diverse: trofice, de reproducere, probiotice (cooperare, simbioză, comensalism, amensalism etc.) și antibiotice (con competiție, prădătorism, parazitism sau parazitism). Din punct de vedere trofic, ființele vii sunt împărțite în trei categorii: producători, consumatori (specii fitofage și zoofage) și descompunători. Nicio verigă nu poate lipsi în natură. În natură, fiecare specie depinde în existența sa de o multitudine de alte specii care îi controlează existența și îi asigură supraviețuirea. În locul său de origine fiecare specie nou apărută a intrat în interrelație cu alte specii din biocenoză și nu ar fi putut supraviețui și evolua în lipsa unor mecanisme de autoreglare care nu permit înmulțirea exponențială a unei specii și extincția altora. Marele genetician Nicholas Vavilov considera că centrul genetic mondial al unei specii este zona în care a apărut specia respectivă și a putut să evolueze având în vedere presiunea exercitată de celelalte specii. Dacă o specie de producător devine ținta unui roi de specii fitofage, acestea nu pot să o elimine deoarece, pe de o parte, și-ar pune astfel în pericol propria existență, iar pe de altă parte populațiile de specii fitofage sunt controlate de roiuri de specii zoofage, asigurând un echilibru în natură. Cu alte cuvinte, o specie nu poate trăi singură; este înconjurată de roiuri de roiuri de alte specii care îi controlează existența iar indivizii acelei specii depind la rândul lor de speciile respective. În acest sens, în această lucrare aducem dovezi obținute din cercetările noastre de aproape jumătate de secol referitoare la unele specii de dăunători care atacă culturile de *Brassica oleracea* var. *capitata* și complexele de entomofagi care le controlează populațiile. După principiul biosemiotic al lui Jasper Hoffmeyer, un organism pluricelular este un roi de roiuri de celule care formează un întreg, deci o specie este formată dintr-un roi de roiuri care alcătuiesc o unitate și depind în existența lor unele de altele.

Cuvinte cheie: specii, biosemiotică, roi, biocenoză parazitare, biocenoză entomofagă.

Introduction

Like the individual, the species is an ecological level of organization. This means that the species cannot live alone, but it must enter into relationship with other species in the biocoenosis of which it depends on. In other words, each species depends in its existence on other species that ensure their existence and control its own existence. The famous geneticist Nicholas Vavilov perfectly intuited that a species cannot survive and evolve but in interrelation with other species that depend on each other in their existence. N. Vavilov believes that the place in which a species occurs and evolves is its world genetic centre. This means that each species has a proper evolution, resulting in geological time from the interrelations established with other species in the successive ecosystems in which it evolved along time. The essence of this concept is that a species cannot be isolated from the complex of species in the middle of which it develops its existence. If a species belongs to the category of producers, it means that it can become the target of a complex of phytophagous species that depend in their existence on that producer. The phytophagous species might eliminate the respective producer from nature, if they multiply exponentially. Such elimination does not occur in nature, or it is produced under extreme conditions, because the phytophagous species would put their existence into danger, on the one hand, and on the other hand, these would become the target of the attack of some zoophagous species, which control their populations, ensuring the survival of the producer. The complex interrelationships do not stop here because the zoophagous species of first order may become the target of some zoophagous species of the second order, and, these, in their turn, of some zoophagous species of higher order or of peak, at a time when we speak about predatory species, and in case of the parasitoid species one can form tertiary particularly complex food chains, such as: primary parasitoids → secondary parasitoids → tertiary parasitoids → quaternary parasitoids (Mustață & Mustață, 2001).

In nature, it functions a series of self-adjustment mechanisms within each biological system. In the present case such mechanisms might function according to the models rendered in figures 1 and 2:

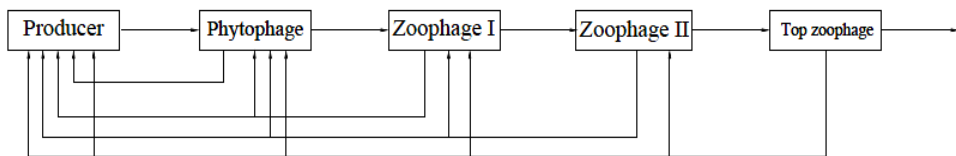


Figure 1. Self-adjustment mechanism of predatory type.

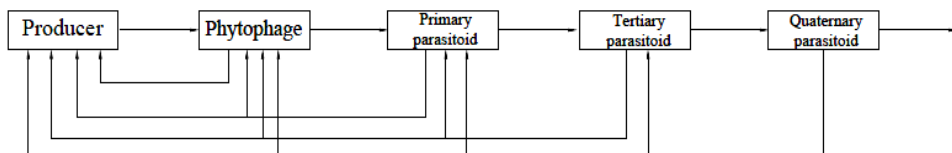


Figure 2. Self-adjustment mechanism of parasitoid type.

Such self-adjustment mechanisms do not allow the exponential growth of some species and the extinction of others.

Only in such a way, we can explain the survival of some species in geological time in the world genetic centre of a species. Moved from this centre, the species may face some difficulties or can achieve exponential multiplication (The case of the species *Leptinotarsa decemlineata* Say and *Plutella xylostella* L., which extended their areal winning large geographical area) leaving the sphere of self-adjustment mechanisms.

Thinking in this way, we can imagine the species *Brassica oleracea* var. *capitata*, which is a producer surrounded by a swarm of phytophagous insects to which they ensure their existence in the quality of host (of food source) and that control its existence. The phytophagous species also become the target of some zoophagous species (predatory or parasitoid) that control their populations thus providing a natural biological balance. In this way, we can imagine that around a predatory species it acts a swarm of phytophagous species, closely followed by parasitoid and predatory swarms. All of these swarms revolve around a predatory species as an intrinsic part of the respective species. Thus, when we think of the species *Brassica oleracea* var. *capitata*, we cannot think of phytophagous insects that may attack the crop. Forcing the thinking, we might consider that the cabbage has the ecological mission to ensure the existence of some phytophagous species. So, in nature, there, where we find cabbage plants it is natural (almost obligatory) to meet some phytophagous species, too, as if they would belong to the species. By their presence in the cabbage crops, the phytophagous species attract a number of predatory or/ and parasitoid species. Accepting this possibility we realize that the broad sphere of the producing species extends incorporating the predatory and parasitoid swarms too; it is as if the producing species were a swarm of species swarms.

Thus, we arrive to the biosemiotic thinking of Jasper Hoffmeyer, who, in the 7th biosemiotic principle, postulates that the organisms are a swarm of swarms of cells. It is about pluricellular organisms, to which swarms of cells form different types of tissues, and these give rise to other swarms that are the organs that make up the organisms as a unitary whole, which is a swarm of swarms of cells depending in their existence on each other and on the whole the respective being forms (Hoffmeyer, 1995; 1996).

Why do we not apply this principle in the case of biological and ecological species? The species appears to us as a swarm of species swarms depending in their existence on each other. Thus, thinking we realize the biosemiotic dimensions of the species that become unexpected.

Arguments and Discussion

To ensure the understanding of the concept according to which a species is a swarm of swarms of species, we bring some arguments based on our research of nearly half a century referring to the knowledge of the complexes of pests and natural enemies that control some crops of *Brassica oleracea* var. *capitata* in Romania.

Cabbage is a cosmopolitan species that accompanies man everywhere. It is native to the Mediterranean zone, which means that here it is found the world genetic centre of this species, but it expanded its area almost on the whole planet.

Normally, the *Brassica oleracea* var. *capitata* in its extension should be accompanied by the full suite of phytophagous species. Not really; not all the species have the same ecological valences. The biggest density of phytophagous species is found in the native zone. However, in this area we will meet both the complexes of predators and the parasitoids which provide a certain biological balance. In Romania, *Brassica oleracea* var.

capitata is the target of the attack of a number of about 50 species of phytophagous species. Being near the world genetic centre, the cabbage should not be put in danger of extinction. And, though, some crops of cabbage may be totally destroyed in some areas, as a result of the environmental ecological imbalances caused by the chemical controlling activity against pests. But, if in a certain area some cabbage crops may be compromised, in other areas they can resist to the attack and even thrive. Conditions vary from one area to another and from one period to another.

In our research, we followed a number of species of phytophagous insects that attack the cabbage crops and the complexes of entomophages that control their populations. In this regard, we will only put into discussion just some of these species: *Brevicoryne brassicae* L., *Delia radicum* L., *Plutella xylostella* L., *Pieris brassicae* L., *P. rapae* L. and the species *Mamestra brassicae* L. These species are the most damaging species, but they are controlled, in the conditions of Romania, by strong complexes of entomophages.

Brevicoryne brassicae is a species particularly harmful in certain conditions; it may compromise totally some cabbage crops. The big number of generations per year (over 20) and the very high prolificacy of virginogenous females make possible the exponential growth of this species at the time when it is not controlled. By their presence in the crops of cabbage, the colonies of this aphid attract an impressive number of entomophagous species (predatory and parasitoid). In our research, we managed to achieve a food network in which we included the species of predatory insects (aphidiphagous) and some of their parasitoids and the parasitoid and hyperparasitoid species (Mustață, 1974-1975).

As we can see in Figure 3, there are numerous species of Syrphidae, Chamaemyiidae and Itonididae from the order Diptera; species of Coccinellidae from the order Coleoptera, two species of Chrysopidae from the order Neuroptera and one species from the family Anthoridae, the order Heteroptera. These species form the swarm of predators, which is accompanied by a swarm of parasitoid insects that control their populations. There follows a swarm of primary parasitoids from the family Aphidiidae, limiting the populations of that aphid, but which it is accompanied by a swarm of hyperparasitoids (acting as secondary, tertiary and even quaternary parasitoids) belonging to the families: Charipidae, Megaspilidae, Encyrtidae and Pteromalidae. We can affirm without fear that we shall be wrong that in the cabbage crops attacked by *Brevicoryne brassicae* we will meet many entomophagous species among these species (Mustață & Costea, 2000; Mustață & Mustață, 2000; Mustață *et al.*, 2000).

The cabbage roots are often attacked by the larvae of the species *Delia radicum* L. At a more intense attack the plant can dry out and die. In our research we found that the larvae of *Delia radicum* are controlled by a number of 27 species of primary parasitoids belonging to the families: Ichneumonidae and Braconidae from the order Hymenoptera (Fig. 4). In other words, *D. radicum* has its swarm of parasitoid species controlling its populations.

The species *Plutella xylostella* L. from the family Plutellidae is a butterfly extremely injurious to cabbage crops. Sometimes only this species can compromise totally a crop of cabbage. In Romania, *P. xylostella* has 4 generations in the south of the country and 3 generations in north; in Taiwan, it has up to 20 generations per year. It multiplies like the aphids and it becomes an extremely harmful species. In the conditions of Romania, the species *P. xylostella* is kept under control by an impressive number of primary parasitoids. We found situations in which this species was parasitized 80-90% in some crops, and even more (Mustață & Costea, 2000; Mustață & Mustață, 2000; Mustață *et al.*, 2000; Mustață & Mustață, 2001).

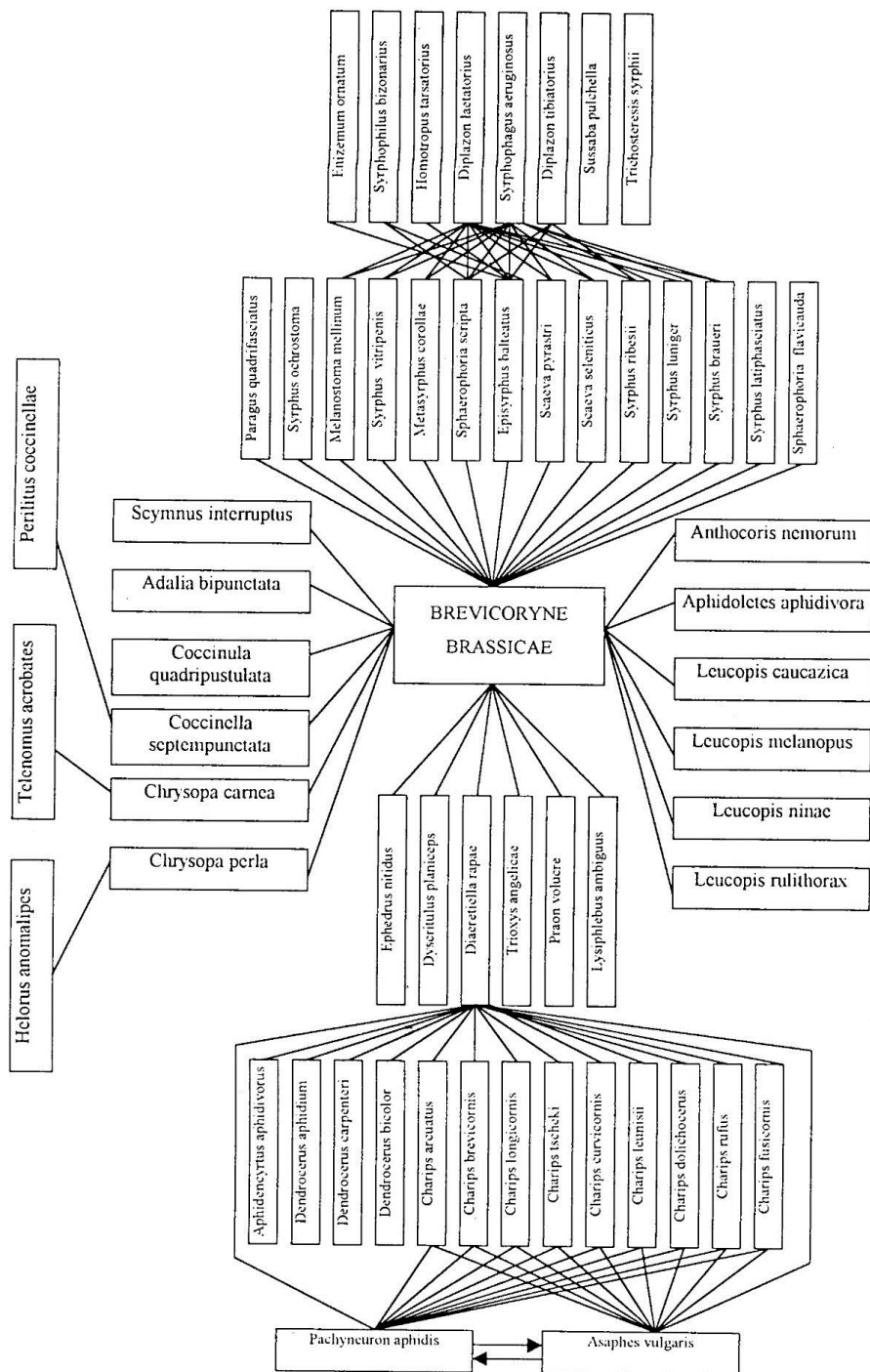


Figure 3. The trophic network specific to the populations of *Brevicoryne brassicae*.

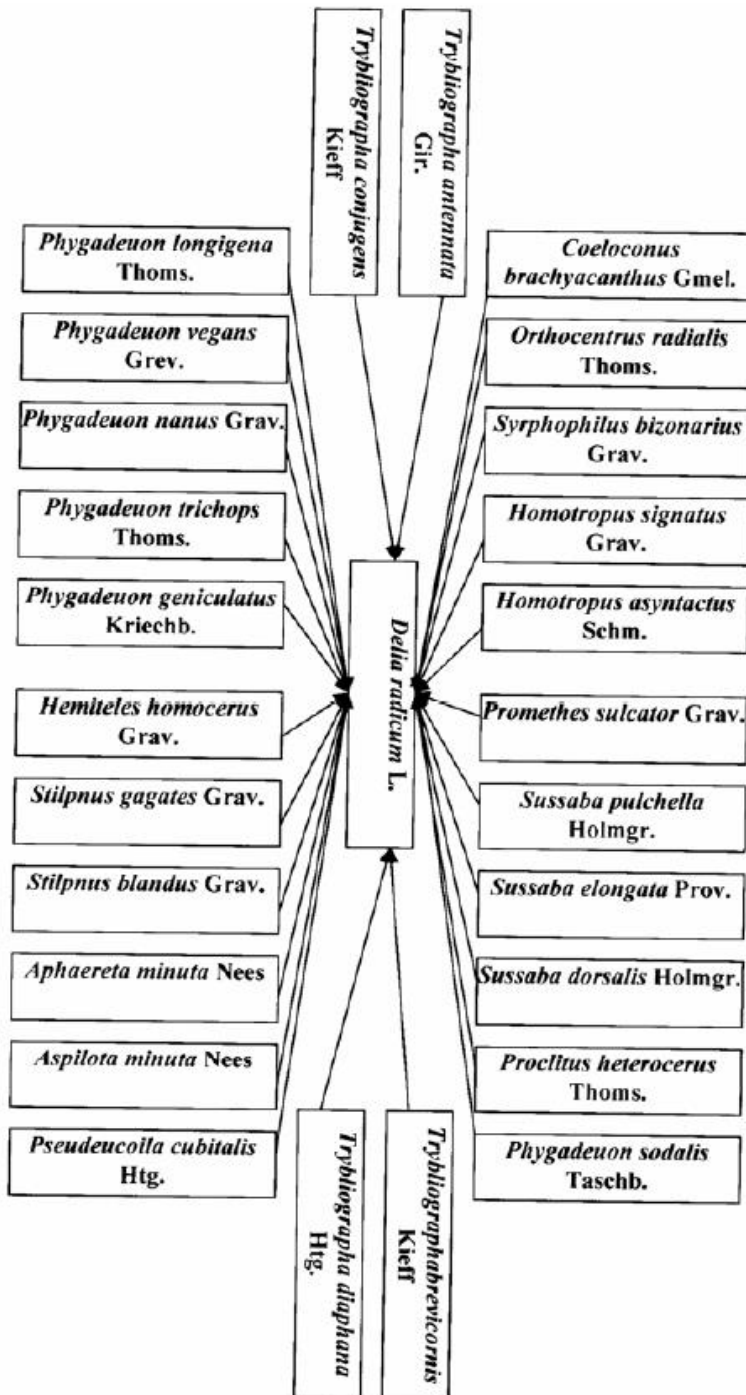


Figure 4. The trophic network specific to the populations of *Delia radicum*.

In the conditions of eastern Romania (Moldavia and Dobroudja) *P. xylostella* is controlled by a number of 39 species of primary parasitoids (Fig. 5). Their efficiency being very high, in the complex of parasitoids there started to emerge a number of secondary parasitoids, too (19 species), and the species *Oomyzus sokolowskii* acts both as primary parasitoid and secondary one, as part of the so-called buffer systems that plays a very important role in keeping of natural balance.

A special case is formed by the species *Pieris brassicae* L., *P. rapae* L. and *P. napi* L. Being sister species of the same genus, they are controlled by a common complex of parasitoids and hyperparasitoids, we can hardly realize, it has no sense, separate networks characteristic to the three species.

In the conditions of Romania, the species of *Pieris* are controlled by an impressive number of parasitoid species. In Figure 6, we present 23 species of primary parasitoids and 15 species of secondary parasitoids. The primary parasitoids succeed in the ecological conditions from the eastern part of Romania to parasitize the populations of *Pieris* in proportion of 70-80% and even more. In the last two decades it began to appear several species of secondary parasitoids, which have the role to provide some biological balance.

If *Brassicae oleracea* has its world genetic centre in the Mediterranean zone, we can affirm that the species *Brevycorine brassicae*, *Plutella xylostella* too, and those of the genus *Pieris* have their world genetic centre in the same zone.

We cannot affirm the same thing about the species *Mamestra brassicae* which, though it is controlled by a number of 18 species of primary parasitoids (Fig. 7), these do not realize a reduction in the population of *M. brassicae* of more than 30-40%. Only the species of *Trichogramma* performs in certain crops a parasitization of 60-70% of the eggs of this pest. Also in the complex of parasitoids of this species it began to appear, in the last decades, a number of species of secondary parasitoids, which means that nature begins to ensure the protection of species.

We presented just a few phytophagous species that attack the cabbage crops in Romania. We have to imagine ourselves that also the other phytophagous species are controlled by a bigger or smaller number of entomophagous species. We can speak of true biocoenoses of entomophagous type, including here both the predatory and parasitoid species. Or we can distinguish two types of biocoenoses: of predatory and parasitoid type. The complexes of entomophages that have been put into evidence act in the areas in which man does not cause severe biological imbalances by using the chemical weapon against pests. Considering that nature is not affected by such biological imbalances we might think so: any crop of cabbage may be attacked by a number of phytophagous species: They cannot miss because these species have their existence strictly related to this host plant. The trophic link among these species is so strong that we can say that every couple: *Brassica oleracea* var. *capitata* - *Brevicoryne brassicae*, *Brassica oleracea* var. *capitata* - *Plutella xylostella* etc. are well strengthened biosystems, made through coevolution.

We can think that *Brassica oleracea* var. *capitata* can live without *Plutella xylostella*, but it cannot live without its host. Thinking in this way, we can individualize a swarm of phytophagous species which have their existence connected to the cabbage crops (Fig. 8).

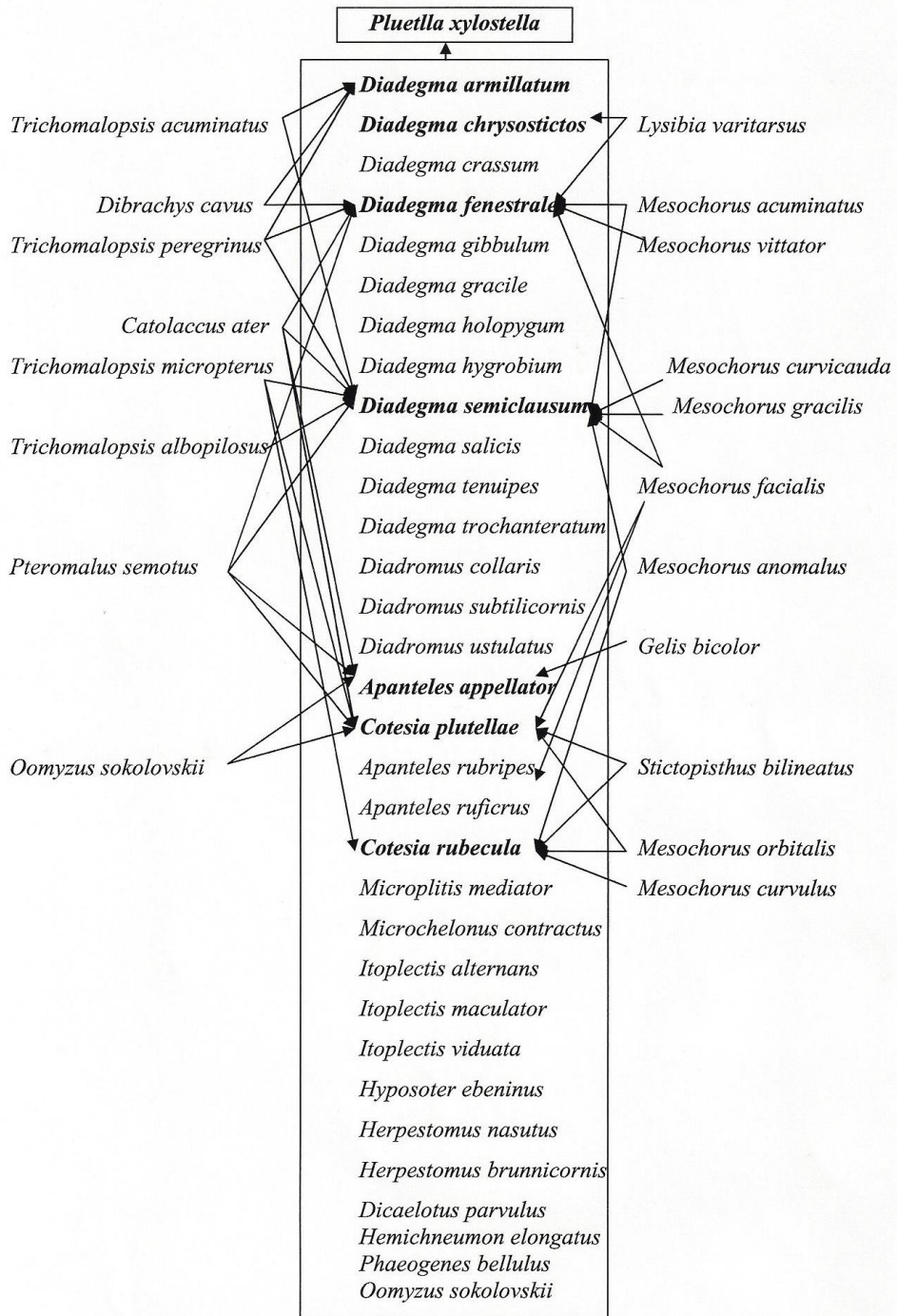


Figure 5. The trophic network specific to the populations of *Plutella xylostella*.

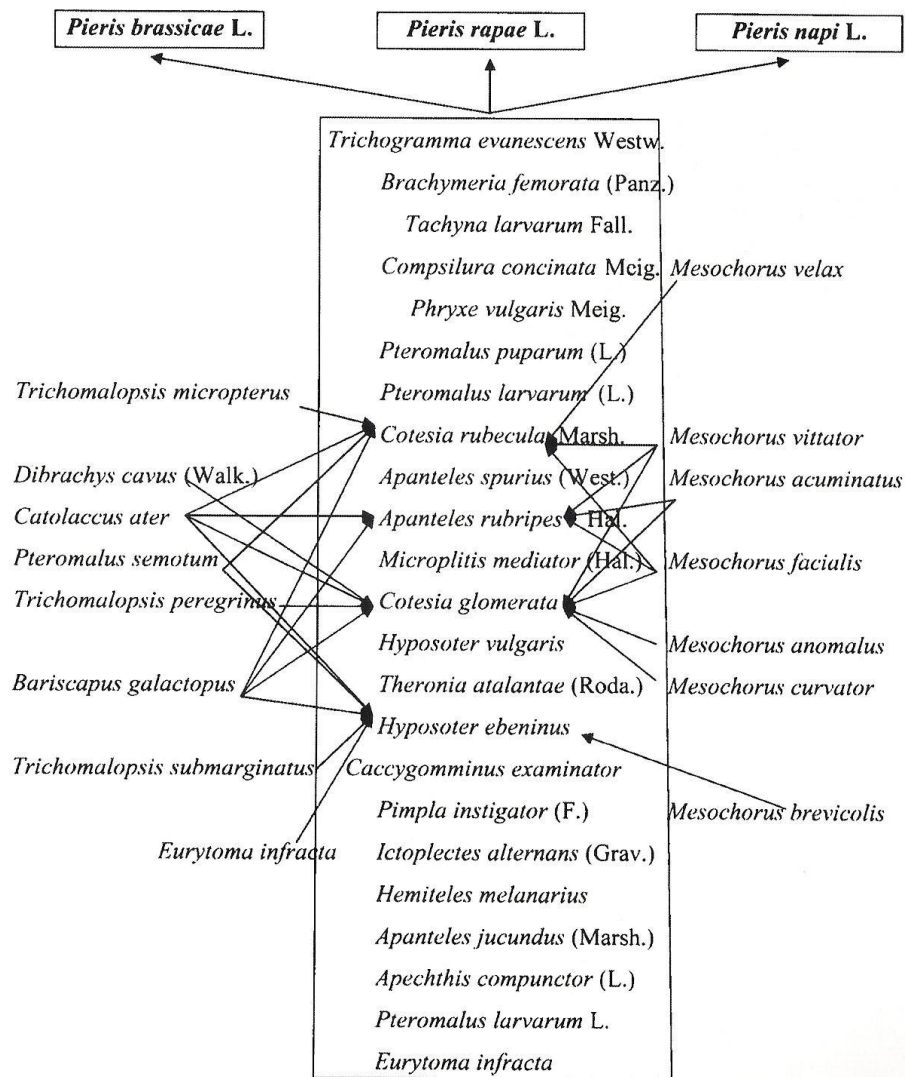


Figure 6. The trophic network specific to the populations of *Pieris* spp.

In their turn, the phytophagous species become the target of the attack of some predatory or parasitoid species. Thus, we can individualize other biosystems: *Brevicoryne brassicae* - *Diaeretiella rapae*, *Brevicoryne brassicae* - *Episyrphus balteatus* etc. We have to recognize the existence of some swarms of predatory insects and swarms of parasitoid insects revolving around the species *Brassica oleracea* var. *capitata* as if it would be a part of this species. In Figure 8, we represented the species *Brassica oleracea* var. *capitata* by a

single plant, around which the swarm of phytophagous species revolve, followed by swarms of predatory and parasitoid insects that control their existence.

Starting from here we must understand that in nature no species can live alone, that each species depends in its existence on the species controlling their populations and providing their existence. The species cannot evolve than within such complexes; these form well defined ecological structures, more or less stable.

Like a pluricellular organism that is formed of swarms of swarms of cells that constitutes to a unitary whole, so a species is formed of swarms of swarms of species with which forms a unitary whole controlling their existence mutually.

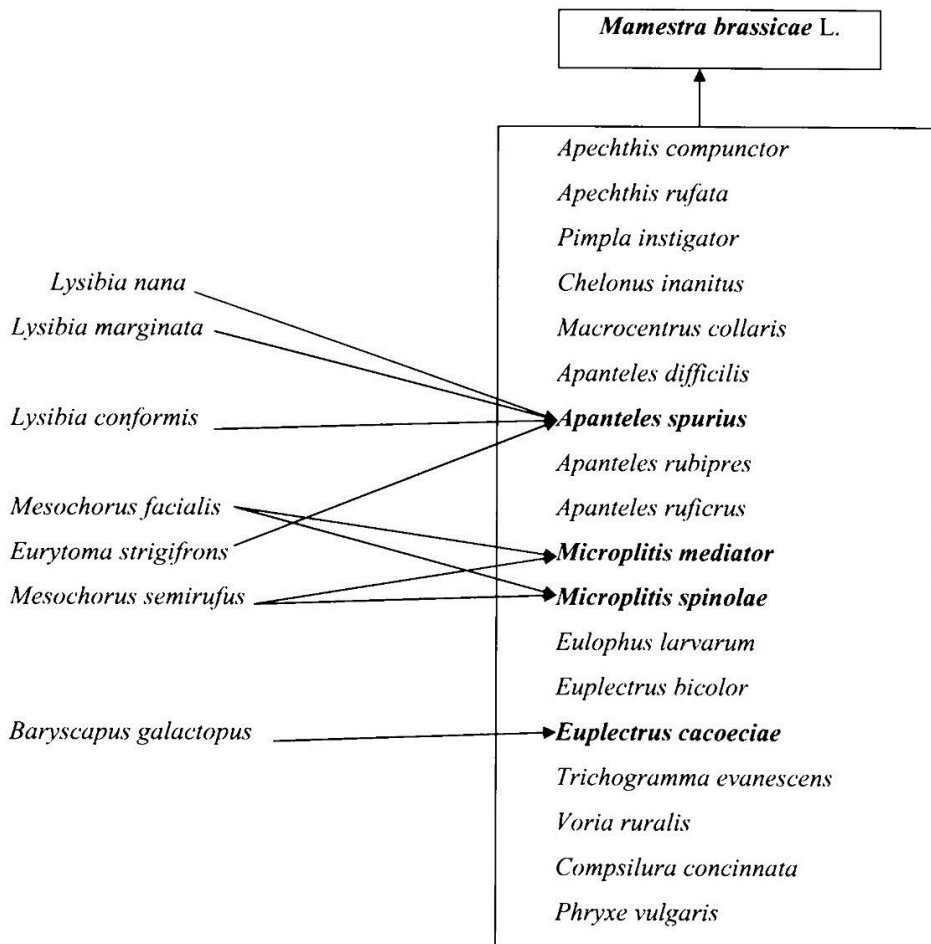


Figure 7. The trophic network specific to the populations of *Mamestra brassicae*.

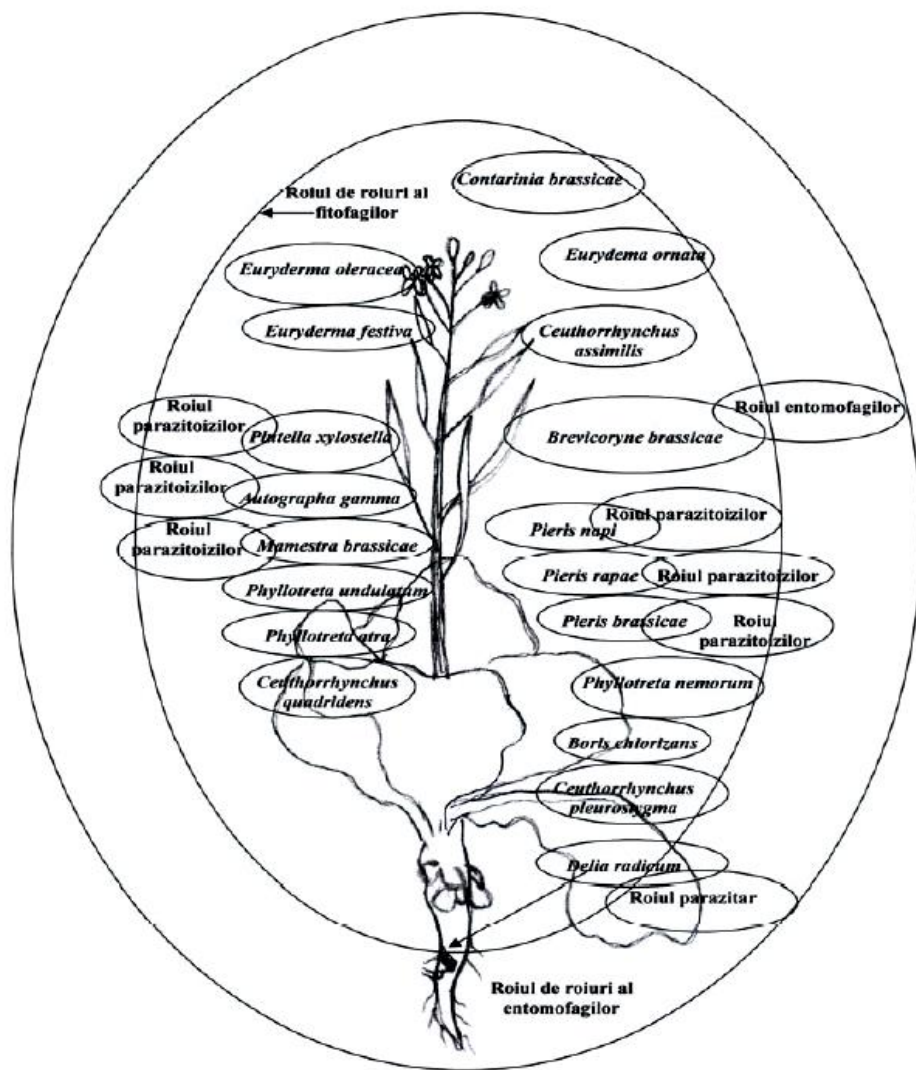


Figure 8. *Brassica oleracea* var. *capitata* surrounded by the swarm of phytophagous species, followed by swarms of predatory and parasitoid insects that control their existence.

Conclusions

In the research performed over a half a century regarding the knowledge of the complexes of phytophagous species and their natural enemies acting in the crops of *Brassica oleracea* var. *capitata* in Romania, we found that this species is constantly attacked by some phytophagous species. We reported in Romania about 50 species of

cabbage pests that attack the cabbage crops. Among these species: *Brevicoryne brassicae* L., *Delia radicum* L., *Plutella xylostella* L., *Mamestra brassicae* L. and species of the genus *Pieris* (*brassicae*, *rapi* and *napi*) are practically found in all the cabbage crops. For each of these species we identified very big complexes of parasitoids that control their populations naturally, often with high efficiency. If in a crop of cabbage one finds a certain phytophagous species, surely you will also find some of entomophagous species that limit its population.

Thus, we find that *Brassica oleracea* var. *capitata* is accompanied in Romania by a swarm of phytophagous insects. In their turn, these are accompanied each by a swarm of entomophagous species. All of these swarms of species depend on in their existence by the species *Brassica oleracea* var. *capitata*.

It is as if it would form a unitary whole, as if the structural and functional boundaries of this species would expand and would include all accompanying swarms.

Jasper Hoffmeyer launches in his works several biosemiotic principles. The 7th principle postulates that a pluricellular organism is formed of swarms of swarms of cells that function as a whole. Some swarms of cells form the organism that functions as a whole.

Applying this principle in the understanding of species as an ecological level of organization, we have to accept that the species is formed of swarms of species that depend in their existence on each other and form a unitary whole.

All these interrelationships are of biosemiotic nature and function on the basis of the semiotic dialogue among species, concretized in a succession of signs and signals.

Thus, we wish to introduce in biology a biosemiotic concept, in conformity with which a species is formed of swarms of swarms of species that control their existence reciprocally.

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TRICHOPRIA SOCIABILIS MASNER, 1965 (HYMENOPTERA: DIAPRIIDAE) NEW TO ROMANIA, WITH NOTES ON ITS LIFE HISTORY

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Abstract. Numerous individuals of *Trichopria sociabilis* Masner, 1965 (Hymenoptera: Diapriidae) have been obtained from sentinel pupae of *Calliphora vicina* Robineau-Desvoidy (Diptera: Calliphoridae) placed in the Cîrlic area near Iași city (eastern Romania). This is the first record of the parasitoid in Romania. Observations regarding parasitism percentage, sex ratio, courtship and copulation, oviposition, etc. are presented, accompanied by illustrations.

Keywords: Hymenoptera, Diapriidae, *Trichopria sociabilis*, *Calliphora vicina*, parasitoid, synanthropic fly, parasitism percentage, sex ratio, courtship, copulation, oviposition.

Rezumat. *Trichopria sociabilis* Masner, 1965 (Hymenoptera: Diapriidae), specie nouă pentru fauna României, cu note despre biologia sa. Numeroși indivizi de *Trichopria sociabilis* Masner, 1965 (Hymenoptera: Diapriidae) au fost obținuți din pupe santinelă de *Calliphora vicina* Robineau-Desvoidy (Diptera: Calliphoridae) plasate în zona Cîrlic, lângă orașul Iași (estul României). Aceasta este prima menționare a parazitoidului în România. În lucrare sunt prezentate observații referitoare la procentajul de parazitare, sex ratio, comportamentul de împerechere, ovipoziție etc., însoțite de imagini.

Cuvinte cheie: Hymenoptera, Diapriidae, *Trichopria sociabilis*, *Calliphora vicina*, parazitoizi, muște sinantropice, procentaj de parazitare, sex ratio, împerechere, ovipoziție.

Introduction

Diapriids are small Hymenoptera, with average body size of 2-4 mm (Masner, 1995), smooth and polished body surface and, in most European species, mainly black or dark brown coloration. The members of Diapriidae are usually easily distinguished from other Hymenoptera by their antennae, which are inserted above the clypeus, on a conspicuous transversal ledge. Most diapriids are larval-pupal or pupal parasitoids of Diptera; some species are parasitoids of Coleoptera or other Hymenoptera (Masner, 1995). Because diapriids are mainly parasitoids of Diptera, they can be used as biocontrol agents against pest flies and midges.

In Europe, *Trichopria* is represented by about 65 species (Kozlov, 1978). Nixon (1980) considered that *Trichopria* is the most common and the largest genus of Diapriinae in Great Britain.

Despite their potential use, the species of Diapriidae are very poorly known in Romania. The Romanian species have been partly studied mainly by Klaus Fabritius (1973) and Irina Teodorescu (1973) in their PhD theses. Fabritius (1973) mentioned that in Romania, *Trichopria* is one of the most specious genera of diapriids, but, because of its unclear taxonomy, the identification of the species is very difficult. From this reason, he cited from Romania just one species in this genus, *Trichopria tetratoma* Kieffer, 1911.

Teodorescu (1973) reported 15 species of *Trichopria* from Romania: *T. aequata* (Thompson, 1858), *T. bipunctata* Kieffer, 1911, *T. cilipes* Kieffer, 1909, *T. fuscicornis* (Kieffer, 1911), *T. laminata* (Kieffer, 1911), *T. lonchaeorum* Kieffer, 1911, *T. major* (Priesner, 1953), *T. nigricornis* (Thompson, 1858), *T. nigra* (Nees, 1834), *T. parvula* (Nees, 1834), *T. spinosa* Kieffer, 1911, *T. thomsoni* Kieffer, 1858, *T. tetratoma* Kieffer, 1911, *T. tenuicornis* (Thompson, 1858), and *T. verticillata* (Latreille, 1805). She reared these species from various fly hosts such as *Piophilidae* (*Piophilidae*) (*T. cilipes*, *T. lonchaeorum*, *T. major*, *T. nigra*, *T. parvula* and *T. tetratoma*); *Paregle* sp. (*Anthomyiidae*) (*T. major*); *Lucilia sericata* (*Calliphoridae*) (*T. cilipes*, *T. major*, *T. tetratoma*); and *Calliphora erythrocephala* (*Calliphoridae*) (*T. cilipes*).

The aim of this paper is to document the first record of *Trichopria sociabilis* Masner in Romania and present some observations that we carried out in laboratory regarding its behaviour and biology.

Material and Methods

Sentinel pupae of the blowfly *Calliphora vicina* Robineau-Desvoidy (Fig. 1) were placed in several areas near Iași city (Botanical Garden, Cîrc forest, Breazu forest). The maggots of this species are grown commercially and are widely available in specialized stores for hunting and fishing. In laboratory, in 2-3 days at 20-21°C the maggots pupate, hence there is no need for parallel cultures of hosts to obtain fresh pupae. In each of the places mentioned above we put together 25 fly pupae in small net bags suspended at about one meter above ground on the available wooden vegetation (Fig. 2), and left them in place for a week (20-27.viii.2013). The bags were placed near carrion traps in the event that the smell of rotten meat would attract the parasitoids. After one week, the pupae were brought into laboratory and separated in glass vials until the emergence of either flies or parasitoids. Several females and males were transferred on fresh pupae to study various aspects of their behaviour and biology.

Results and Discussion

In laboratory we managed to obtain individuals of *Trichopria sociabilis* (Fig. 3) only from several sentinel pupae from Cîrc forest.

Host stage preference

After mating, several females were separated in vials together with fly maggots in order to test their preference for oviposition into maggots. Females of *T. sociabilis* together with 20 developed maggots of *C. vicina* were placed for two days (14-16.ix.2013) in vials. From these maggots, after 12-13 days, we obtained just adults of *C. vicina* on 27-28.ix.2013. The conclusion of this experiment is that *T. sociabilis* is not a larval-pupal parasitoid, this species ovipositing the host just in the pupal stage.

Parasitism rate and duration of development

From the initial 25 sentinel pupae left in the field we obtained parasitoids from only 6 of them (24% parasitism rate). On 16.ix.2013, 20 pupae of *C. vicina* were put in vials with females of *T. sociabilis* for one day, then the pupae were separated one by one in vials. On 26.ix.2013 we obtained two adult flies and next day another eight, thus from a total of 20 pupae, only ten pupae were attacked by parasitoids (50% parasitism rate). On

31.x.2013 the first parasitoids emerged, while the last ones emerged on 4.xi.2013. In conclusion, the development of *T. sociabilis* in laboratory conditions (18-19°C during the night and 22-23°C during the day) took between 45 and 49 days. In *T. drosophilae*, the emergence of new parasitoids took place after 23-25 days (Romani *et al.*, 2008).

Sex-ratio

The sex-ratio was measured in six cases (Table 1). In most of them, females are more numerous than males. Bernal (1998) provides examples for other parasitoids: in *Coccophagus semicircularis* (Förster) (Chalcidoidea: Aphelinidae) females proved to be more numerous than males, the *Drosophila* parasitoid *Leptopilina heterotoma* (Cynipoidea: Figitidae) has a sex ratio near one, while in *L. boulandi* the males are more numerous than females.

Table 1. The sex-ratio for the parasitoid *T. sociabilis*.

pupa no.	females	males
1	16	17
2	7	1
3	43	4
4	29	9
5	40	5
6	13	17
Total	148	53

Parasitoid emergence

The emergence of parasitoids from their host pupae is usually made through more than one exit hole (4-7) (Fig. 4). Males don't emerge before females. In all six observed cases, the first emerged specimen was a female, but not all females emerged before males.

Courtship behaviour

The observed sequence of courtship behaviour in *T. sociabilis* is presented below and illustrated in Fig. 5. The male and female touch their antennae. The male has the initiative and climbs on the back of the female, previously catching female's antennae. On the back of the female the male keeps the female's antennae in an approximate vertical position, immobilized between the anterior legs of the male (Fig. 5a). During this time the female can move, and in some cases, the male can't manage to climb on the back of the female and gives up. The female seems to accept the courtship in the moment when the male manages to climb on her back and start to move his middle legs on the lateral sides of her propodeum. To summarize, the position of the male on the back of the female is as follows: the forelegs stay on the head of the female, keeping among them the antennae of the female; the middle legs continuously move ahead and back on the pilosity of the lateral sides of propodeum; the hind legs keep the male fixed on the female metasoma (Fig. 5b). The male is a little shorter than the female, so his genitalia can't be in contact with hers during courtship. After the male sits on the female, he starts moving his antennae along hers, more exactly the sex-segment on each male antenna along the corresponding female clava. The movement decreases in amplitude, being oriented towards the last segment of the clava (Fig. 5a). All this behaviour takes between 3 and 9 minute and in eight out of ten

cases it was not followed by copulation. In *Trichopria drosophilae* Perkins the male was observed to spread his wings before copulation (Romani *et al.*, 2008).

Copulation

The male, because it is shorter than the female, liberate the female's antennae and, remaining on the back of the female, goes towards her posterior part until their genital areas touch (Fig. 5c). The copulation was observed just in two cases: in the first one it was shorter (16 sec.), while in the second it lasted for 1 min. and 18 sec. Jervis (2005) observed that in *Nasonia vitripennis* (Walker) (Chalcidoidea: Pteromalidae) the copulation lasted 15-20 sec., in *Lariophagus* sp. (Chalcidoidea: Pteromalidae) 40-80 sec., in *Melittobia* sp. (Chalcidoidea: Eulophidae) 5-10 sec., and noted that there was a correlation between the time necessary for copulation and the air temperature. We made the above observations at room temperature.



Figure 1. *Calliphora vicina*, adult in lateral view.



Figure 2. Sentinel pupae in net bags.



Figure 3. *Trichopria sociabilis*, female in dorsal view.



Figure 4. Exit holes made by *T. sociabilis* in the host pupa.

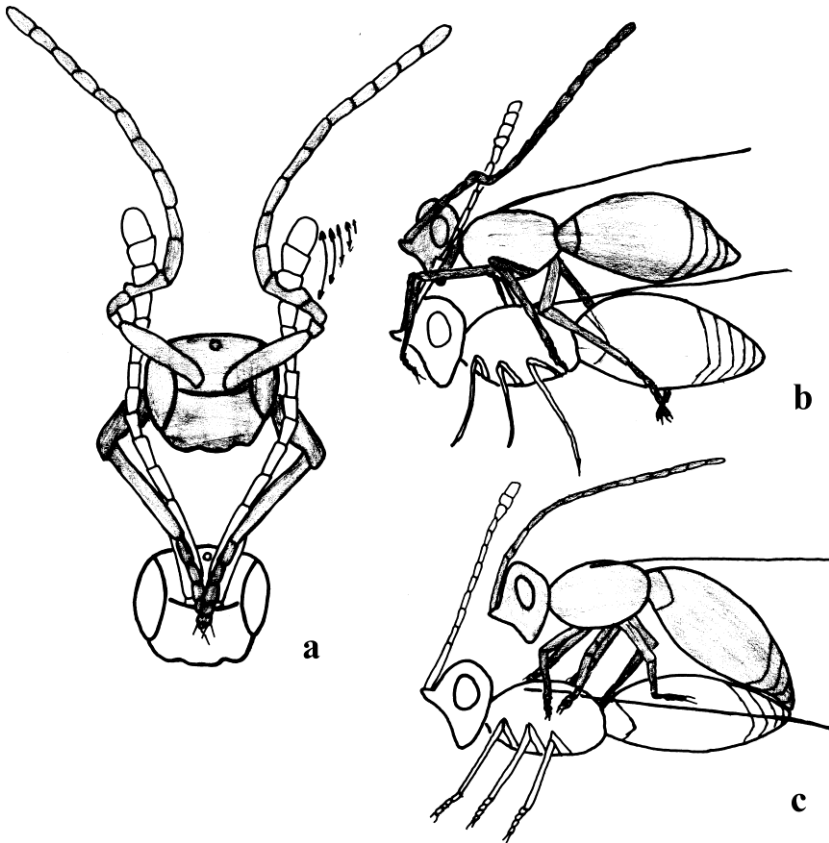


Figure 5. Courtship and mating in *T. sociabilis* (see text for explanations).

Post-copulation behaviour

The male cleaned his antennae using the forelegs, while the female cleaned her metasoma, especially its apex, using the hind legs.

Competition between males

During our observations we didn't notice “sneaky males” trying to copulate with the female whilst another male was performing courtship. The competition between males consists in fights, which take place during the courtship behaviour. Whilst one male is in courtship, another one or two try to take his place. The attack is concentrated especially on the fore legs and the antennae of the male in courtship and its purpose is to release the antennae of the female. If the attacker manages to release the female's antennae, usually the male in courtship is defeated. In *Nasonia vitripennis* “sneaky males” are able to copulate with females that are courted by another male (Jervis, 2005).

Competition between females

We didn't observe females fighting each other or females trying to disturb another female while in courtship or during oviposition.

Oviposition

One host pupae can be oviposited by more than one female (Fig. 6). In one case we observed one pupa being oviposited by seven females in the same time. The time for ovipositing is variable, being between 43 and 112 minutes. In some cases we observed the females ovipositing in two rounds. In one case the first round lasted 94 minutes; then the female pulled out her ovipositor, and after one minute introduced it back in the same place and continued ovipositing for another 18 minutes.



Figure 6. Two females of *T. sociabilis* simultaneously ovipositing in the same pupa.

Location of the parasitoids in the host pupae

Towards the end of their development the parasitoids occupy the entire body of the host pupae, which was almost entirely consumed (Fig. 7).

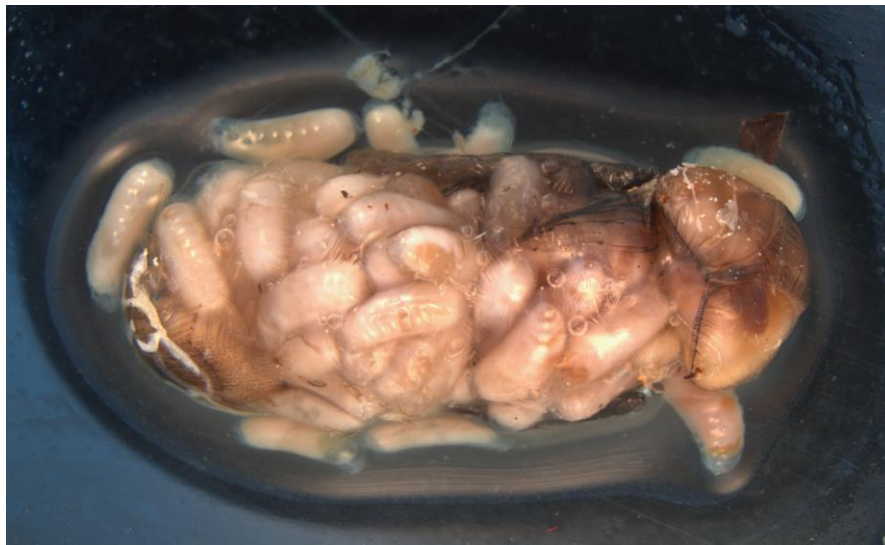


Figure 7. Immature individuals of *T. sociabilis* in the host pupa.

Acknowledgments

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HERPETOFAUNA FROM THE UPPER TOPOLOG RIVER BASIN (ROMANIA)

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Abstract. In the current paper we present our results from a herpetological survey that took place along one of the Southern Carpathians river systems. The survey was conducted over a period of two days in the summer of 2008 and in spring 2011 and a four-day period in the summer of 2013, following the upper course of the Topolog River and one of its tributaries, the Topologel stream. We documented ten species of amphibians (and one hybrid) and four species of reptiles, all except two, being previously recorded from the neighboring area. The “exceptions” are the Agile Frog (*Rana dalmatina*) and the Marsh Frog (*Pelophylax ridibundus*) which we observed in sites located in the lowermost areas.

Keywords: Southern Carpathians, herpetofauna, upper Topolog River.

Rezumat. Herpetofauna din bazinul superior al râului Topolog (România). În lucrarea de față prezentăm rezultatele unui studiu herpetofaunistic ce s-a desfășurat de-a lungul unui bazin hidrografic din Carpații Meridionali. Studiul de față a fost efectuat pe o perioadă de două zile în vara anului 2008 și primăvara anului 2011, și patru zile, în vara anului 2013, de-a lungul cursului superior al râului Topolog și al unuia dintre afluenții acestuia, pârâul Topologel. Am înregistrat zece specii de amfibieni (și o formă hibridă) și patru de reptile, toate cu excepția a două specii, fiind înregistrate în prealabil într-o zonă învecinată. “Excepțiile” sunt broasca roșie de pădure (*Rana dalmatina*) și broasca mare de lac (*Pelophylax ridibundus*), pe care le-am observat în zonele cele mai joase.

Cuvinte cheie: Carpații Meridionali, herpetofaună, cursul superior al râului Topolog.

Introduction

The Carpathian Mountains represent one of the most pristine ecosystems in Romania and probably of all Europe (Vološčuk, 2013). The Southern Carpathians host a large array of habitats, from the bold high peaks through the dense coniferous forests to the long and narrow corridors carved by rapids. Although gone are the days when access in this types of habitats was difficult, some areas of the Carpathian arch are still insufficiently known in terms of herpetofaunal distribution. The Southern Carpathians are no exception, although extensive herpetological data from the area exist (e.g. Fuhn, 1960; Fuhn & Vancea, 1961; Iftime *et al.*, 2009; Iftime & Iftime, 2006; 2007; 2010; 2011; 2013; Strugariu *et al.*, 2009), and an overall view over the distribution of herpetofauna in the Carpathian arch is emerging (Cogălniceanu *et al.*, 2013a; 2013b), more faunistical and long-term studies are needed in order to assess conservation priorities and make possible management activities that would counteract the loss and degradation of habitats.

The Topolog River is one of the tributaries of the Olt River, originating high up in the Făgăraș mountain chain. The uppermost reaches of its valley are comprised in the

Munții Făgăraș Site of Community Interest (ROSCI0122). For this reason, but also because of the known vulnerability of herpetofauna (e.g., Alford & Richards, 1999 for amphibians and Gibbons *et al.*, 2000 for reptiles) and because of the wide protective coverage of amphibians and reptiles by Romanian law, the knowledge of the herpetofauna of the Topolog basin has practical conservation importance.

The herpetofauna of the Topolog drainage basin is poorly studied – the recent review by Cogălniceanu *et al.* (2013b) lists three amphibian species: *Bombina variegata* (Linnaeus, 1758), *Bufo bufo* (Linnaeus, 1758), and *Rana temporaria* (Linnaeus, 1758) on the Topolog valley, all in the same point, while Cogălniceanu *et al.* (2013a,b) indicate the presence of 15 species of herpetofauna: *Salamandra salamandra* (Linnaeus, 1758), *Triturus cristatus* (Laurenti, 1768), *Lissotriton vulgaris* (Linnaeus, 1758), *Ichthyosaura alpestris* (Laurenti, 1768), *Bombina variegata* (Linnaeus, 1758), *Bufo bufo* (Linnaeus, 1758), *Hyla arborea* (Linnaeus, 1758), *Rana temporaria* (Linnaeus, 1758), *Pelophylax kl. esculentus* (Linnaeus, 1758), *Lacerta agilis* Linnaeus, 1758, *Podarcis muralis* (Laurenti, 1768), *Zootoca vivipara* (von Jacquin, 1787), *Anguis (fragilis) colchica* (Nordmann, 1840), *Natrix natrix* (Linnaeus, 1758) and *Vipera berus* (Linnaeus, 1758) in a similar habitat on the next valley to the East (the Argeș valley). Our observations from the Topolog River and Topologel stream conclude the first dedicated investigations of the upper Topolog basin.

Material and Methods

The present survey was conducted on the Topolog and Topologel valleys, in the central part of the Southern Carpathians (Sâna Mare – Mâzgavu – Culmea Marginii Mountains, southern cline of the Făgăraș massif). Data was collected on the 24th of August 2008, the 2nd of April 2011 and between the 3rd and 6th of July 2013, along a 30 Km path following the upper course of the Topolog River and one of its tributaries, the Topologel stream. Altitude of the studied area ranged from around 500 m A.S.L. to over 1500 m A.S.L. Taking into consideration the size of the area we collected data from 20 randomly selected sites (Table 1; Fig. 1). Mostly, the areas we investigated were temporary ponds, the rocky banks of the rivers, screes, areas covered with scrubs and the forest edge.

Live individuals were primarily identified via direct observation but some animals were captured by hand and subsequently released back into their habitats. Individuals of the *Pelophylax esculentus* complex were determined according to morphological and chromatic features described in the literature (e.g. Berger, 1966; 1973; Cogălniceanu *et al.*, 2000).

Results and Discussion

We documented ten species of amphibians: *Salamandra salamandra* (Linnaeus, 1758), *Triturus cristatus* (Laurenti, 1768), *Lissotriton vulgaris* (Linnaeus, 1758), *Ichthyosaura alpestris* (Laurenti, 1768), *Bombina variegata* (Linnaeus, 1758), *Bufo bufo* (Linnaeus, 1758), *Hyla arborea* (Linnaeus, 1758), *Rana dalmatina* (Fitzinger in Bonaparte, 1839), *Rana temporaria* (Linnaeus, 1758), *Pelophylax ridibundus* (Pallas, 1771), the kleptotaxon *Pelophylax kl. esculentus* (Linnaeus, 1758), and four species of reptiles: *Lacerta agilis* (Linnaeus, 1758), *Podarcis muralis* (Laurenti, 1768), *Zootoca vivipara* (von Jacquin, 1787), and *Vipera berus* (Linnaeus, 1758) (Figs. 2, 3). According to the data we collected, the most common amphibian species in the area was *Bombina variegata*, found in ten of the twenty sites, while the most widespread reptile species being *Zootoca vivipara*, with presence in six of the twenty sites investigated (Table 1).

Table 1. Site records for the amphibian and reptile species identified on the Topolog river basin during the present survey; sites numbers correspond to the ones from Figure 1.

Investigated site no.	Coordinates	Habitat type	Species found
1	45°16'7.57" N 24°31'19.1" E	Deep, permanent ponds with alder thickets in mixed deciduous forest	<i>Lissotriton vulgaris</i> , <i>Bufo bufo</i> , <i>Rana dalmatina</i> , <i>Rana temporaria</i> , <i>Pelophylax ridibundus</i> , <i>Pelophylax kl. esculentus</i> , <i>Lacerta agilis</i>
2	45°20'7.66" N 24°30'50.6" E	Mixed deciduous forest, small ponds	<i>Salamandra salamandra</i> , <i>Rana temporaria</i>
3	45°16'9.71" N 24°30'45.5" E	Mixed deciduous forest, small ponds	<i>Lissotriton vulgaris</i> , <i>Rana dalmatina</i> , <i>Rana temporaria</i>
4	45°21'0.69" N 24°30'44.0" E	Mixed deciduous forest, small ponds	<i>Lissotriton vulgaris</i> , <i>Rana temporaria</i>
5	45°19'57.1" N 24°30'8.55" E	Pond at village edge	<i>Bufo bufo</i>
6	45°21'9.89" N 24°30'26.4" E	Mixed deciduous forest, small ponds	<i>Triturus cristatus</i> , <i>Ichthyosaura alpestris</i> , <i>Bombina variegata</i> , <i>Hyla arborea</i> , <i>Podarcis muralis</i>
7	45°21'38.06" N 24°30'5.75" E	Limestone rocks	<i>Podarcis muralis</i>
8	45°23'11.4" N 24°30'16.7" E	Beech forest with clearings and small ponds	<i>Bombina variegata</i> , <i>Rana temporaria</i> , <i>Lacerta agilis</i> (including <i>erythronotus</i> morph)
9	45°26'37.07" N 24°28'48.1" E	Beech forest	<i>Rana temporaria</i>
10	45°27'26.49" N 24°28'58.9" E	Mixed beech-spruce forest	<i>Zootoca vivipara</i>
11	45°33'34.34" N 24°32'10.68" E	Semi-open area with deciduous shrubs, rocks and logs	<i>Bombina variegata</i> , <i>Bufo bufo</i> , <i>Rana temporaria</i> , <i>Podarcis muralis</i> , <i>Zootoca vivipara</i> , <i>Vipera berus</i>
12	45°27'44.82" N 24°28'47.28" E	Temporary ponds in concrete remains – open area	<i>Ichthyosaura alpestris</i> , <i>Bombina variegata</i>
13	45°27'36.40" N 24°29'4.20" E	Temporary ponds and ditches with water	<i>Bombina variegata</i>
14	45°27'53.46" N 24°30'29.95" E	Temporary ponds and ditches with water	<i>Salamandra salamandra</i> , <i>Bombina variegata</i>
15	45°28'31.73" N 24°31'28.42" E	Semi-open, swampy area with temporary ponds, scattered rocks and logs	<i>Bombina variegata</i> , <i>Bufo bufo</i> , <i>Rana temporaria</i> , <i>Zootoca vivipara</i>

Investigated site no.	Coordinates	Habitat type	Species found
16	45°30'29.52" N 24°31'3.61" E	Temporary ponds and ditches with water	<i>Bombina variegata</i> , <i>Zootoca vivipara</i>
17	45°30'52.85" N 24°30'42.66" E	Temporary ponds and ditches with water	<i>Bombina variegata</i>
18	45°31'32.52" N 24°31'24.60" E	Semi-open area with permanent ponds and scattered logs	<i>Rana temporaria</i> , <i>Zootoca vivipara</i>
19	45°32'33.90" N 24°32'15.18" E	Temporary ponds and ditches with water	<i>Bombina variegata</i> , <i>Rana temporaria</i> , <i>Zootoca vivipara</i>
20	45°32'45.49" N 24°32'8.12" E	Open rocky area with shrubs	<i>Vipera berus</i>

The faunistical list resulting from our data closely mirrors the herpetofauna of the next valley to the east, the Argeş valley, matching the old record of *Hyla arborea* from the Argeş and adding those of two ranid species, *Rana dalmatina* and *Pelophylax ridibundus*, but lacking the Slow-worm (*Anguis (fragilis) colchica*) and the Grass Snake (*Natrix natrix*), which are found on the Argeş. The habitat is, however, favourable for these two species, and we consider that they may be present in the Topolog valley as well, being missed by our survey because of the short time available for detection. Also, comparing the herpetofauna of the Topolog valley to that of its western neighbour, the Cozia massif (for which see Iftime & Iftime, 2006; 2007), we may notice that some thermophilic species (e.g. *Darevskia praticola*, *Vipera ammodytes*) present in Cozia were not found on the Topolog. However, *Rana dalmatina*, which is frequent in Cozia, was also found here; we express the opinion that the colubrid species *Zamenis longissimus*, *Coronella austriaca*, and *Natrix tessellata*, which are found in Cozia, may also occur in the Topolog valley.

The herpetofaunal assemblage of the Topolog basin is typical for the montane and submontane Carpathian areas. We can also note a clear altitudinal distribution, with less cold-tolerant species such as *Rana dalmatina*, *Pelophylax ridibundus*, and *P. kl. esculentus* concentrated in the lower reaches of our investigated area, while the uppermost stations only harbour typical montane species such as *Bombina variegata*, *Rana temporaria*, *Zootoca vivipara*, and *Vipera berus*.

Conclusions

Our survey indicates the presence of ten species of amphibians (plus one hybrid form) and four species of reptiles on the Topolog and Topologel valley; however, our observations show the habitats along this river system to be suitable for other reptile species which are found in nearby areas. A more thorough, and long-term, study is needed to construct the full picture of the distribution of the herpetofauna in the area, in order to elaborate measures for their protection.

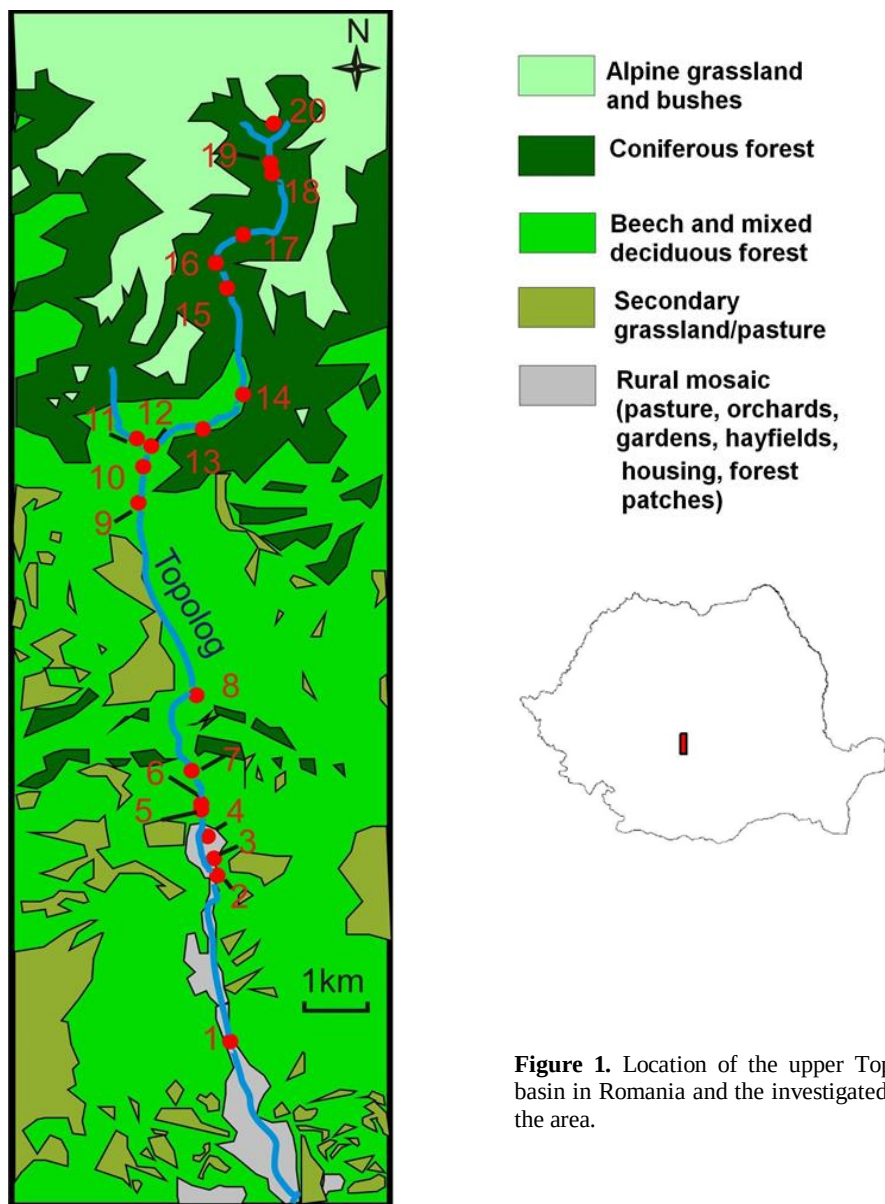


Figure 1. Location of the upper Topolog river basin in Romania and the investigated sites from the area.

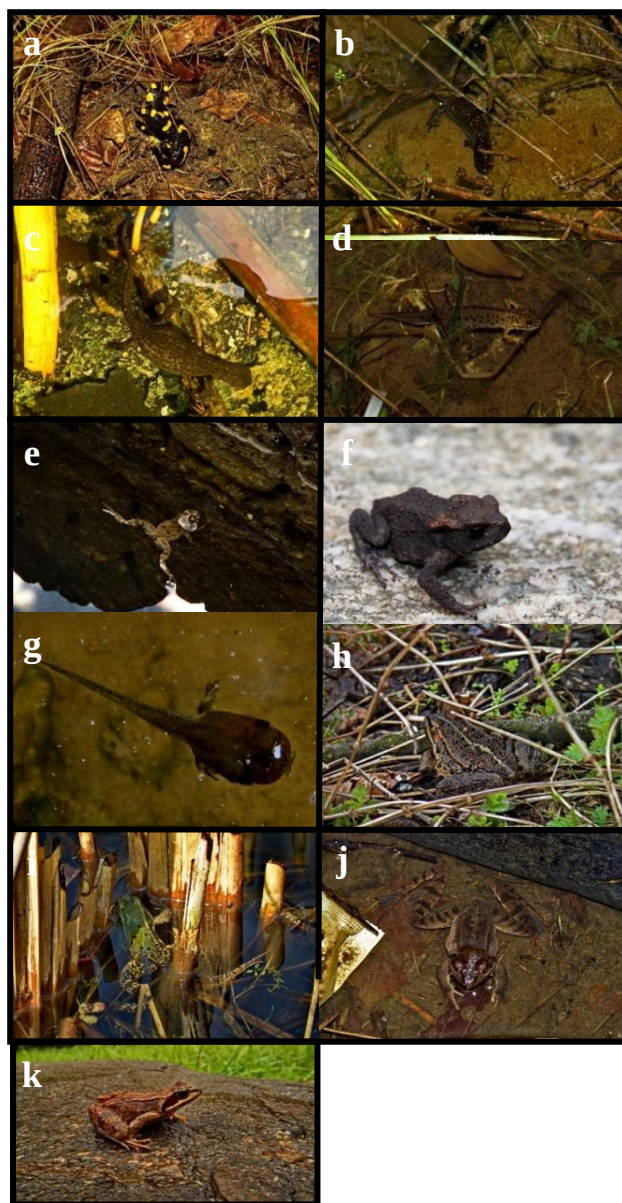


Figure 2. Specimens of amphibian and reptile species identified on the upper Topolog river basin: a. *Salamandra salamandra* photo P.C. Dincă; b. *Triturus cristatus*, photo Al. Iftime; c. *Ichthyosaura alpestris* photo P.C. Dincă; d. *Lissotriton vulgaris*, photo O. Iftime; e. *Bombina variegata* photo P.C. Dincă; f. *Bufo bufo* photo P.C. Dincă; g. *Hyla arborea*, larva, photo Al. Iftime; h. *Pelophylax ridibundus*, photo Al. Iftime; i. *Pelophylax kl. esculentus*, photo O. Iftime; j. *Rana dalmatina*, photo O. Iftime; k. *Rana temporaria* photo P.C. Dincă



Figure 3. Specimens of reptiles species identified on the upper Topolog river basin: a. *Lacerta agilis*, common colour morph, photo Al. Iftime; b. *Lacerta agilis*, *erythronotus* colour morph, photo O. Iftime; c. *Podarcis muralis* photo P.C. Dincă, d. *Zootoca vivipara* photo P.C. Dincă, e. *Vipera berus*, photo P.C. Dincă.

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HABITAT SELECTIVITY OF SYMPATRIC TAWNY OWL (*STRIX ALUCO*) AND URAL OWL (*STRIX URALENSIS*) IN HILL FORESTS FROM NORTH-EASTERN ROMANIA

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Abstract. Although the ecology of Ural and Tawny Owl is well known, there are several aspects regarding ecological interaction between species that are not fully understood. The interactions between Ural and Tawny Owl are considered to be mostly as interference competition. In order to see if there is a niche differentiation regarding habitat among the two competitive we calculate habitat selectivity of the two species, using the Manley's Standardized Habitat Selection Index. The study area is represented mostly by broadleaf forests at altitude situated between 200 and 450 m asl. The habitat categories were taken accordingly to forest tree ages and forest consistency. We have noticed a segregation between the two *Strix* species regarding glades with old trees or group of old trees situated at least 25 m apart from each other. Thus, with a habitat selectivity index $W_i = 2.12$, Ural Owl have an affinity towards it, while Tawny Owl seems to avoid ($W_i = 0.69$). Both species seems to have an affinity towards old forests (tree ages greater than 81 years), higher in the case of Tawny Owl ($W_i = 2.87$), while medium age forests (41-80 years) are used proportionally to its availability. Our study proves that there is a segregation regarding habitat type concerning glades with old trees, probably as a result of the exclusion Tawny Owl by larger Ural Owl from this type of habitat, forcing it to refuge to medium age forests, but since both species can be found in Old forests, some questions regarding competitive exclusion in these areas rises.

Keywords: Tawny Owl, Ural Owl, habitat selectivity, interference competition, competitive exclusion.

Rezumat. Selectivitatea habitatelor în cazul speciilor simpatrice huhurezul mic (*Strix aluco*) și huhurezul mare (*Strix uralensis*) în pădurile de deal din nord-estul României. Deși ecologia speciilor *Strix uralensis* și *Strix aluco* este bine cunoscută, există anumite aspecte, în ceea ce privește interacțiunile ecologice dintre specii, care nu sunt complet cunoscute. Interacțiunile dintre huhurezul mare și cel mic sunt considerate a fi interacțiuni de competiție de interferență în mare parte. Pentru a vedea dacă există o diferență de nișă în ceea ce privește habitatul celor două specii aflate în competiție, s-a calculat selectivitatea habitatului a celor două specii, utilizând indicele Manley standardizat de selecție a habitatului. Aria de studiu este reprezentată în mare parte din păduri de foioase aflate la altitudini între 200 și 450 m. Habitatetele au fost categorisite în funcție de vârsta și structura pădurilor. Am observat o segregare a celor două specii în cazul răriștilor de pădure cu copaci sau grupuri de arbori bătrâni situați la cel puțin 25 m distanță unul de celălalt. Astfel, cu un index de selectivitate de habitat $W_i = 2,12$, huhurezul mare are o afinitate față de acestea, pe când huhurezul mic încearcă să le evite. ($W_i = 0,69$). Ambele specii par a avea o afinitate față de pădurile bătrâne (cu arbori mai bătrâni de 81 de ani), o afinitate mai mare în cazul huhurezului mic ($W_i = 2,87$), pe când pădurile de vârstă medie (41-80 ani) sunt folosite în proporția disponibilității lor. Studiul de față demonstrează ca există o segregare referitor la tipul de habitat în ceea ce privește poienile cu copaci bătrâni, probabil ca rezultat al excluderii huhurezului mic de către cel mare din acest tip de habitat, forțându-l să se refugieze în pădurile de vârstă medie.

Cuvinte cheie: huhurez mic, huhurez mare, selectivitate de habitat, competiție de interferență, exclusie competitivă.

Introduction

Although the ecology of Ural and Tawny Owl is well known, there are several aspects regarding ecological interaction between species that are not fully understood (König *et al.*, 2008).

Tawny Owl is commonest species of owl in Central Europe (König *et al.*, 2008). It breeds in semi-opened deciduous forests with clearings, riverine forests, parks and larger gardens with mature trees, open landscapes with wooded patches, and avenues of trees in open farmland (Mikkola, 2012). In Romania it has a wide distribution in most of the forested areas (Munteanu *et al.*, 2002). Ural Owl on the other hand is a larger species that has a northern area of distribution ranging from Scandinavia, across Asian taiga, all the way to Japan. There are several populations across Alps, Carpathians and Dinaric Alps (König *et al.*, 2008). In Romania, the main population is situated in Carpathians (Munteanu *et al.*, 2002), but we have found the species in hill forests in north-eastern part of the country (Moldova Region).

According to distribution map (Mikkola, 2012), the species mostly live in allopatry, but in several areas, including our own, they are sympatric.

Competition is known to be one of the main interactions in animal world (Odum, 1971). There are three main types of competition regarding the mechanisms though they manifest (Pianka, 1981): (1) Interference competition, manifested directly between individuals via aggression; (2) Exploitation competition, manifested indirectly through a common limiting resources which acts as an intermediate and (3) Apparent competition, also manifested indirectly between two species which are both preyed upon the same predator.

The interactions between Ural and Tawny Owl are considered to be mostly as interference competition (König *et al.*, 2008), although in some areas there is proof that the species are not competitors at all (Stürzer 1998).

The Gause's law of competitive exclusion indicates that two species competing for the same resources cannot coexist if other ecological factors are constant (Begon *et al.*, 1996). Two competing species coexist in a stable environment only after the differentiation of their niches (Begon *et al.*, 1996).

The three most fundamental niche dimensions for partitioning of the environmental resources by animals are (1) activity time, (2) food selection and (3) habitat use (Pianka, 1981; Schoener, 1974).

Both Tawny and Ural Owl are nocturnal species, although, the last one can sometimes hunt during the day also (Korpimäki, 1986). Regarding the food selection, most studies show a similarity between the two species (Korpimäki, 1986; Lundberg 1980). This leaves one's concluding that the differentiation niche is done at a habitat selectivity level. The studies in Slovenia (Vrezec, 2003; Vrezec & Tome, 2004) show an altitudinal segregation of the two species, while in Sweden it is a habitat segregation (Lundberg, 1980). The study made in Sweden is different though, due to the fact that in that case the Ural Owl and Tawny Owl are parapatric. Since in the studied area the altitude variation is low, only 250 m, the altitude segregation is not a factor to be considered. Thus, we tested the habitat type segregation by calculating habitat selectivity of the two species, using the Manley's Standardized Habitat Selection Index (Manley *et al.*, 1993).

Material and Methods

The study area is situated in the North-Eastern part of Romania, in Moldova region in Iași County (Fig. 1). We have selected two large forests (Bîrnova, 47° 01'N, 27°39'E and Mădărjac, 47°06'N, 27°17'E), situated in a hilly landscape, both Natura 2000 sites. Altitudes ranging from 200 to 450 m asl. The main forest vegetation is represented by Beech (*Fagus*

sylvatica) forests, along with *Carpinus* sp., *Quercus* sp., *Tilia* sp., *Acer* sp., *Fraxinus* sp., and in some areas small patches of plantations of *Pinus sylvestris* and *Picea abies*. The habitat types included in Natura 2000 SCI from the studied area are the following: 91Y0 Dacian Oak -Hornbeam Forests, 9130 *Asperulo-Fagetum* Beech Forests, 9170 *Galio-Carpinetum* Oak-Hornbeam forests, along with small patches of 92A0 *Salix alba* and *Populus alba* galleries (Doniță *et al.*, 2005; Bădăraș, 2013). The age of the forest varies from young and very young ones (5-20 years) to ancient ones (over 140 years). The forests are relatively compact, covering about 40481 ha. The anthropic impact is low, with few small localities at the edge of the study area.

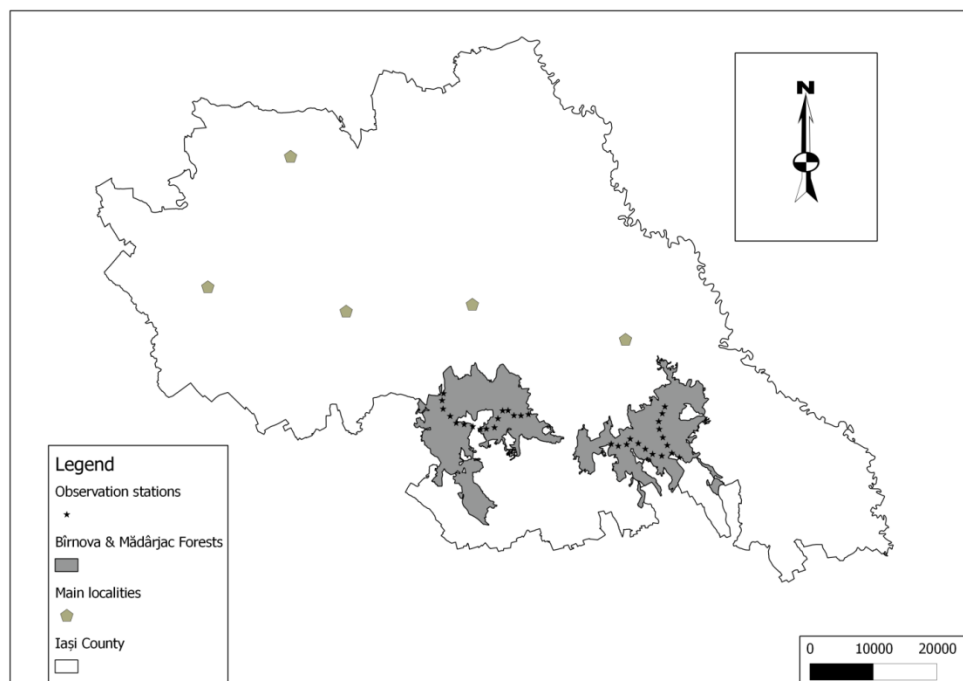


Figure 1. Study area and observation stations.

The data was collected in the period of 2011-2012, during the spring and autumn, using playback method (Bibby *et al.*, 1992). We have selected 32 observation stations, 16 for each forest (Fig. 1). The observation stations were situated at a distance of 1.5 km one from each other. For each station, we considered a buffer area of 750 m radius from the observation point in which birds can be acoustically detected. Thus, we have covered 15% from Bîrnova forest's surface and 12 % from Mădărjac forest. At each observation station, we played using an Mp3 player and a megaphone, specific sounds of Tawny Owl males for a period of 2 minutes, followed by a period of 5 minutes in which we waited for response in silence from the target species. After this we repeated the playback experiment with Ural Owl. We appreciated the distance and direction of owl response, and we mapped the location. The experiments were conducted monthly during March, April, May and August, September and October of 2011 and 2012. The playback experiments were conducted in

good weather conditions, in nights without wind or precipitations, starting half an hour after sunset. We have conducted also several field trips in the buffer areas to gather data regarding habitat conditions. The data gathered regarding forest age especially was correlated with maps of forest planning and geo-referenced aerial pictures of the forest. We mapped the buffer area of each station by habitat type, using Quantum GIS, Version 1.8.0 software. The forest habitats were classified by tree age and forest consistency. Thus, we divided the forest habitats in 5 classes: undergrowth (thicket of trees younger than 20 years), young forest (age between 21 and 40 years old), mature forest (41-80 years old), old forest (above 81 years old), and glades (trees or group of trees older than 81 years, separated by at least 25 meters one from each other). The other types of habitat include open pastures, anthropic and open orchards, but there were not taken in consideration in this study because there was no data regarding the presence of the species in these habitats.

We used Manley's Standardized Habitat Selection Index (W_i) (Manley *et al.*, 1993). The index is based on the selection ratio W_i , which is the proportional use divided by the proportional availability of each type of habitat.

$$W_i = u_i / a_i$$

where:

u_i = proportion of the sample of used resource units in category i or frequency of sightings.

a_i = proportion of available resource units in category i or landscape / habitat area.

A W_i value larger than 1 indicates a positive selection for the resource and a value less than 1 indicates avoidance of the resource. A value around 1 indicates that the resource was used proportionally to its availability and no resource selection was noted.

Results and Discussion

Our study covered a surface of 56.52 km², out of which 48.24 km² represents forestry habitats. The largest surface was represented by medium aged mature forests (44.22%, Tables 1, 2), followed by young one (20.34). The poorest represented class was glades (6.15%) and undergrowth (4.73%). During the study we had 400 observations of Tawny Owl (Table 1) and 46 observations of Ural Owl (Table 2). The Manley's Standardized Habitat Selection Index W_i values for both species are different for each habitat type. Thus, in the case of Ural Owl, W_i value was largest for glades of old trees ($W_i = 2.12$), indicating a strong positive selection towards these habitats, while the lowest value was for young forest ($W_i = 0.64$) and undergrowth ($W_i = 0$), clearly an avoidance of the species towards them. In the case of Tawny Owl, the largest affinity towards habitat type was registered in the case of old forests ($W_i = 2.87$), while the lowest towards glades with old trees ($W_i = 0.69$ and undergrowth ($W_i = 0.37$)).

The competition between two ecological similar species like in the case of the two sympatric Ural and Tawny owl determines in our study area the differentiation of their niches (Begon *et al.*, 1996). Our study proves that in the region, the two species prefer habitats with different characteristics. The studies of the two species in the Dinaric Alps (Vrezec & Tome, 2004) proved that the segregation between species is done by altitude. We, on the other hand proved that if the altitude is not a factor to be considered, due to low amplitude, the segregation is done by different habitat type, much as in Fennoscandia (Lundberg, 1980; Korpimäki, 1986).

Tabel 1. Manley's Standardized Habitat Selection Index for Tawny Owl.

Habitat type	Undergrowth (age < 20 years)	Young forest (age 21–40 years)	Mature forest (41-80 years)	Old forests (> 81 years)	Glades with trees separated by at least 25 m one from each other (> 81 years)
Habitat area (m ²)	2671204	11494515	24995653	5604616	3476960
Total covered habitat area (m ²)	56520000	56520000	56520000	56520000	56520000
a _i	4.73	20.34	44.22	9.92	6.15
Number of individuals observed in habitat	7	61	196	114	17
Total number of individuals observed	400	400	400	400	400
u _i	1.75	15.25	49	28.5	4.25
W _i	0.37	0.75	1.11	2.87	0.69

Tabel 2. Manley's Standardized Habitat Selection Index for Ural Owl.

Habitat type	Undergrowth (age < 20 years)	Young forest (age 21–40 years)	Mature forest (41-80 years)	Old forests (> 81 years)	Glades with trees separated by at least 25 m one from each other (> 81 years)
Habitat area (m ²)	2671204	11494515	24995653	5604616	3476960
Total covered habitat area (m ²)	56520000	56520000	56520000	56520000	56520000
a _i	4.73	20.34	44.22	9.92	6.15
Number of individuals observed in habitat	0	6	27	7	6
Total number of individuals observed	46	46	46	46	46
u _i	0	13.04	58.7	15.22	13.04
W _i	0	0.64	1.33	1.53	2.12

Thus, we found that The Ural Owl shows a high preference for glades with trees or group of trees older than 81 years, separated by at least 25 m one from each other. This type of habitat, due to its tree ages, provides good nesting places for the species. These are represented by large tree holes, cavities left by large broken-off branches, hollow trunks

where canopy has been broken (“chimney stacks”), old stick nests of larger birds such as Northern Goshawk (*Accipiter gentilis*) or buzzards (*Buteo* sp.) (König *et al.*, 2008). We consider that another reason why the species would have such a large affinity towards this habitat is connected with food habits. Both species are opportunistic forregers (Kociuba, 2012; Lesiński, 2010). Although the food niche of the two species overlaps most in Fenoscandia, the Ural Owls can feed on larger preys than the Tawny Owl (Korpimäki, 1986), due to its larger body size and talons (Mikkola, 1981). Thus, we can only presume that in these glades there is a greater diversity of prey, such as larger rodents or birds, than in the more young closed forests. Also, compared to Tawny Owl, the predation risk by diurnal raptors such as Northern Goshawk is low, the species being capable of hunting and perching in more open areas.

The ecological importance of these habitats, with large old trees and decaying wood is undeniable (Peterken, 1996; Fuller, 1995). Thus, according to the theory of ecological dominance in relation to the body size (Brown & Maurer, 1986), which states that the larger species is a superior competitor and smaller one an inferior one, one can conclude that Ural Owl out-competes the Tawny Owl in this habitat type.

One problem arises when we analyse the selectivity for old forest habitat type. The both species of owls seems to have a high affinity towards this habitat type, the largest value of W_i being in the case of Tawny Owl ($W_i = 2.87$). Considering the fact that this habitat also provides good nesting places and has a rich diversity of prey, the question of why the superior competitive Ural Owl does not shows a larger selectivity towards it arises. One possible explanation is the small population size of the species compared to Tawny Owl in the studied area, showing the need for further studies in the area.

Both species seems to use medium forests proportionally to its availability, while young forest and undergrowth are clearly avoided ($W_i > 1$) (Fig. 2). This is probably because of poor nesting opportunities, lower prey diversity and difficulty to hunt in thick undergrowth areas.

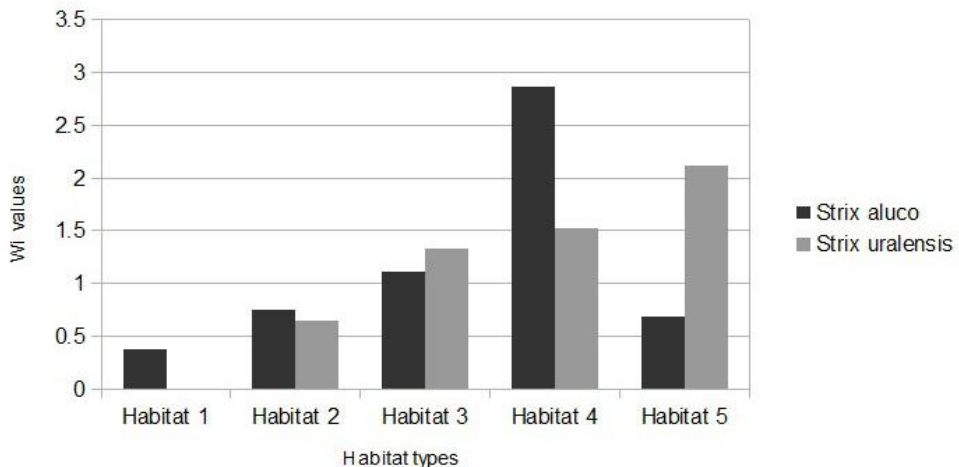


Figure 2. Manley's Standardized Habitat Selection Index for Ural and Tawny Owl. Habitat 1: undergrowth; Habitat 2: young forest; Habitat 3: mature forest; Habitat 4: old forest; Habitat 5: glades with old trees.

Conclusions

The Manley's Standardized Habitat Selection Index W_i values for both species are different for each habitat type. Thus, we found that The Ural Owl shows a high preference for glades with trees or group of trees older than 81 years, separated by at least 25 m one from each other, while Tawny Owls seems to avoid them.

Both species seems to use medium forests proportionally to its availability, while young forest and undergrowth are clearly avoided. Our study proves that there is a segregation regarding habitat type concerning glades with old trees, probably as a result of the exclusion Tawny Owl by larger Ural Owl from this type of habitat, forcing it to refuge to medium age forests, but since both species can be found in Old forests, some questions regarding competitive exclusion in these areas rises. Thus, there is still a need for further investigation concerning the ecological hierarchy of these species in the study area.

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ETHOLOGICAL STUDY OF THE ROOK (*CORVUS FRUGILEGUS* L.) IN THE WILD AND IN SEMI-CAPTIVITY

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Abstract. The aspects under study in this paper refer to reproductive activity, feeding, roosting, behaviour of the rook in nature and in circumstances of semi-captivity. In Tătărași (Iași), starting with spring 2011 we carried out observations in 10 rook nests, focusing on the following aspects: copulation, laying the eggs, incubation, hatching, post-embryonic development and fledging. In 2010, we experimentally kept 5 fledglings in semi-captivity and we fed them with a varied diet, following their eating preferences. We've already mentioned this experiment in the 57 issue of Scientific Annals of “Alexandru Ioan Cuza” University of Iași. Many fledglings starve in case of falling off the branch, because parents usually stop providing them food. Only healthy individuals are taken care of. As an element of scientific novelty in the spring of 2012 we have recorded for the first time a case in which the parents adapted to the youngster's weak flying abilities by feeding it in the lower part of the tree.

Keywords: behaviour, pairs, food, insects, field.

Rezumat. Studiu etologic despre cioara de semănătură (*Corvus frugilegus* L.) în natură și în semicaptivitate. Aspectele abordate în prezenta lucrare sunt: activitatea de cuibărit, hrănirea, înnoptarea, comportamentul ciorii de semănătură în natură și în condiții de semicaptivitate. În Tătărași (Iași), începând cu primăvara anului 2011, am efectuat observații la 10 cuiburi de cioară de semănătură pentru a surprinde: copulația, depunerea ptei, incubția, ecloziunea puilor, dezvoltarea postembrionară și emanciparea puilor. În anul 2010 am crescut experimental, în captivitate, 5 pui zburători, pe care i-am hrănit variat, urmărindu-le preferințele alimentare. Referirile la experimentul în cauză apar în tomul 57 al Analelor Științifice ale Universității „Alexandru Ioan Cuza” din Iași. Puii zburători căzuți de pe ramuri mor de foame, în cele mai multe cazuri, întrucât părinții de regulă nu-i mai hrănesc. Doar exemplarele sănătoase sunt îngrijite. Ca un element de noutate științifică, în primăvara anului 2012 am înregistrat pentru prima dată adecvarea la semnalele unui pui cu capacitate slabă de zbor a răspunsului parental – hrănirea sa în porțiunea bazală a coronamentului.

Cuvinte cheie: comportament, perechi, hrană, insecte, câmp.

Introduction

The rook is a sinantropic bird which finds its food and roosting or breeding ground in the vicinity of cities or towns. The biological cycle of the rook was recorded in the colony in Tătărași district (Iași), and the aspects under observation were: pair-bonding, building the nest, copulation, duration of laying the eggs, duration of incubation, post embryonic development and young fledging. The rehabilitated young birds interact well with humans, which makes it possible to raise them in semi-captivity.

Material and Methods

Rook data, gathered in the study area, have been synthesized in a report and supported by images. In order to take fixed images and films we used a digital camera Fujifilm FinePix HS20EXR, a digital video recorder Panasonic SDR-H80 SD/HDD, together with a tripod T nB FTDC034880. The ethologic observations at the breeding place were carried out from block terraces on Vasile Lupu Street (Iași). The study of the feeding

activity was carried out primarily on Bahlui alluvial field (Iași). In order to study the rook roosting behaviour we carried out observations on Carol I Avenue and in “Anastasiu Fătu” Botanical Garden of Iași.

Results and Discussion

The breeding activity starts with territorial fights between the members of the colony. The individuals dispute the nests by attempts at mutual intimidation, manifested through shrieks and pinching (Fig. 1).



Figure 1. Battle between adults for occupying an old nest (original).

The behaviours which is important in the formation of the pairs is the courtship-feeding (Fig. 2).



Figure 2. Food transfer between mates (original).

After the pairs are formed, the rooks begin building the nest, mating and defending their territory. In spring, in March or April, rooks build or repair their old nests. They use tree branches (Fig. 3), grass, dirt, feathers as materials. The nest-building activity is marked by food-begging calls from the female. These acoustic signals are associated only with breeding (Perrins & Cramp, 1998). The finalization of the nest building usually takes place in the second decade of March.



Figure 3. Nest building from vegetable material (original).

In view of copulation, the male attracts the female by means of a series of movements – bowing, opening the wings, tail-fanning, advancing towards the female. The female's sexual responsiveness may be deduced from a combination of gestures – shaking the tail and opening the wings. The copulation lasts for 10 to 13 seconds, in which time the male vigorously flaps his wings (Perrins & Cramp, 1998). The courtship display followed by copulation is possible in trees (Fig. 4) or on the ground (Fig. 5).



Figure 4. Courtship displayed in the canopy (original).



Figure 5. Courtship displayed on the ground (original).

The female lays the first egg a few days after finishing the nest, in the reclining part of the nest (Fig. 6). The number of the eggs may vary between 1 and 6. In case of destruction of the initial clutch, the female may lay a new series of a maximum of 3 eggs(replacement clutch). Incubating the eggs lasts 16 to 18 days and the female begins to transfer heat to the clutch after laying the first 2 eggs. The female food-begging calls are usually more intense after laying the eggs.



Figure 6. Freshly laid egg (original).

Hatching takes place along 2-3 days. The egg shells are partly eaten by the female after hatching and later removed from the nest. In 2011, from a total of 18 eggs distributed among 5 nests, the first chicks to hatch did so on April 20th.

The male brings food to the family, helps sanitize the nest and defend the chicks. While the nest is being used, parents feed chicks invertebrates, fruit and cereal grain. 40 days after the hatching the young birds leave the nest, but stay in the care of the parents for other 5-6 weeks (Perrins & Cramp, 1998).

In the first few days after leaving the nest, the fledglings can only fly for short distances and receive food from their parents in the canopy. The typical sounds for food requirement are high pitched, long and slightly shaky. Any young falling to ground are ignored and therefore doomed (Cătuneanu, 1953; Røskaft & Slagsvold, 1985; Perrins & Cramp, 1998). However, we have recorded a case in which the parents adapted to the fledgling's weak flying abilities by feeding it in the lower part of the canopy (Fig. 7). The analyzed parental behaviour was carried out in unusual conditions, which constitutes an element of scientific novelty. In Tătărași colony we observed 21 chicks (distributed in 16 nests) out of which only 11 reached fledging.

Once the development of the plumage is completed, flights above fields and plantations of seasonal fruit trees (cherry trees, mulberry trees) start. In such places parents teach the fledglings how to get food and feed them at the same time. Both parents look after the youngsters after they start flying (Fig. 8).

The rook displays a gregarious way of life all through the year (Perrins & Cramp, 1998). In the cold season and at the beginning of spring it joins bevvies with the jackdaw (Fig. 9).



Figure 7. Fledgling rook perched in the lower part of the canopy (original).



Figure 8. Family group on the feeding ground (original).



Figure 9. Rooks and jackdaws feeding in a mixed flock, in Tătărași district (original).

The rook beavies use the tree branches and the roofs or terraces of buildings to roost. During breeding season, rook males look for food alone or in small groups. In summer, after the flight from the colony, the youngsters join their parents to the feeding grounds, where they will follow until the end of summer. In autumn, youngsters are separated from adult population. They make pairs during the first autumn and are ready to breed after 2 years old. These birds usually spend their day in open spaces, and in the evening come to the roosts after a series of curvatures above the trees. In December 8th, 2010 we noticed a concentration of over 80 individuals in a feeding ground in Tătărași district.

In Iași, there are winter roosts in several areas: next to Prefectura, in a square of plane trees, in the “Titu Maiorescu” student campus and its surroundings towards the west, in the Grădina Copou, in the lime trees along Carol I Avenue, in the southern sector of the Botanical Garden and in Păcurari district. In the agglomerations formed on trees at night, one can notice a vertical stratification of the birds according to age (Cramp & Perrins, 1994). The adults occupy the upper and the youngsters occupy the lower part of the tree.

The species under study expresses alarm in different ways, when it is scared or disturbed. Panic at meeting man within its feeding grounds is expressed by means of precipitated gestures such as running, grabbing and throwing food, displaying open beak and fanned tail, at the same time as emitting alarm calls. In case the nest is disturbed, the rooks emit alarm calls and hit the branches with their beak at the same time (Stănescu, 1973). Simulations of in-flight attacks are observed when a predator enters the territory. When a carnivore (a cat for example) comes within the range of a fledgling, adults automatically highlight the warning behaviour. In trees, squirrels are driven away with warning sounds. The rook is usually cautious about human contact, but allows close observations from humans in winter when it has limited access to food.

During breeding season the pairs of the long eared owl (*Asio otus*) look for the breeding grounds of rooks and drive away the birds they meet in the nests. The rook emits warning signals in such situations and usually leaves the nest. At the same time, the rook swells its feathers and simulates attacks in the direction of the intruder (Fig. 10). When eggs are laid by the long eared owl, its activity of looking for nests stops and the two species of birds cease interacting. Rook nests used by the long eared owl have been found in five breeding grounds in Iași city.



Figure 10. The alarm posture adopted at meeting long-eared owl (original).

Behaviour of rehabilitated fledglings

Looking after fledglings may be carried out in an outdoor aviary, on a balcony or in an open space with natural vegetation shade. The rehabilitated youngsters are easily tamed and recognize their care taker, even when raised in open spaces (Fig. 11). They have to be hand reared for a very long time, until their second moult (August), when they become able to feed themselves.



Figure 11. Young rook raised in semi-captivity (original).

In ethologic experiments carried out on rehabilitated youngsters, we noticed the decreasing dependence on the care taker as the moult process advances. The decrease of food begging in the *Corvus frugilegus* youngster at the stage of immature plumage development is an original fact observed by us.

Generally speaking, birds prefer to perch on the upper part of the canopy or buildings, where they feel safe. They take their first flying exercises on short distances, and later they learn the spatial landmarks of the raising ground and will explore neighbouring areas too. In order to follow their kind in the wilderness, they emit sounds and execute curvatures in order to evoke the start of the journey. In nature fledglings raised by parents receive insects hunted in the field (for example crickets), as is fit for the need of food based on animal protein. We fed the 5 fledglings kept in semi-captivity in 2010 with a varied diet, following their eating preferences. Meat was preferred to eggs and cheese. Among insects, they preferred orthopters. Of vegetarian food, they chose green beans, oat flakes, a series of fruit and vegetables and did not refuse mushrooms either. They displayed great pleasure in eating walnuts.

Conclusions

In the hot season, the rook finds food (insects and seeds) in the alluvial plain of rivers.

Forming bebies to search for food starts in summer, after the young flies from the nest. Generally speaking, juveniles form smaller bebies than adults. The rook associates with the jackdaw in all seasons.

When roosting, adults occupy the upper parts of the tree, whereas the youngsters stay in the lower parts.

Defence from the enemy is done by alarm calls, emitted both from a fixed location (tree, ground) and in flight. When an enemy is present in the colony, rooks use to hit the branches with their beaks.

Conflicts between the rook and the long eared owl are manifest during the early breeding season, when the long eared owl is looking for available corvids nests to lay the eggs.

The new aspects of our study refer to the behaviour of brooding young after fledging and the characteristics of raising fledglings in semi-captivity. Fledglings raised in semi-captivity need a rich animal protein diet, but also appreciate vegetables, fruits, seeds. Their tendency to go back to nature is manifest both by sounds and by curvatures above the location where they were raised.

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BIOMETRIC ASPECTS IN ROOK (*CORVUS FRUGILEGUS* L.)

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Abstract. The paper presents measurements made on 56 rook eggs and on 92 rook chicks, all collected from Iași in the spring of 2011. The number of eggs laid may vary between 1 and 6. The biometric study of eggs consisted in the measurement of three traits: weight, the breadth and the length. The chick goes through three post embryonic development stages: with down, with developing plumage and with fully completed moult. We have measured 16 traits for chicks: body mass, total body length, body width, body height, keel length, head length, head width, head height, beak length, beak width, beak height, openness of wings, forearm length, tarsus length, tarsus width and third toe length. For the research of this type we used seven statistic descriptors such as: the minimal value, the maximal value, the arithmetic average, the standard deviation, the variation quotient, the linear regression and the determination quotient. This way we carried out the first biometric study of the egg and the chick of this species and the results are unique data collected in Romania at least.

Keywords: biometrics, egg length, egg breadth, chick, keel.

Rezumat. Aspecte de biometrie la cioara de semănătură (*Corvus frugilegus* L.). Lucrarea prezintă măsurători efectuate la 56 de ouă și la 92 de pui de cioară de semănătură, colectați din Iași, în primăvara anului 2011. Numărul de ouă depuse poate varia între 1 și 6. Studiul biometric al ouălor a constat în măsurarea a trei caractere: greutatea, lățimea și lungimea oului. Puilul trece prin trei stadii de dezvoltare postembrionară: cu puf, cu penaj în dezvoltare și cu năpârlirea completă. La pui am măsurat 16 caractere: greutatea, lungimea totală, lățimea corpului, înălțimea corpului, lungimea carenei, lungimea capului, lățimea capului, înălțimea capului, lungimea ciocului, lățimea ciocului, înălțimea ciocului, anvergura aripilor, lungimea antebrațului, lungimea tarsului, lățimea tarsului și lungimea celui de al treilea deget. Pentru cercetări de felul acesta am folosit șapte descriptori statistici: valoarea minimă, valoarea maximă, media aritmetică, deviația standard, coeficientul de variație, regresia liniară și coeficientul de determinare. Astfel am realizat primul studiu biometric la oul și la puii acestei specii, iar rezultatele sunt unice, în România.

Cuvinte cheie: biometrie, lungimea oului, lățimea oului, pui, carenă.

Introduction

Few articles have been written about rook egg biometry. We know just one example, *The breeding biology of the rook Corvus frugilegus* L. in Canterbury, New Zealand, by Coleman (1972). Perhaps our paper is the first one describing the rook chick development and biometrics, elaborated from original data. During April, May and June, we followed the chicks development in colonies located in the study area. In the conditions of 2011, the first hatchlings were observed on the 20th of April in nests from the following colonies: Iași Railway Station colony, “Titu Maiorescu” campus colony and Tătărași district colony. We took the named chicks under survey until around the age of 40 days, when they left the parental nests.

Material and Methods

Rook data, gathered in the study area, have been synthesized in a report and supported by images. In order to take fixed images and films we used a digital camera

Fujifilm FinePix HS20EXR, a digital video recorder Panasonic SDR-H80 SD/HDD, together with a tripod T nB FTDC034880.

For the observations in the nest I used the climbers equipment and techniques and a special device for tree climbing with stability and safety stakes was used. I took both eggs and chicks for measurements from the active nests. Their transportation was done in wool boarded cases. At the end of the observations I put the eggs and chicks back in the nests.

The biometric study of eggs consisted in the measurement of three traits: weight, the breadth and the length. The weight was measured with a scale, and egg length and breadth with a calliper. We have measured 16 traits for chicks: body mass, total body length, body width, body height, keel length, head length, head width, head height, beak length, beak width, beak height, openness of wings, forearm length, tarsus length, tarsus width, third toe length. For sizes smaller than 15 cm, we used the calliper, and for bigger sizes we used the ruler and sometimes gauge tape. To weigh the chicks we used the Tefal scales.

The statistical processing of the data in the field was carried out using Microsoft Office Excel 2007 software. The statistic descriptors used were:

1. The minimal value
2. The maximal value
3. The arithmetic average

$$\bar{x} = \frac{\sum x}{n}$$

4. The standard deviation

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

5. The variation quotient

$$CV = \frac{s}{\bar{x}}$$

6. The linear regression

$$\mu_y = \alpha + \beta x$$

7. The determination quotient

$$r^2 = \frac{SP_{ext}}{SP_t}$$

Results and Discussion

The eggs display fluctuating colours, usually greenish-brown, with great variety in terms of morphology and biometry (Fig. 1 and Fig. 2). The number of eggs laid may vary between 1 and 6 (Perrins & Cramp, 1998).



Figure 1. Greenish-brown eggs (original).



Figure 2. Bluish-brown eggs (original).

The values of the length registered in eggs varied between 33.2 and 46.8 mm, with an average value of 37.8 mm and for the breadth – between 21.8 and 29.5 mm, with an average of 26.2 mm. As to the weight, the eggs had values between 9.7 and 22 g, with an average of 14.4 g (Table 1).

Table 1. Descriptive statistics for measurements carried out on eggs.

No.	Descriptors	Measurements		
		Metric traits (mm)		Weight (g)
		Egg length	Egg breadth	
1.	$\bar{x}$	37.8	26.2	14.4
2.	<i>S</i>	2.9	1.3	2.9
3.	<i>Minimum</i>	33.2	21.8	9.7
4.	<i>Maximum</i>	46.8	29.5	22
5.	<i>CV</i>	0.1	0.1	0.2

The determination quotient (r^2) indicates the proportion of the interdependence between the investigated biometric data (Zamfirescu & Zamfirescu, 2008). For the relation between weight and the length of the eggs (Fig. 3) the value of r^2 was higher than the one obtained for the relation between the weight and the breadth (Fig. 4). We have not found any relation between the values of egg length and egg breadth.

Hatching takes place along 2-3 days. The chick goes through three post embryonic development: with down (eyes and ears are closed, Fig. 5), with developing plumage (Fig. 6) and youngster with fully completed moult (Fig. 7). In between there are successions of intermediate development stages. We have made the statistic description of the body by

means of the average calculation, the standard deviation and the variation quotient for the characteristics of body mass, total length, width, body height, and keel length (Table 2 and Table 3).

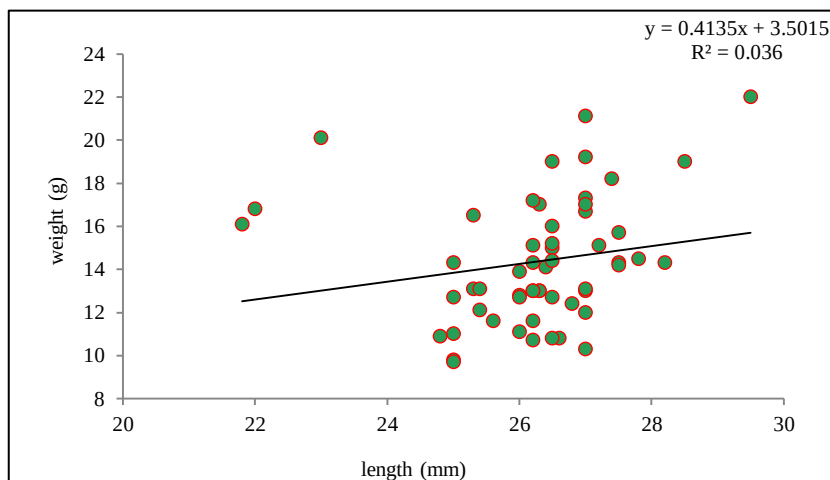


Figure 3. Diagram of values distribution for weight and length.

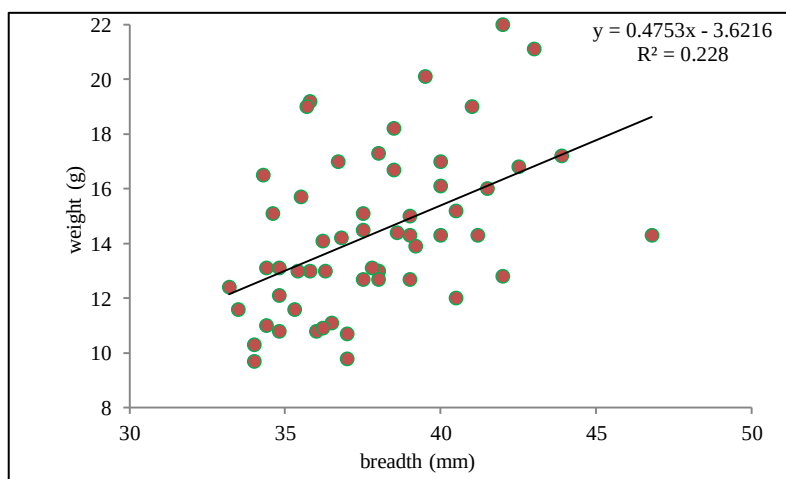


Figure 4. Diagram of values distribution for weight and breadth.



Figure 5. Chick with down (original).



Figure 6. Chick with developing plumage (original).



Figure 7. Youngster with fully completed moult (original).

Table 2. Descriptive statistics for body measurements carried out on rook chicks with developing plumage.

No.	Descriptors	Measurements				
		Body mass (g)	Total body length (mm)	Body width (mm)	Body height (mm)	Keel length (mm)
1.	$\bar{X}$	186.8	170.1	42.2	53.1	24.6
2.	S	79.3	35.5	8.7	8.7	5.2
3.	<i>Minimum</i>	56	90	23.5	34.1	12
4.	<i>Maximum</i>	339	240	63	70	34
5.	CV	0.4	0.2	0.2	0.2	0.2

Table 3. Descriptive statistics for body measurements carried out on rook chicks with fully completed moult.

No.	Descriptors	Measurements				
		Body mass (g)	Total body length (mm)	Body width (mm)	Body height (mm)	Keel length (mm)
1.	$\bar{X}$	299.8	239.9	43.4	54.8	37.4
2.	S	54.8	32.6	6.1	6.6	5.3
3.	<i>Minimum</i>	226	185	31.2	42.5	28
4.	<i>Maximum</i>	417	300	58	66	50
5.	CV	0.2	0.1	0.1	0.1	0.1

Expressed as a linear regression curve, the biometric data from the body of chicks have indicated strong relations between total body length and keel length (Fig. 8 and Fig. 9).

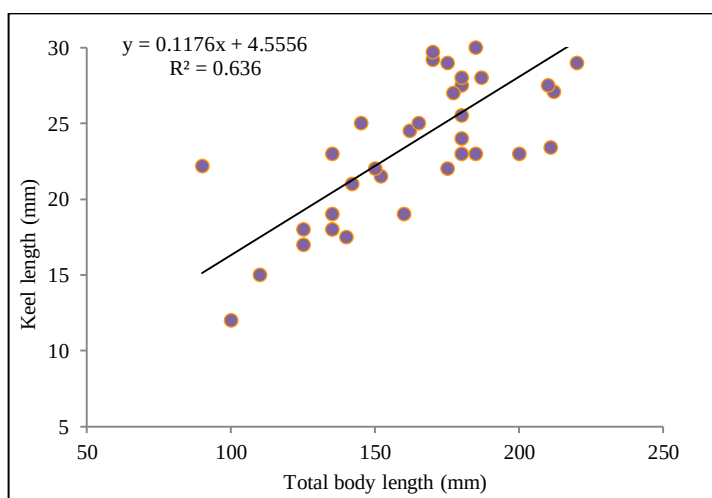


Figure 8. Graphic representation of the relation between total body length and body mass in chicks with developing plumage.

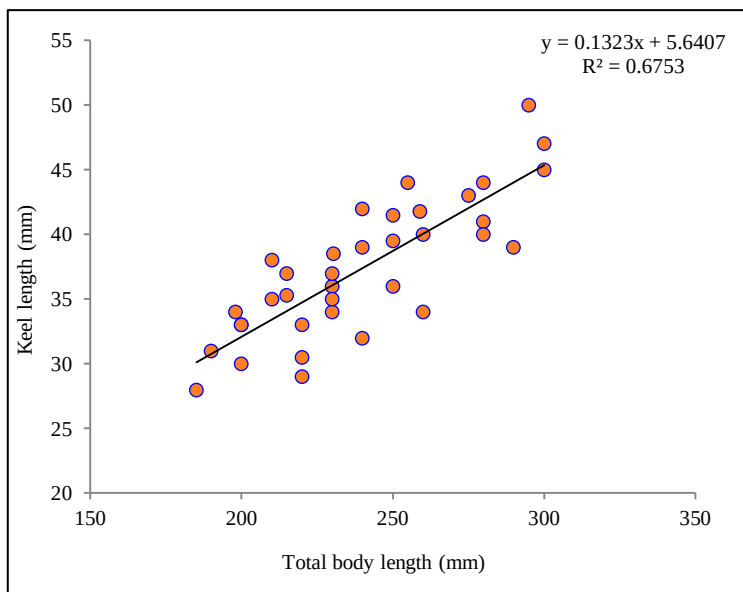


Figure 9. Graphic representation of the relation between total body length and body mass in chicks with fully completed moult.

In eggs case, for every statistically analysed biometric trait we obtained values very close to the average.

We find that, for both types of traits related to chicks body (total body length and keel length), the coefficient of determination is higher in chicks with fully completed moult compared to the chicks with developing plumage. Explanation for this could be the aerodynamic shape gained by the chick in the final stage of the development (juvenile stage), put mainly on the account of the keel development and of the body elongation.

Conclusions

The biometric studies on eggs reveal a close connection between the two metric traits (length and breadth) and the weight around the average. By corroborating the weight with the length, we have obtained a determination quotient (r^2) higher than with the breadth. There are no correlations between egg length and egg breadth.

In biometric measurements on chicks, the variation quotients indicated a small deviation of values from the average. A strong correlation was noted between the keel length and the total body length.

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OSTEOMETRIC SURVEY OF PIG (*SUS DOMESTICUS*) IN BRONZE AGE SETTLEMENTS ON ROMANIA'S TERRITORY

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Abstract. The purpose of this paper is to outline the osteometric variation of pig (*Sus domesticus*) from the Bronze Age in Romania. The bone remains came from Romanian assemblages which dating to: Early (3500-2200 BC), Middle (2200-1600/1500 BC) and Late Bronze Age (1600/1500-1100 BC). Our results reveal that the lower third molar is the most distinctive character that can characterize different populations of pigs (CV%=1.4-1.8). The increase of size of pig from Early to Late Bronze Age is obvious according to statistical analysis.

Keywords: pig, osteometric data, Bronze Age, Romania.

Rezumat. Studiu osteometric al porcului domestic (*Sus domesticus*) din așezări de Epoca Bronzului de pe teritoriul României. Scopul acestei lucrări este de a evidenția variațiile osteometrice pentru porcul domestic (*Sus domesticus*) pe baza resturilor din Epoca Bronzului din România. Resturile osoase provin din situri de Epoca Bronzului timpuriu (3500-2200 BC), Bronzului mijlociu (2200-1600/1500 BC) și Bronzului târziu (1600/1500-1100 BC). Rezultatele arată ca dințele molar trei mandibular are cele mai bune caracteristici care permit diferențierea populației de porc domestic (CV%=1.4-1.8). Conform analizei statistice, se observă o creștere a taliei porcului de-a lungul Epocii Bronzului.

Cuvinte cheie: Epoca Bronzului, porc domestic, date osteometrice.

Introduction

A considerable problem for archaeologists is to clearly assign individual specimens as wild or domestic *Sus*, taking in account their coexistence in samples and crossbreeding process of these two forms. For this reason, new biometric data which could contribute in a better separation of wild and domestic forms are agreeable. Therefore, we propose to characterize and distinguish interpopulational differences in pig of Bronze Age focusing in analysis on those anatomical elements which criteria are certainly belong of pig. Bronze Age in Romania is divided into: Early (3500-2200 BC), Middle (2200-1600/1500 BC) and Late Bronze Age (1600/1500-1100 BC).

Material and Methods

This osteometric study is based on pig (*Sus domesticus*) remains recovered in assemblages dating for Bronze Age from Romania. The regions of Romania that have yielded Bronze Age fauna for osteometrical analysis are: Moldavia - assemblages of: Bârlad (Haimovici, 1965), Piatra Neamț (Haimovici, 1965), Gârbovăț (Haimovici, 1965; 1991), Sărata Monteoru (Haimovici, 1965; 1994), Bogdănești (Haimovici, 1965; 1966), Mîndrișca (Haimovici, 1965; 1980), Poșta Elan (Haimovici, 2006), Erbiceni (Haimovici, 1970), Trușești (Haimovici, 1965), Valea Lupului (Haimovici, 1962; 1965), Foltești (Haimovici, 1965; 1972; 1974); Transylvania - assemblages of: Derșida, Mintiu Gherlei, Otomani, Pecica, Carei, Livezile, Iclod (Bindea, 2008); Banat - assemblages of: Moldova

Veche-Ostrov, Gornea-Păzăriște, Foeni) (El Susi, 1996); Wallachia - assemblages of: Glina (Haimovici, 1997), Verbita (Haimovici, 1965), Popești (Haimovici, 1965), Căscioarele (Perianu & Udrescu, 1990).

The following anatomical elements were analyzed: mandible, maxilla, humerus, scapula, radius, tibia, calcaneus and astragalus. All measurements discussed in this paper were taken according to von den Driesch (1976) (Table 1), and they come from the literature. The bones with non-fused epiphysis, porous surface and atypical measurements were excluded from the study.

Table 1. Linear measurements (according to von den Driesch, 1976).

Abbreviation	Variable description
maxilla	
GL P2-P4	Greatest length of the second premolar and cheektooth row
GL M1-M3	Length of the upper cheektooth row, measured along the alveoli
GL M3	Greatest length of the upper third molar
mandible	
GL M1-M3	Length of the lower cheektooth row, measured along the alveoli
GL M3	Greatest length of the lower third molar
scapula	
GLP	Greatest length of the Processus articularis (glenoid process)
SLC	Smallest length of the Collum scapulae (neck of the scapula)
LG	
BG	Breadth of the glenoid cavity
humerus	
BT	(Greatest) breadth of the trochlea
Bd	(Greatest) breadth of the distal end
Dd	(Greatest) depth of the distal end
SD	Smallest breadth of diaphysis
radius	
Bp	(Greatest) breadth of the proximal end
BFp	(Greatest) breadth of the Facies articularis proximalis
tibia	
Bd	(Greatest) breadth of the distal end
BFd	Breadth of the Facies articularis distalis
Dd	(Greatest) depth of the distal end
calcaneus	
GL	Greatest length
GB	Greatest breadth
astragalus	
GL	Greatest length
GB	Greatest breadth

The withers heights have been estimated according to Teichert's coefficients using astragalus (listed by Udrescu *et al.*, 1999).

The descriptive analysis was realized out separately for each variable. We described the variability using coefficient of variation (CV%), which is dimensionless and allows a comparisons of variability of large and small anatomical elements. In order to test

the homogeneity of the populations, the Kolmogorov-Smirnov test was used on each variable assuming they had a continuous distribution. The measurements of variables are compared using one-way ANOVA test. Multivariate analysis has not been undertaken because, although potentially valuable in the analysis of complete skulls and skeletons, this was likely to be of limited use for the generally highly fragmented archaeological specimens.

In statistical analysis XLStat version 2012.4.01 was used.

Results and Discussion

In Bronze Age, the pig (*Sus domesticus*) represented a principal alimentary resource for human population, having the largest implication in Early Bronze Age according to pig remains came from assemblages. This aspect is illustrated in Figure 1: skeletal remains belonging to Early Bronze represents more than 34% of total domestic mammals identified (in samples of Walachia region); the lower frequencies of pig remains were accepted in samples from Moldavia region in the period of transition Eneolithic - Bronze Age (6.51% of domestic mammal).

The complete metapodials providing data on withers height are absent in our samples, therefore the withers height is established by means astragalus (Fig. 2).

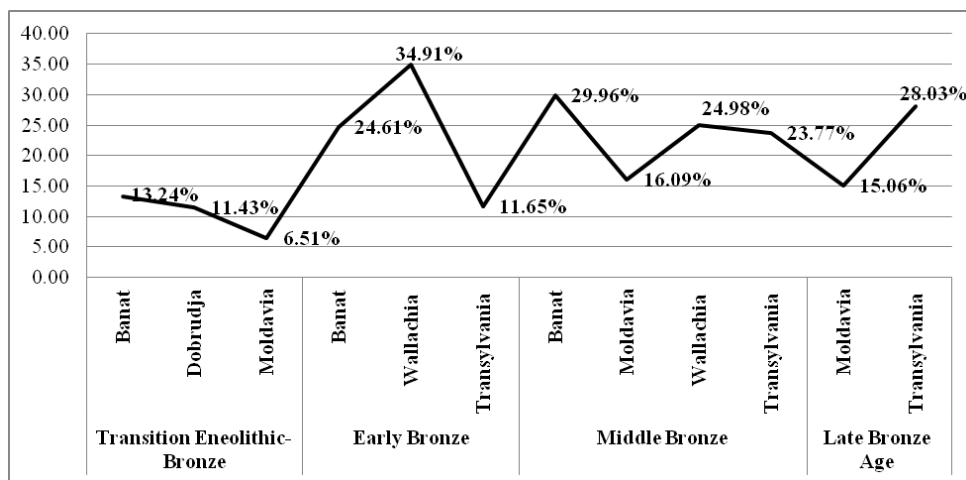


Figure 1. Pig proportions (%NISP) calculated from the domestic mammals remains.

The observed distributions of data were not significantly different from normality ($p > 0.05$) for every variable. Analyses of variance were used to test each character for differences between variables from material of settlements. No significant differences were found for any character ($p > 0.05$), excepting the size in the lower third molar in three assemblages ($p < 0.05$).

Table 2 provides summary statistics for measurements of anatomical elements.

The degree of variability of measurements differs when the CV% of variables are compared (Table 2; Fig. 3). The high variability was underlined by humerus, in specially: breadth of diaphysis (SD): CV% = 28.02 and depth of the distal end (Dd): CV% = 25.72.

Low variability was obvious in case of the upper and lower molars (CV% = 1.4-9.5), tibia (length of tibia CV% = 2.2) and astragalus (length of astragalus (GL) CV% = 1.7).

The most accurate results were obtained for the series of lower molars (length of cheek tooth row (CV% = 1.8) and the third molar (CV% = 1.4). In the case of this anatomical element considerable difference between measurements was obtained.

In Figure 4, the comparative representation for the lower third molar (GL M3) is shown. The molar measurements are not substantially affected by sexual dimorphism (Payne & Bull, 1988), that measurements of the lower third molar provide consistent results about size of pigs in Bronze Age. A significant differences between size of this molar was obvious in three assemblages: Mândrișca, Bogdănești and Cernavodă (One Way ANOVA: $F=6.3$; $p<0.05$). These data highlight that tooth measurements are better suited for identifying interpopulational differences (in case of our study), revealing the greater specimens in Cernavodă assemblage: GL M3 (Mean / Standard Deviation) = 39.2 / 2.89 and smaller specimens in Mandrișca assemblage: GL M3 (Mean / Standard Deviation) = 32.28 / 0.8).

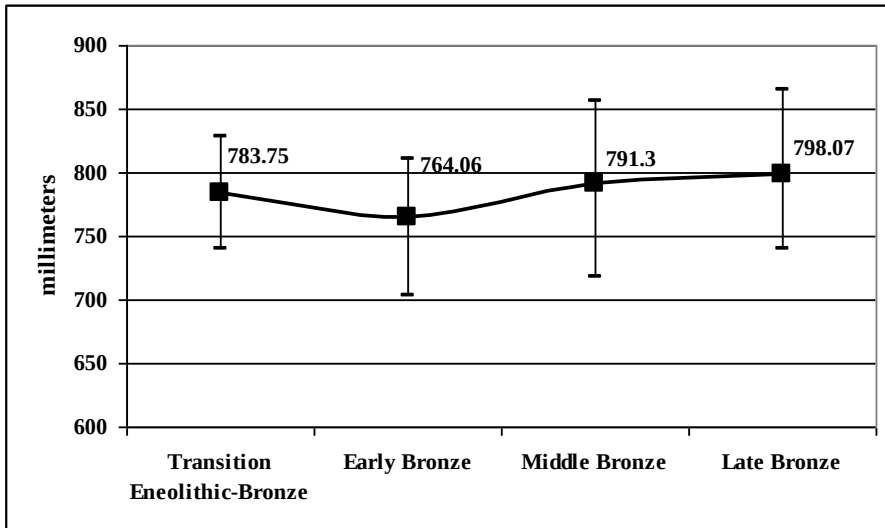


Figure 2. Variation in withers heights of pig in Bronze Age, in Romania.

Table 2. Summary statistics for measurements of pig remains. Abbreviations: n - number of remains examined; SD – standard deviation; Min, Max – Minimum, Maximum range measurement; CV - coefficient of variation in %; CL - confidence level a mean of population.

Anatomical element	Variable	n	Mean	SD	Min.	Max.	CL (95%)	CV%
maxilla	GL P2-P4	27	40.66	8.0	31	44	2.3	19.67
	GL M1-M3	77	69.35	4.21	55.5	80	0.95	6.07
	GL M3	12 3	33.43	3.19	27	43	0.56	9.5

Anatomical element	Variable	n	Mean	SD	Min.	Max.	CL (95%)	CV%
mandible	GL M1-M3	62	71.49	5.11	56	85	1.29	1.8
	GL M3	19 2	34.98	3.48	22.5	41	0.49	1.4
scapula	GLP	22	36.55	5.09	28	49	2.26	13.92
	SLC	31	24.98	4.53	20	39	1.66	18.12
	LG	19	31.82	5.37	24	42	2.59	16.88
	BG	22	23.94	3.4	17	30	1.51	14.21
humerus	BT	14	32.48	2.46	28.5	36.2	1.42	7.56
	Bd	77	40.20	3.97	26	46	0.9	9.87
	Dd	15	35.21	9.06	18	45	5.01	25.72
	SD	5	18.84	5.28	11.8	25	6.55	28.02
radius	Bp	42	30.44	1.86	27	36	0.58	6.12
	BFp	37	21.73	2.78	17.5	32	0.93	12.8
tibia	Bd	77	40.20	3.97	26	46	0.9	2.2
	BFd	1	-	-	26.4	-	-	-
	Dd	37	27.2	4.61	9	38	1.54	16.96
calcaneus	GL	5	63.9	3.1	80	83.5	3.9	4
	GB	5	28.6	4.22	24	32	5.24	14.75
astragalus	GL	53	42.98	2.8	38	48	0.77	1.7
	GB	42	25.98	2.46	21	32	0.76	2.92

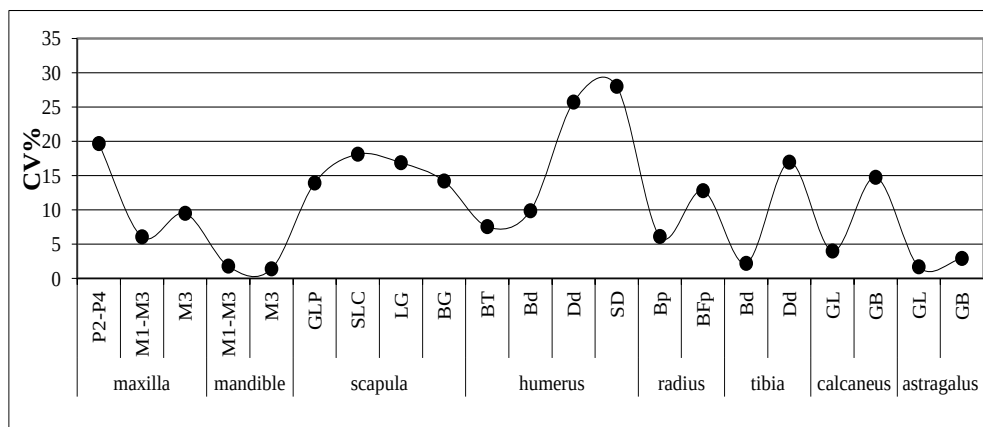


Figure 3. Variation in pig measurements (CV%) in Bronze Age settlements on Romania's territory.

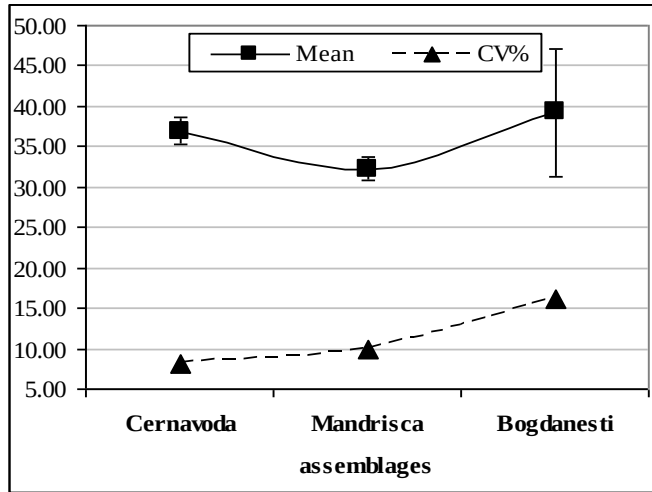


Figure 4. Comparative analysis of the length (GL) of the lower third molar of pigs in Bronze Age (only assemblages with significant differences) (in millimetres).

Conclusion

The lower third molar is clearly the most distinctive character that can characterize different populations of pigs. Taking in account the significant differences between the samples belonging the two different subperiod (Transition Eneolithic - Bronze Age: Cernavodă, and Middle Bronze Age: Mândrisca and Bogdănești), and the high variability for some of postcranial bones (humerus and scapula) we can conclude that in Bronze Age is typified by the presence of admixture of breed. This supposition could be underlined by the increase of withers heights of pig towards Late Bronze. Our study offer some range sizes of anatomical elements which can be used like a criteria to identify domestic swine specimens.

Acknowledgements

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SPINA BIFIDA OCCULTA IN MEDIEVAL AND POST-MEDIEVAL SKELETONS FROM IASI CITY, IN NORTH-EAST ROMANIA

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Abstract. Using macroscopic examinations, this paper provides diagnoses of spina bifida occulta (occult spinal dysraphism) in skeletons from the medieval and post-medieval sites of Iasi City in North-East Romania. As a congenital disorder consisting of an incomplete fusion of the posterior neural arch, spina bifida occulta appears mostly in the lumbosacral region, affecting the sacrum. Palaeopathological analysis of the osteological lesions could reveal factors of stress leading to spinal dysraphism: deficiency in the maternal nutritional state, exposure to teratogenic factors and genetic predisposition. The osteological material available for analysis consists of 947 skeletons found in burial and reburial tombs from four necropolises of XVth– XIXth centuries, discovered between 1995 and 2011. Within these populations (18-x years), sacral spina bifida occulta (sacral occult spinal dysraphism) was identified in 10 subjects (eight males aged 18-60 years and two females aged 18-20 years and 40 years, respectively). The incidence of sacral spina bifida occulta is 3.83% in the total population for which the sacrum was preserved (261 sacra) and by gender we recorded 5.19% in the male group (154 sacra) and 1.86% in the female group (107 sacra).

Keywords: spina bifida occulta, paleopathology, medieval and post-medieval, Iasi city, Romania.

Rezumat. Spina bifida occulta la nivelul unor schelete umane medievale și post-medievale din orașul Iași (Romania). Prezenta lucrare descrie, utilizând analiza macroscopică, cazuri de *spina bifida occulta* (disrafism spinal ocult) identificate la schelete umane din situri medievale și post-medievale ale orașului Iași, din nord-estul României. Ca afecțiune congenitală constând într-o incompletă fuziune a arcului neural posterior, spina bifida occulta apare mai ales în regiunea lumbosacrală, afectând sacrumul. Analiza paleopatologică a leziunilor osteologice ar putea indica ca factori de stres asociați disrafismului spinal: deficiența nutrițională maternă, expunerea la factori teratogeni și predispoziția genetică. Materialul osteologic analizat constă în 947 schelete găsite în morminte de înhumare și reinhumare din patru necropole de secole XV-XIX, descoperite între anii 1995 și 2011. În cadrul respectivelor populații (18-x ani), spina bifida occulta sacrală (disrafismul spinal ocult sacral) a fost identificat la 10 subiecți (opt bărbați cu vârste de 18-60 ani și două femei cu vârste de 18-20 și 40 ani). Incidența spinei bifide occulta este de 3,83% din totalul populației pentru care sacrumul a fost păstrat (261 sacrumuri); repartitia pe genuri a cazurilor indică o frecvență de 5,19% în grupul bărbaților (154 sacrumuri) și de 1,86% în grupul femeilor (107 sacrumuri).

Cuvinte cheie: spina bifida occulta, paleopatologie, medieval și postmedieval, orașul Iași, România.

Introduction

This study concerns the medieval and post-medieval human populations living in the Iasi city (Romania). The study is mainly focus on the osteological lesions associated with the congenital anomaly named spina bifida occulta.

Congenital anomalies or malformations are produced by pathological changes in the normal development of the embryo during intrauterine life (Aufderheide & Rodriguez-Martin, 1998); some of them can be identified in the new-born babies, but most defects remain undetected until childhood or even adolescence (Marcsik *et al.*, 2002).

Congenital anomalies were recorded from the most ancient times, on the Babylonian clay plates from the Royal Library of Nineveh, assembled by the Syrian king Assurbanipal (700 BC). Traces of congenital malformations in the primitive cultures have been found on some bones of the affected people, specifically on a sacrum and on a femur discovered on the territory of France and dated from the Neolithic period (Savona-Ventura, 2007). Bone anomalies were found in the cranial segment, in the spine and in the appendicular skeleton. The highest incidence of the developmental anomalies was recorded in the spine, followed by the cranial segment and the appendicular skeleton, with lower incidences. Reports on the incidence of congenital malformations in prehistoric populations are very rare, because most of the affected children died during birth or shortly after that (Barnes, 1994).

Developmental anomalies appear due to genetic influences or an environmental stimulus which manifested itself during a critical stage of development, when the developing structures are vulnerable. Most of the developmental anomalies of the skeleton in historical populations are located in the spine, affecting most frequently the lumbosacral region (Masnicová & Beňuš, 2003); thus, spina bifida is the most common congenital defect, characterized by an incomplete fusion of the posterior midline of the osseous tissues, which leaves the spinal cord relatively unprotected (Marcsik *et al.*, 2002). Spina bifida can also be defined as a developmental defect resulting in aplasia or hypoplasia of one or both parts of the neural arch and/or spinous process (Masnicová & Beňuš, 2003). Spina bifida occurs within the first month of pregnancy as a result of a defect in the process of neurulation in which the vertebral column and spinal cord are supposed to fully form and close (Fishman, 2003).

In the XIXth century, specifically in 1886, was published one of the most important monographs on spina bifida, by Friederich von Recklinghausen, who included in his work two remarkable illustrations that clearly outline both the internal and the external pathology of spina bifida. Recklinghausen also observed that some patients with spina bifida survived into adulthood (Marcsik *et al.*, 2002). Spina bifida is the expression of spinal dysraphism (Zemirline *et al.*, 2012), which includes a spectrum of congenital disorders caused by incomplete or abnormal closure of the neural tube during early embryogenesis (Vesna & Nirmala, 1998).

Based on physical observation, cases of spinal dysraphism can be grouped in two categories: serious anomalies such as spina bifida aperta or cystica (posterior protrusion of neural tissue through a bony vertebral defect that results in non-skin covered lesions with exposed neural tissue, such as the meningocele, an open neural tube defect) and mild, asymptomatic lesions, such as spina bifida occulta (occult spinal dysraphism) (Armstrong, 1993; Byrd *et al.*, 1991). All these malformations can induce a variety of neurological defects, such as impaired walking and problems in the bladder function (Gleeson *et al.*, 2006). Hydrocephalus is another effect of spina bifida, which appears due to the excess cerebral spinal fluid accumulated in the brain. It appears in approximately 11-90% of the people with spina bifida, occurring most often in those with a higher lesion level (Dicianno *et al.*, 2008) and those with myelomeningocele (Fishman, 2003). Genetic studies show that occulta and cystic forms of spina bifida are different expressions of the same dominant gene (McKusick, 1998).

Paleoanthropological studies on spina bifida were mainly conducted on the sacrum, although 60% of the physiological effects on the organism are associated with

spina bifida of the L3-S1 and only 10% involve the S2-S5 segments (Kumar & Shane Tubbs, 2011). The reported incidence of spina bifida in the lumbosacral region (L5 and S1) is up to 25% (Barnes, 1994), usually involving only one or two vertebrae, but occasionally several vertebrae can be affected, particularly in the sacrum. Spina bifida occulta of the sacrum is considered the most common type of spinal abnormality (Senoglu *et al.*, 2008).

According to the report on the clinical significance of spina bifida occulta (occult spinal dysraphism), this disorder ranges from mild, asymptomatic lesions to severe defects such as the meningocele or the neurologic deficiencies (Albrecht *et al.*, 2007).

Many authors published data on the incidence of spina bifida occulta, obtaining different results; the reported frequency ranged greatly among researchers and populations. Spina bifida varies across gender, ethnicity and geographic location. However, its frequency ranges from 1 to 5 cases per 1000 live births (Fishman, 2003). The prevalence of spina bifida occulta decreases with age, possibly as a result of new bone formation or calcification (Mehdizadeh *et al.*, 2010) and males appear to be more frequently affected by developmental delay defects in the sacrum than females (Aufderheide & Rodriguez-Martin, 1998). The reported incidence of spina bifida is higher in Hispanics than it is in Caucasian or African Americans (Shaer *et al.*, 2007).

The presence of spina bifida is linked to vitamin, folic acid and zinc deficiency among mothers. It is argued that vitamin deficiencies, acting together, may interfere with the closure of the neural tube or that such deficiencies may allow some unknown teratogenic factors (agents causing malformations) to have a certain influence (Lovett & Gatrell, 1988). The origin of spina bifida is multifactorial. This anomaly involves a genetic predisposition and environmental factors which act like triggers; however, the precise cause remains unknown (Windham & Bjerkedal, 1982).

The sacrum usually consists of five segments, but in some cases the number of segments can change with either the addition of the sixth lumbar vertebra (lumbarization) or the sacralization of the last lumbar vertebra or the first coccygeal vertebra (White & Folkens, 2005). The clinical significance of the lumbosacral transitional vertebra (lumbarization) has made the subject of many debates and the incidence of this anomaly varies greatly, ranging from 4% to 24% (Delpont *et al.*, 2006). Sacralization was described by O'Connell in 1951 and it represents the extension of the sacrum to the lower region of the pelvis, whereas the spinous process of the last lumbar vertebra can be united to the iliac crests or it can be located immediately below them (Prakash *et al.*, 2011). In both lumbarization and sacralization, the defect is complete or incomplete, unilateral or bilateral, symmetrical or asymmetrical (Barnes, 1994).

Paleoanthropological studies in Romania have already addressed preliminary questions related to the demography and pathology, including diagnosis of occult spinal dysraphism, characterizing the medieval and post-medieval populations living in the Iasi city of Romania (Simalcsik *et al.*, 2011; Groza *et al.*, 2012).

Iasi city is located in the North-East of Romania, in the Moldavia region; it was the capital of the Principality of Moldavia from 1564 to 1859. Since XVth century, the historical evolution of the city took place in the conditions of permanent disasters: was often assaulted and burned by Tatars, Turks, Polish or Russians, was hit by starvation periods and plague. The city had a slow development, being limited in surface and with a small but diverse population (Romanians, Armenians, Hungarians, Polish, Germans or Russians). There are various references to the life of the inhabitants; they were dealers,

craftsmen or farmers (Caprosu & Zahariuc, 1999). A characterization of peripheral slums of Iasi is offered by N.A. Bogdan (1997-2004) who describes these suburbs considered countryside as having small houses, built out of ordinary materials, with unpaved street, with poor people, which worked a lot with their arms, with carting agriculture and cattle and poultry breeding. The description also underlines the insanitary conditions of the slums.

Material and Methods

The osteological material subjected to the study (947 skeletons) was unearthed from four necropolises discovered in the Iasi city area and dated between the second half of the XVth century and the first half of the XIXth century. The archaeological excavations conducted in the Iasi city area (Romania) between 1995 and 2011 by a group of scientists directed by Mrs. Stela Cheptea, archaeologist from the Centre for European History and Civilization in Iasi (Romania).

The first sample, the osteological series exhumed in 1995 from the necropolis of the “Virgin Mary” Catholic Church (XVth-XIXth centuries), are badly preserved and consists of 89 skeletons found in burial and reburial tombs. The second sample, from the necropolis discovered in 2007 on the premises of the “St. Nicholas-Ciurchi” Church (XVIth-XVIIIth centuries), offered for study 680 inhumed and re-inhumed skeletons, most of them also ill-preserved. The third sample, the osteological series excavated in 2008 from the necropolis located on eastern side of the former Princely Court (XVIIth century), consists of 111 inhumation skeletons, is in a satisfying state of preservation. The fourth sample, from the necropolis of XVIth-XIXth centuries discovered in 2011 on the premises of the Banu Church pursuant to the edifice reinforcement and rehabilitation works, contains 67 inhumed and re-inhumed skeletons.

The bone fragments were restored, marked and subjected to a bio-morphoscopic analysis to determine the individual age and gender, the pathologies and the anomalies associated. The precarious state of preservation for some of the skeletons, as well as the absence of bone fragments made it very difficult for us to conduct the anthropological and paleopathological analysis.

The age and sex determination for the subjects over 18 years was accomplished using the methods and procedures recommended by Bruzek (2002), Mays (1998), Brothwell (1981), Schmitt (2005), Walrath *et al.* (2004). In the case of subadults, the age was estimated based on the primary and permanent teeth stages of development (Ubelaker, 1979; Schaefer *et al.*, 2009), as well as on the analysis of the level of ossification between the long bones epiphyses and diaphyses and their repartition in the corresponding age categories (Mareš, 1955; Fazekas & Kosa, 1978; Jeanty, 1983; Scheuer & Black, 2000).

The size was calculated based on the dimensional scales suggested by Manouvrier (1982), Bach (1965), Breitingner (1938), Trotter & Gleser (1952, 1958).

We were particularly interested in identifying the cases of spina bifida occulta (occult spinal dysraphism), tracing to that effect the abnormalities in the midline of the spine, regardless of their position. In this study we took into account only the subjects aged 18-x years. We macroscopically established for each subject if spina bifida occulta was present or absent in the sacrum, since this particular anomaly can be easily recognized in a skeleton (Waldron, 2009). Where we identified this abnormality, we also marked its location. In order to accurately evaluate the prevalence of this lesion, one must analyze its incidence in relation to the chronological age. If hydrocephalus was absent, the anomaly is

classified as spina bifida occulta or occult spinal dysraphism. The presence of spina bifida occulta in the segments S3, S4 and S5 should come under the normal range of variation of the sacral hiatus. However, all cases of spinal dysraphism must be recorded regardless of their incidence in the spine (Kumar & Shane Tubbs, 2011). As regards total sacral spina bifida occulta, the posterior lamellae of all sacral vertebrae are completely unfused (Senoglu *et al.*, 2008). Besides spina bifida occulta, we also identified other anomalies, such as sacralization and lumbarization. Complete sacralization consists of a total union between the spinal process of the last lumbar vertebra (L5) and the sacrum. Incomplete sacralization shows a well-defined joint line between the process and the sacrum. If the first sacral segment (S1) is separated from the sacrum, the defect is called lumbarization (Aufderheide & Rodriguez-Martin, 1998; Barnes, 1994).

Results and Discussion

Analyzing by age and gender the entire osteological material (947 skeletons) exhumed from the four necropolises of the XVth-XIXth centuries found in the Iași city area, the mortality rate for children aged 0-14 years is approximately 17%. The death rate recorded for adolescence is about 8%, for adults (20-30 years) is 12%, and 57% for mature people (30-60 years); the senile people (60-x years) recorded about 6%. The ratio between the number of deceased males and the number of deceased females is 1.06 – there are a higher number of male skeletons compared to the female skeletons (406/383).

In the total number of subjects aged 18-x years (744 skeletons), we identified 10 cases of sacral spina bifida occulta (8 males aged 18-60 years and 2 females aged 18-20 years and 40 years, respectively). The incidence of the sacral spina bifida occulta is 3.83% in the total number of subjects for whom we retrieved the sacrum (261 sacra) and by gender we recorded 5.19% in the male group (154 sacra) and 1.86% in the female group (107 sacra).

First sample

From the total of 89 human skeletons unearthed from the necropolis of the “Virgin Mary” Catholic Church (XVth-XIXth centuries), the mortality rate for the subjects under 20 years is approximately 24%, of which 20.23% (18 subjects) is associated with children aged 0-14 years. In the subjects past the age of 20, the maximal death frequency is recorded in the maturity stage (approximately 57% - 51 subjects: 28♂ and 23♀), whereas in the adulthood stage the mortality rate is 9% (eight subjects - 3♂ and 5♀). In the age interval 60-x years we recorded a mortality rate of 10.11% (nine subjects: 5♂ and 4♀). In the segment 18-x years (71 subjects), the sacrum is present in only 28 of the subjects.

From the total 28 sacra, just one female sacrum (subject M5) belonging to a subject aged approximately 40 in the moment of death, presents spina bifida occulta (occult spinal dysraphism). Thus, the incidence of spina bifida occulta in this population is 3.57% if we consider the total number of subjects in which the sacrum is present and 10% if we refer to the female group.

Subject M5. The cranial segment of the female subject in question is badly preserved and presents a high degree of fragmentation. A fragment of the calvaria is missing from the neurocranium – the parietal-temporal area; a small bone fragment is also missing from the left side of the occipital. The facial massif lacks the palate area, the left

cheek bone and the left half of the mandible. The postcranial segment lacks the following components: the thoracic vertebrae T₂, T₃, T₄, T₅ and T₁₂, the lumbar vertebrae L₃ and L₄, the tibiae and the fibulae, the left calcaneus and the astragals.

The stature calculated by the long bones is 1673 mm on average, which falls under the tall category.

The sacrum of the subject M5 has a posterior interlaminary dehiscence in the L5-S1 and S3-S5 segments (spina bifida occulta) – the posterior laminae of the vertebrae didn't fuse in these segments. Besides spina bifida occulta, in this sacrum we can also observe the sacralization of the last lumbar vertebra – L5 (Fig. 1).

Second sample

The second osteological series, unearthed from the necropolis of the “St. Nicholas-Ciurchi” Church (XVIth-XVIIIth centuries) contains 680 skeletons: 179 subadults, (infans I, infans II and juvenis) and 501 subjects (224♂ and 278♀) past the age of 20 years (adultus, maturus, senilis). The mortality rate in the subadult segment, meaning subjects aged 0-20 years is considerably high (10.29% for infans I, 7.65% for infans II și 8.38% for juvenis - 34♂; 23♀), which means that approximately one quarter of the population (26.32%) didn't reach adulthood. In the age interval 20-x years, the highest death rate is recorded for the subjects in the maturus category (55.44% - 176♂; 201♀), whereas the rate for the adultus is 12.35% - 28♂; 56♀, and for the subjects past the age of 60 (senilis) we recorded a mere 5.88% (21♂; 19♀).

The sex ratio (the ratio between the number of males and females) considered for the entire population indicates a slightly higher prevalence of the female skeletons compared to the male skeletons (299 females and 259 males).

In the total number of subjects aged 18-x years (519 individuals), the sacrum is present in 129 cases (62♂ and 67♀).

Only two sacra out of 129 present spina bifida occulta (occult spinal dysraphism); both sacra belong to male subjects aged 30-45 years. Sacral occult spinal dysraphism (sacral spina bifida occulta) represents 1.55% of the total number of subjects in which the sacrum was preserved and 3.22% of the male subjects.

Subject R113F. The first case of sacral spina bifida occulta was identified in a male subject (subject R113F) aged 30-35 years and 1645 mm tall (medium-sized). This well preserved skeleton was exhumed from a tomb which also contained re-inhumations. The sacrum of the subject has two dehiscences: the first one is located in the S1 segment, whereas the second is in the S3-S5 segment (Fig. 2).

In this case, the two interlaminary sacral dehiscences are associated with other pathologies: the arthritis of the clavicles in the acromioclavicular joint area and osteophytes on the radial tuberosity; the right coxal bone – with osteophytes on the iliac crest; the thoracic vertebrae T₆-T₁₂ and the lumbar vertebrae L₁-L₃ have osteophytes on the edges of the vertebral bodies and Schmorl nodules.

Subject M126A. The second skeleton with sacral spina bifida occulta also belonged to a male subject (subject M126A), aged 40-45 years. This skeleton is incomplete, since in the cranial segment we only have the frontal bone. In the postcranial skeleton lacks the right astragal, fragments of the shoulder blades, the left clavicle, humeri, the left ulna and the left radius.

The sacrum has a posterior interlaminary dehiscence (sacral spina bifida occulta) in the S₂-S₅ segment (Fig. 3).



Figure 1. Subject M5 - ♀, 40 years: posterior view of sacrum - spina bifida occulta in the L5-S1 and S3-S5 segments, associated with the sacralization of L5.



Figure 2. Subject R133F - ♂, 30-35 years: posterior view of sacrum - sacral spina bifida occulta in the S1 and S3-S5 segments.

Third sample

In the osteological series unearthed from the eastern side of the Princely Court (XVIIth century) we identified 111 skeletons, of which 15 subadults (juvenis) (10♂ and 5♀ - 13.51%), 21 adults (12♂ and 9♀ - 18.92%), 67 mature people (56♂ and 17♀ - 65.77%) and two senile males (1.80%) – the number of male skeletons was significantly higher compared to the female skeletons (80/31). No death was recorded in the age interval 0-14 years.

The sacrum is present in 66 males and 25 females (91 subjects) of the total series, which included 106 subjects (18-x years). We observed that six sacra in the total of 90 bones present spina bifida occulta – five sacra belonged to males aged 18-60 years and a sacrum belonged to a female aged 18-20 years. Spina bifida occulta recorded an incidence of 6.59% in the total number of subjects, affecting 6.57% of the males and 4% of the females.

Subject M XIV. The first case of sacral spina bifida occulta was identified in a male subject (subject M XIV), aged 18-19 years. The well preserved and almost integral skeleton was exhumed from an individual tomb.

The subject's height is 1657 mm (medium-sized). The tibiae and the humeri have bone excrescences at the muscle insertions. The sacrum presents occult spinal dysraphism categorized as posterior spina bifida occulta with a dehiscence located in the S1 and S3-S5 segments (Fig. 4).

The dehiscence located in the S1 segment represents 20% of the total types of closed spinal dysraphism. This form of dysraphism doesn't present associated clinical

symptoms and the sacral hiatus identified in the S3-S5 segment is frequently reported in the scholarly literature (Tortori-Donati *et al.*, 2000).



Figure 3. Subject M126A - ♂, 40-45 years: posterior view of sacrum: sacral spina bifida occulta in the S2-S3 segment.

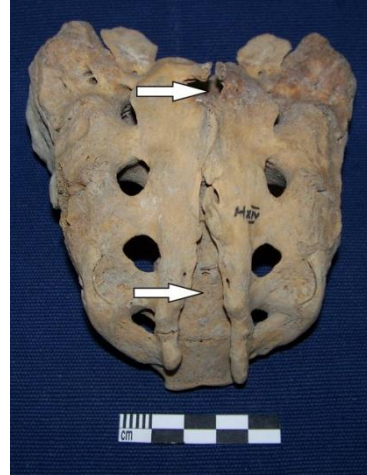


Figure 4. Subject M XIV - ♂, 18-19 years: posterior view of sacrum - sacral spina bifida occulta in the S1 and S3-S5 segments.

Subject G8 M25. Another case of spina bifida occulta was noted in a female subject (subject G8 M25) aged 18-20 years, who was buried in the same tomb with two other mature subjects aged 40-50 years. From the cranial skeleton of this female we only retrieved the frontal bone and a fragment of the occipital bone. The incomplete sacrum presents a posterior interlaminary dehiscence in the S4-S5 segment (sacral spina bifida occulta) – the posterior laminae of the sacral vertebrae failed to fuse in this segment (Fig. 5).



Figure 5. Subject G8 M25 - ♀, 18-20 years: posterior view of sacrum - sacral spina bifida occulta in the S4-S5 segment.

Subject M XIII. The male subject (subject M XIII) aged 25-30 years in the moment of death has an incomplete postcranial skeleton; however, the bone fragments are well preserved (the calculated stature is 1671 mm – over-medium sized). The sacrum presents sacral spina bifida occulta in the S2 and S3-S5 segments (Fig. 6a) associated with the incomplete central anterior lumbarization (separation) of the first sacral vertebra S1 from the rest of the sacrum's body (Fig. 6b).



Figure 6. Subject M XIII – ♂, 25-30 years: a. posterior view of sacrum - sacral spina bifida occulta in the S2 and S3-S5 segments; b. anterior view of sacrum – incomplete central lumbarization of the first sacral vertebra (S1).

Subject M IV. The cranial segment of the subject M IV belonging to an adult male aged 25-30 years presents a dip near the coronal suture caused by a blow; it also has nine Wormian bones on the lambdoid suture. The postcranial segment lacks the tibiae and the fibulae, a fragment of the left femur and the right calcaneus. The sacrum has two dehiscences: the first one is located in the S1 segment and the second is in the S3-S5 segment (Fig. 7).

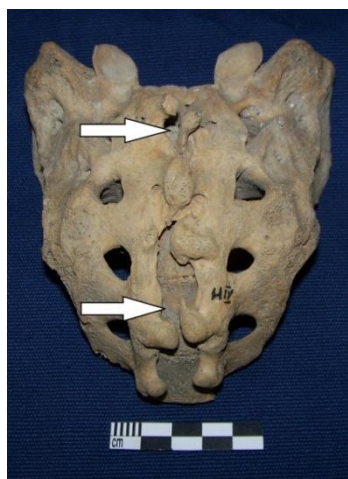


Figure 7. Subject M IV - ♂, 25-30 years: posterior view of sacrum – sacral spina bifida occulta in the S1 and S3-S5 segments.

Subject G10 M33-A. Another case of spina bifida occulta was identified in a male mature subject (aged 40-45 years), marked as G10 M33-A. He was buried next to three other subjects: a male aged 40-45 years and two females aged 20-55 years. The skull is absent and the postcranial skeleton lacks the femurs, the tibiae and the fibulae, the left radius and the left ulna. The subject's stature is 1796 mm (falls under the tall category). In this case, there is a total spina bifida occulta from the L5 segment to the S1-S5 segment (Fig. 8a), associated with the central sacralization (fusion) of the last lumbar vertebra (L5) to the body of the sacrum (Fig. 8b).



Figure 8. Subject G10 M33-A – ♂, 40-45 years: a. posterior view of sacrum – spina bifida occulta in the L5-S5 segment; b. anterior view of sacrum – sacralization of the last lumbar vertebra (L5).

Subject M XI. The last case of sacral spina bifida occulta, in the third series, was identified in a mature male (55-60 years) marked as M XI, with a stature of 1667 mm (medium-sized). The subject has in the cranial segment, specifically on the right parietal, a hole caused by an ante-mortem blow. The thoracic vertebrae (T8-T11) of the subject have marginal osteophytes. We observed a total spina bifida occulta S1-S5 (posterior interlaminary dehiscence) and a channel formed between the laminae (Fig. 9).



Figure 9. Subject M XI – ♂, 55-60 years: posterior view of sacrum – total sacral spina bifida occulta (S1-S5).



Figure 10. Subject M 45 – ♂, 50-55 years: posterior view of sacrum – sacral spina bifida occulta in the S3-S5 segment.

Fourth sample

The osteological material (67 skeletons of XVIth-XIXth centuries) unearthed from

the necropolis of the Banu Church is mostly derived from reinterment tombs. We found 18 skeletons of children (0-14 years: approximately 27%), three teenagers (2♂ and 1♀ - approximately 4%), two adults (2♂ - 2.99%), 40 mature people (22♂ and 18♀ - 59.70%) and four senile people (3♂ and 1♀ - 5.97%).

In this osteological series, we retrieved 13 sacra (8♂ and 5♀) from the total of 48 subjects, aged 18-x years. Among these 13 bones there was a single case of spina bifida occulta in a male subject (subject M45) aged 50-55 years. The incidence of sacral spina bifida occulta (sacral occult spinal dysraphism) is 7.69% in the total number of subjects for which the sacrum is present and 12.50% in the male group.

Subject M45. The skeleton exhumed from an individual tomb is incomplete. The cranial segment lacks the base, a fragment of the occipital bone, the left mastoid process and the left side of the facial skeleton. The skull has four Wormian bones on the lambdoid suture and two Wormian bones on the parietal-temporal suture. The postcranial skeleton lacks the following components: fragments of the coxal bones, the right tibia and the right fibula, the radiuses and the left ulna.

Apart from the sacrum, all the other elements of the vertebral column are represented only by fragments of vertebral bodies.

The sacrum of the subject M45 shows signs of spina bifida occulta (Fig. 10) with a dehiscence located in the S3-S5 segment.

Conclusions

This research assesses the frequency of sacral spina bifida occulta (occult spinal dysraphism) in medieval and post-medieval populations inhabiting the city of Iasi (XVth-XIXth). The human remains subjected to analysis (947 skeletons) were exhumed from four necropolises discovered in the Iasi city area, between 1995 and 2011.

We have found no case of cervical, thoracic or lumbar interlaminar dehiscences.

The osteological data generated in this research suggest that the frequency of sacral spina bifida occulta is relatively low. Thus, the incidence of sacral spina bifida occulta is 3.83% in the total population for which the sacrum was preserved (261 sacra) and by gender we recorded 5.19% in the male group (154 sacra) and 1.86% in the female group (107 sacra).

This paper makes a contribution to our understanding of health during the medieval and post-medieval times. Spina bifida occulta (occult spinal dysraphism), as abnormality defined by an incomplete fusion of the osseous tissues in the midline, has a multifactorial origin involving both a genetic predisposition and environmental factors which act like triggers. The association between the two categories of factors explains why spina bifida doesn't "run" in the family like other genetic disorders.

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RECONSTRUCTION OF THE DEMOGRAPHIC PROFILE AND THE LONGEVITY OF THE POPULATION INHABITING THE CITY OF IAȘI DURING THE LATE MIDDLE AGES AND THE EARLY MODERN PERIOD (XVTH-XIXTH CENTURIES)

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Abstract. This scientific report highlights different aspects regarding certain demographic indicators pertaining to the four necropolises (XVth-XIXth centuries) discovered between 1995 and 2011 in the Iași city area (Romania): the necropolis of the “Sf. Maria” Catholic Church, XVth-XIXth centuries; the necropolis of the “Sf. Nicolae-Ciurchi” Church, XVIth-XVIIIth centuries; the necropolis located on the eastern side of the former Princely Court (“Curtea Domnească”), XVIIth century; the necropolis discovered on the premises of the Banu Church (XVIth-XIXth centuries). The comparative analysis of the paleodemographic characteristics associated with the four osteological series revealed nearly similar features; the only exceptions we encounter are related to the childhood period (0-14 years) and the adult period. The highest death rate for the subjects over 20 years was recorded in the mature period (30-60 years: ranging from 55.44% to 65.77%), whereas the segment over 60 years recorded the lowest incidence rates (between approximately 2% and 11%). The average lifespan for the total population (the four series) is 34.73 years, whereas by gender (for 20-x years) it amounts to 43.45 years in males, respectively 41.96 years in females. The average lifespan estimated for each studied series (0-x years) displays very similar values – ranging from 34.06 years to 36.94 years (which is higher than the average lifespan for other Moldavian synchronous series). Calculated by gender (for the age interval 20-x years), this indicator shows higher values in the male cases (with approximately one year in the “Sf. Maria” Catholic Church, with approximately two years in the “Sf. Nicolae-Ciurchi” Church and with approximately three years in Princely Court); the only exception is encountered in the population exhumed from the necropolis of the Banu Church, where the average lifespan in the female cases is approximately four years higher compared to the male cases.

Keywords: mortality, demographic study, Middle Ages, Modern Period, XVth-XIXth centuries.

Rezumat. Reconstrucția profilului demografic și longevitatea populației Iașului în perioada medievală târzie și începutul perioadei moderne (secolele XV-XIX). În prezentul articol sunt puse în evidență aspecte privind unii indicatori demografici din patru necropole (secolele XV-XIX) descoperite între anii 1995-2011 pe raza orașului Iași (Romania): necropola Bisericii Catolice „Sf. Maria”, secolele XV-XIX; necropola Bisericii „Sf. Nicolae-Ciurchi”, secolele XVI-XVIII; necropola situată în partea estică a fostei Curți domnești, secolul XVII; necropola descoperită în incinta Bisericii Banu, secolele XVI-XIX. Analiza comparativă a cele patru serii osteologice indică caracteristici paleodemografice aproximativ asemănătoare, cu excepția perioadei copilăriei (0-14 ani.) și a perioadei adulte. În cazul subiecților care au depășit 20 de ani, maximum de frecvență a deceselor s-a înregistrat în etapa maturității (30-60 ani: între 55,44% și 65,77%), decesele în rândul subiecților de peste 60 de ani înregistrând ponderile cele mai reduse (între circa 2% și 11%). Durata medie de viață pentru totalul populației (cele patru serii) este de 34,73 de ani, iar pe sexe (pentru 20-x ani) aceasta este de 43,45 ani la bărbați și de 41,96 ani la femei. Durata medie de viață calculată pentru fiecare serie studiată (0-x ani) prezintă valori foarte apropiate - între 34,06 de ani și 36,94 de ani (fiind mai crescută comparativ cu durata medie de viață a altor serii sincrone din Moldova). Pe sexe (pentru 20-x ani), aceasta este mai crescută la bărbați (cu circa un an la Biserica Catolică „Sf. Maria”, cu circa doi ani la „Sf. Nicolae”-Ciurchi; cu circa trei ani la Curtea domnească), excepție făcând populația de la Banu la care durata medie de viață a femeilor este cu circa patru ani mai mare față de bărbați.

Cuvinte cheie: mortalitate, studiu demografic, Evul Mediu, Perioada Modernă, secolele XV-XIX.

Introduction

The archaeological excavations, conducted in the Iași city area between 1995 and 2011 by a group of scientists (directed by Mrs. Stela Cheptea, archaeologist) from the Centre for European History and Civilization, led to the exhumation of ample archaeological material. The skeletons found in the four necropolises were dated from the Late Middle Ages and the Early Modern Period (XVth-XIXth centuries).

The entire osteological material (947 skeletons) was made available to the staff at the Iași Anthropological Research Department for a complex paleoanthropological study (morpho-biological, demographic and paleopathological).

In this article we set out to conduct a paleodemographic study of the entire osteological material exhumed from the four necropolises: the necropolis of the “Sf. Maria” Catholic Church, XVth-XIXth centuries; the necropolis of the “Sf. Nicolae – Ciurchi” Church, XVIth-XVIIIth centuries; the necropolis located on the eastern side of the former Princely Court (“Curtea Domnească”), XVIIth century; the necropolis of the Banu Church, XVIth-XIXth centuries.

The medieval populations represent the product of a sustained local progress, standing proof of the cultural continuity, from the most ancient times down to the present day. In the course of time they were also influenced by certain foreign populations which they made contact with, being subject to changes in the anthropological structure. Moreover, the successive socio-economic changes induced some transformations in the aspect of the paleodemographic characteristics. During the Middle Ages, the sanitary deficiencies and the absence of efficient measures in this area have led to the outbreak of many diseases and implicitly to an increase in the number of deaths recorded (Cihodaru *et al.*, 1980).

Demography considers the population as a singular object for quantitative analysis and seeks to explain variations in population size, structure and dynamics (Chamberlain, 2006). Paleodemographic studies provide important information regarding the life patterns of ancient populations and they are of great value for understanding population dynamics in historic and prehistoric times (Nagaoka *et al.*, 2006).

In reconstructing the demographic features of the past populations, it is of great importance to accurately determine the age and sex of the human bones using the available methods. Based on the paleodemographic analysis of the varied human communities, we can estimate the number of inhabitants and the population density for a specific settlement, the general and the infant mortality rate, the age and sex distribution of deaths, as well as the life expectancy.

Material and Methods

Research conducted upon the anthropological structure for various groups of people cannot exclude demographic problems, such as the number of inhabitants living in a settlement and their density, the general and the infant mortality, the mortality rate by gender and by age, as well as the life expectancy. Consequently, this article states the demographic features which define a segment of the population inhabiting the city of Iași during the Late Middle Ages and the Early Modern Period (XVth-XIXth centuries).

The osteological material is represented by four osteological series (consisting of 947 skeletons) exhumed from four necropolises located in the Iași city area and dated between the XVth century and the first half of the XIXth century.

The human osteological material unearthed in 1995 from the necropolis of the “Sf. Maria” Catholic Church (XVth-XIXth centuries) is represented by 89 skeletons found in burial and reburial tombs.

The necropolis discovered in 2007 on the premises of the “Sf. Nicolae-Ciurchi” Church (XVIth-XVIIIth centuries) offered us for study 680 human skeletons, most of them ill-preserved, coming from 300 individual burial tombs or reburial tombs. On the other hand, the osteological series excavated in 2008 from the necropolis located on eastern side of the former Princely Court (XVIIth century) presents a satisfying state of preservation in the 111 inhumation skeletons (found in 60 tombs).

The fourth necropolis (XVIth-XIXth centuries) discovered in 2011 on the premises of the Banu Church pursuant to the edifice reinforcement and rehabilitation works, contains 67 skeletons (inhumed and re-inhumed).

The bone fragments were restored, marked and subjected to a bio-morphoscopic analysis to determine the individual age and gender, the pathologies and the sporadic occurrences. As we previously mentioned, the precarious state of preservation for some of the skeletons (the absence of bone fragments which would have served to restore more important bone structures) hindered the anthropological analysis and the paleopathological analysis, implicitly.

The age and sex determination for the subjects over 18 years was accomplished using the methods and procedures recommended by Brothwell (1981), Bruzek (2002), Mays (1998), Schmitt (2005), Walrath *et al.* (2004).

The age at death for subadults was estimated based on the primary and permanent teeth stages of development (Ubelaker, 1979; Schaefer *et al.*, 2009), as well as on the analysis of the level of ossification between the long bones epiphyses and diaphyses and their repartition in the corresponding age categories (Maresh, 1955; Fazekas & Kosa, 1978; Scheuer & Black, 2000). In the case of subadults over 15 years, their sex was determined based on the macroscopic analysis of certain pelvic features.

After establishing the age and gender for each skeleton, we conducted a demographycal analysis of the studied population, tracing the mortality rates by age and gender, as well as the average lifespan, which was estimated by calculating the life expectancy at birth (0-x years) and at the age of 20 (20-x years). Life expectancy at birth offers the most consistent evaluation of the mortality rate. This indicator defines the average number of years remaining to a person from the moment of birth to the age limit, considering that, throughout life, from year to year, the mortality rate maintains the value established in the year when the calculation was made (Țarcă, 2008). Life expectancy at birth, also called average lifespan, was determined based on the mortality tables (Acsádi & Nemeskéri, 1970), which represent important demographic models where the main place is occupied by mortality and survival (Chamberlain, 2006; Țarcă, 2008).

The mortality tables contain several mathematical indicators associated with deaths, grouped by specific life stages (half decades) based on which we established in the end the life expectancy, both for the entire population (0-x years) and for the adult population (20-x years):

- dx = the death rate;
- lx = the survival rate;
- qx = the death probability;
- Lx = the average lifespan lived within the age interval;

- T_x = the sum of the average life spans lived within the current age interval and the remaining intervals;
- $e^{\circ}x$ = the life expectancy (the average lifespan) (Chamberlain, 2006).

Results and Discussion

Since the age and sex distribution of deaths is, in fact, the demographic post mortem representation of the living populations, within this distribution, the incidence of mortality by gender, the average age at death, as well as life expectancy, represent indicators of great importance. In historical periods with high infant mortality rates, the life expectancy at birth is highly sensitive to the rate of death in the first few years of life (Hoppa & Vaupel, 2002). We intend to analyze at first the structure by age and by gender for the entire osteological material (947 skeletons) from the four necropolises (Table 1), as well as the life expectancy for the entire population (0-x years) and by gender (20-x years).

Table 1. Age and sex distribution of the skeletons in the four studied series.

Sex	Male		Female		Indeterminable		Total	
Age (years)	N*	%	N	%	N	%	N	%
Infans I (0-7)	-	-	-	-	98	10.34	98	10.34
Infans II (7-14)	-	-	-	-	60	6.33	60	6.33
Juvenis (14-20)	48	5.07	30	3.17	-	-	78	8.24
Adultus (20-30)	45	4.75	70	7.39	-	-	115	12.14
Maturus (30-60)	282	29.78	259	27.35	-	-	541	57.13
Senilis (60-x)	31	3.27	24	2.53	-	-	55	5.81
Total	406	42.87	383	40.44	158	16.67	947	100

N* = number of estimated individuals

The data recorded in this table indicate a high (approximately 17%) mortality rate among children aged 0-14 years, if we consider the mortality rate recorded at the same ages for other medieval populations.

Within this percentage, the highest incidence is recorded by the infant mortality in children aged 0-7 years. The mortality rate for the population beyond adolescence (5.07% of the males and 3.17% of the females) is 12.14% (4.75% in males and 7.39% in females) in the case of adults (20-30 years) and 57.13% (29.78% in males and 27.35% in females) in the case of mature people (30-60 years). The senile population (60-x years) recorded only 5.81% (3.27% - males and 2.53% - females).

As regards the adult stage, the female mortality presents a higher incidence (7.39%) compared to males (4.75%). This occurrence can be attributed to a higher risk factor for the females during the periods of maximum fecundity – deaths during birth and after birth are more frequent due to the lack of proper medical care.

The ratio between the number of deceased males and the number of deceased females is 1.06 – there are a higher number of male skeletons compared to the female skeletons (406/383).

As regards the gender distribution of the skeletons for the segment 20-x years, represented by 711 subjects, we can observe a slightly higher number of male skeletons compared to the female skeletons – 358 (50.35%) as opposed to 353 (49.64%) (Fig.1)

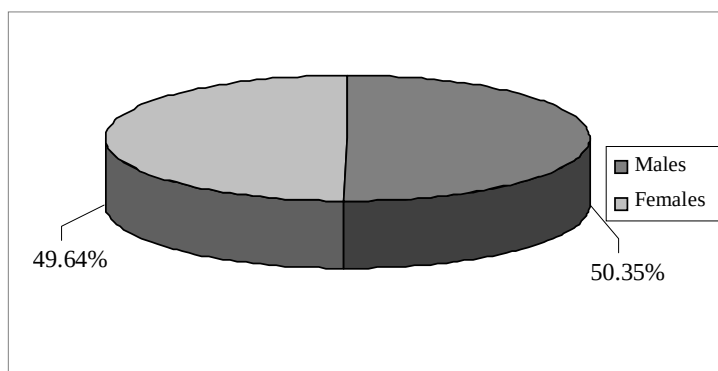


Figure 1. Mortality distribution percentage by gender (20-x years) in the four studied series.

Based on the distribution of the subjects by the age at death, we calculated the life expectancy at birth for the entire investigated series (0-x years) and for the subjects over 20 years, separately for each gender. These indicators reflect the longevity of the population. Thus, the life expectancy at birth for the entire sample (0-x years) is 34.73 years (Table 2) and by gender (for 20-x years) we recorded 23.45 years in the male segment and 21.96 years in the female segment (Tables 3, 4). The average lifespan calculated for the adult skeletons (subjects over 20 years) is 43.45 years in males and 41.96 years in females.

Table 2. Mortality and life expectancy in the four studied series.

Age class	N (Dx)	% (dx)	Survivors	Probability of death (qx)	Life expectancy (e^0_x)
			(1x)		
0-4	59	6.23	100.00	0.0623	34.73
5-9	59	6.23	93.77	0.0664	31.87
10-14	40	4.22	87.54	0.0483	28.96
15-19	76	8.03	83.32	0.0963	25.30
20-24	58	6.12	75.29	0.0813	22.73
25-29	57	6.02	69.17	0.0870	19.52
30-34	83	8.76	63.15	0.1388	16.15
35-39	92	9.71	54.38	0.1786	13.34
40-44	124	13.09	44.67	0.2931	10.70
45-49	93	9.82	31.57	0.3110	9.11
50-54	90	9.50	21.75	0.4369	7.09
55-59	53	5.60	12.25	0.4569	5.65
60-64	53	5.60	6.65	0.8413	3.29
65-69	10	1.06	1.06	1.0000	2.50

Table 3. Male mortality and life expectancy in the four studied series.

Age class	N (Dx)	%(dx)	Survivors	Probability of death (qx)	Lx	Tx	Life expectancy (e^0_x)
			(1x)				
20-24	22	6.16	100.00	0.0616	484.59	2345.24	23.45
25-29	23	6.44	93.84	0.0687	453.08	1860.64	19.83
30-34	41	11.48	87.39	0.1314	408.26	1407.56	16.11
35-39	46	12.89	75.91	0.1697	347.34	999.30	13.16
40-44	67	18.77	63.03	0.2978	268.21	651.96	10.34
45-49	58	16.25	44.26	0.3671	180.67	383.75	8.67
50-54	43	12.04	28.01	0.4300	109.94	203.08	7.25
55-59	25	7.00	15.97	0.4386	62.32	93.14	5.83
60-64	26	7.28	8.96	0.8125	26.61	30.81	3.44
64-70	6	1.68	1.68	1.0000	4.20	4.20	2.50

Table 4. Female mortality and life expectancy in the four studied series.

Age class	N(Dx)	%(dx)	Survivors	Probability of death (qx)	Lx	Tx	Life expectancy (e^0_x)
			(1x)				
20-24	36	10.17	100.00	0.1017	474.58	2196.33	21.96
25-29	34	9.60	89.83	0.1069	425.14	1721.75	19.17
30-34	42	11.86	80.23	0.1479	371.47	1296.61	16.16
35-39	45	12.71	68.36	0.1860	310.03	925.14	13.53
40-44	57	16.10	55.65	0.2893	237.99	615.11	11.05
45-49	35	9.89	39.55	0.2500	173.02	377.12	9.54
50-54	47	13.28	29.66	0.4476	115.11	204.10	6.88
55-59	28	7.91	16.38	0.4828	62.15	88.98	5.43
60-64	26	7.34	8.47	0.8667	24.01	26.84	3.17
64-69	4	1.13	1.13	1.0000	2.82	2.82	2.50

To illustrate the paleodemographic indicators, we also present the results obtained separately for the four populations discovered in the Iasi city area and dated from the Late Middle Ages and the Early Modern Period (XVth-XIXth centuries) (Table 5).

Table 5. Mortality percentage by gender and by age for specific groups of populations living in the Iași city area in the XVth-XIXth centuries.

Age stage	Sex	Infans I (0-7 ani)		Infans II (7-14 ani)		Juvenis (14-20 ani)		Adultus (20-30 ani)		Maturus (30-60 ani)		Senilis (60-x ani)	
		N	%	N	%	N	%	N	%	N	%	N	%
Necropolises													
“Sf. Maria” Catholic Church (XV th -XIX th centuries)	♂	16	17.98	2	2.25	2	2.25	3	3.37	28	31.46	5	5.62
	♀					1	1.12	5	5.62	23	25.84	4	4.49
Total (N=89)		16	17.98	2	2.25	3	3.37	8	8.99	51	57.30	9	10.11
“Sf. Nicolae-Ciurchi” Church (XVI th -XVIII th centuries)	♂	70	10.29	52	7.65	34	5	28	4.12	176	25.80	21	3.09
	♀					23	3.38	56	8.24	201	29.56	19	2.79
Total (N=680)		70	10.29	52	7.65	57	8.38	84	12.35	377	55.44	40	5.88
Princely Court (XVII th century)	♂	-	-	-	-	10	9.01	12	10.81	56	50.45	2	1.80
	♀	-	-	-	-	5	4.50	9	8.11	17	15.32	-	-
Total (N=111)		-	-	-	-	15	13.51	21	18.92	73	65.77	2	1.80
Banu Church (XVI th -XIX th centuries)	♂	12	17.91	6	8.96	2	2.99	2	2.99	22	32.84	3	4.48
	♀					1	1.49	-	-	18	26.87	1	1.49
Total (N=67)		12	17.91	6	8.96	3	4.48	2	2.99	40	59.70	4	5.97

The data recorded in Table 5 for the osteological series unearthed from the necropolis of the “Sf. Maria” Catholic Church (XVth-XIXth centuries) indicate a mortality of approximately 24% for the subjects aged less than 20 years, of which 20.23%, consequently an important percentage, is associated with children aged 0-14 years. In the subjects past the age of 20, the highest death rate corresponds to the maturity stage (approximately 57%), whereas for the adult stage, the mortality index is approximately 9%. In the age interval 60-x years we recorded a death rate of 10.11% (five deaths in males and four deaths in females). As regards the death frequency in the two genders, we signaled a slightly higher prevalence in adult females compared to males (approximately 6% as opposed to 3%). On the other hand, in the mature stage, the male mortality rate is higher than the female rate (31.46% as opposed to 25.84%). The masculinity index or the *sex ratio* (the ratio between the number of males and females) considered for the entire population indicates a slightly higher prevalence of the male skeletons compared to the female skeletons (Table 5).

As concerns the distribution of deaths by gender in the segment 20-x years represented by 68 subjects, we remark on a slightly higher ratio in the male series (36 males – 52.94% as opposed to 32 females – 47.05%) (Fig. 2).

The life expectancy at birth, calculated for the entire population (0-x years) is 36.94 years (Table 6). The life expectancy for the subjects past the age of 20 is 26.81 years in males and 25.94 years in females, meaning the values for the two genders are very similar. The average lifespan, calculated for the adult segment of the population, is 43.64 years in males and 41.49 years in females, also very similar values for the two genders (Table 6).

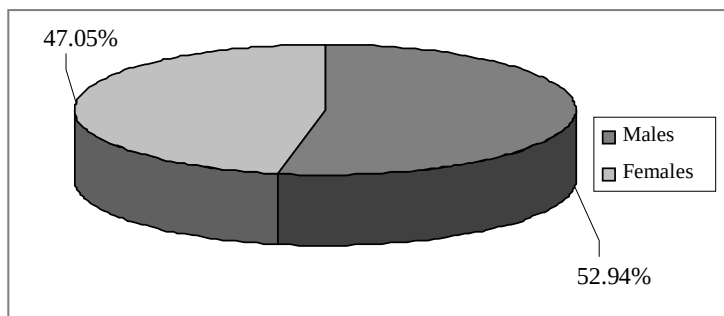


Figure 2. Mortality distribution percentage by gender (20-x years).

Table 6. The average lifespan in the investigated populations.

Necropolises	“Sf. Maria” Catholic Church (XV th -XIX th centuries)	“Sf. Nicolae- Ciurchi” Church (XVI th -XVIII th centuries)	Princely Court (XVII th century)	Banu Church (XVI th -XIX th centuries)
0-x ani	36.94	34.06	35.92	35.63
Male 20-x years	46.81	43.64	39.86	46.76
Female 20-x years	45.94	41.49	35.96	50.39

The osteological material exhumed from the necropolis of the “Sf. Nicolae-Ciurchi” Church (XVIth-XIXth centuries) was in a bad state of preservation, consequently most of the skeletons required an elaborate analysis to determine the age and sex of the skeletons.

From the analysis of the data presented in Table 5 we can observe that the gender determination wasn’t possible in 122 skeletons of children (70 - infans I and 52 – infans II). Thus, the analyzed osteological series allowed a demographic study based on the distribution by gender and age categories.

The repartition of the subjects by age and by gender highlights primarily that approximately 27% of the population (children and teenagers) didn’t reach the adult stage. In the 20-x years group (adults, mature and senile), the highest death frequency is encountered in the mature group (approximately 56%), followed by the adult and senile group with lower incidences (approximately 13% and 6%, respectively).

If we consider the mortality distribution by gender for the 20-x years population, represented by 558 subjects, the ratio is slightly higher in the female series (299 females – 53.58% as opposed to 259 males – 46.41%, Fig. 3). This phenomenon is specific both for the adult stage (56 females compared to 28 males) and the mature stage (201 females as opposed to 176 males) – Table 5.

There is a low frequency of deaths in the age segment 60-x years. We recorded 21 deaths in males (3.09%) and 19 deaths in females (2.79%), consequently the subjects had a long life taking into account the historical period when they lived. If we analyze the ratio between the number of male deaths and the number of female deaths (“the sex ratio”) in the total number of skeletons, the resulted value is rather low (0.86), which indicates a higher number of female skeletons (259/299); this occurrence can be observed both in the adult stage and in the mature stage. The lower mortality rate in the case of males is natural, if we

consider that in those times many of the active males took part in actions of territorial defense and the warriors who died in those fights were buried in other places than the usual necropolises.

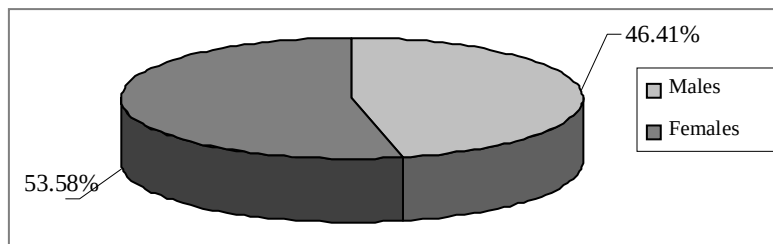


Figure 3. Mortality distribution percentage by gender (20-x years).

The life expectancy at birth for the entire sample (0-x years) is approximately 34.06 years and by gender (for 20-x years) we recorded 23.64 years in the male segment and 21.49 years in the female segment (Table 6). Thus, the average lifespan by gender (for 20-x years) is 43.64 years in males and 41.49 years in females (Table 6) (Simalcsik *et al.*, 2012).

After conducting a paleodemographic analysis of the osteological series unearthed from the XVIIth century medieval necropolis located in the central area of Iași (the eastern side of the ancient Princely Court (“Curtea Domnească” – the Palas Complex area), we observed the absence of mortality in the groups of young people (0-14 years). The highest death rate is recorded in the mature stage (approximately 66%), followed by the adult stage (18.92%) and the adolescent stage (13.51%). In the age interval 60-x years we recorded only two male deaths, which is 1.80% of the total population considered for this study. There is a very high ratio between the number of deceased males and females (2.58) – the number of male skeletons is significantly higher compared to the number of female skeletons (80/31).

As concerns the mortality distribution by gender for the 20-x years segment of the population, represented by 96 subjects, we can also observe that the number of male skeletons is considerably higher than the number of female skeletons – 70 as opposed to 26 (Fig. 4).

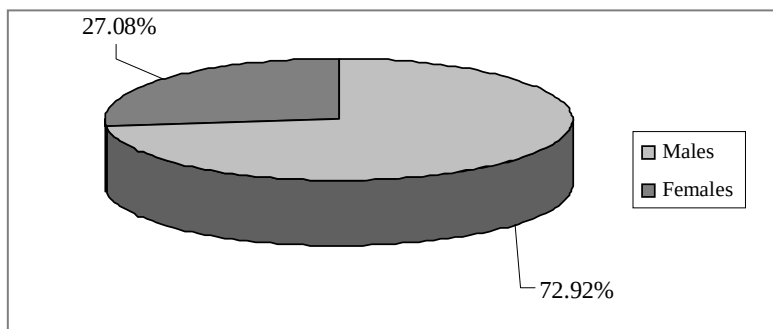


Figure 4. Mortality distribution percentage by gender (20-x years).

The average lifespan calculated for the entire series (0-x years) is 35.92 years and by gender (for 20-x years) it ranges between 39.86 years in males and 35.96 years in females (Table 6).

Table 5 presents the demographic status of the population exhumed in 2011 from the necropolis (67 skeletons) discovered on the premises of the Banu Church (XVIth-XIXth centuries) following the edifice restoration and consolidation works.

If we take a look at Table 5, we are disconcerted in the first place by the relatively high incidence associated with children (infans I and infans II – 24.61% of the total), which suggests that approximately one quarter of the population died before reaching adolescence. If we add to this number the percentage associated with teenagers (4.62%), the result is that approximately one third of the people (29.23%) didn't reach adulthood. We can thus conclude that the mortality rates in the young people from this population decreased with age. Consequently, approximately 71% of the population reached at least adulthood. From this percentage, approximately 3% didn't reach the maturity stage, approximately 62% died in full maturity and only 6% reached the old age (over 60 years). As concerns the distribution by gender, we stated a higher mortality rate in males compared to females (29 males as opposed to 20 females, with a masculinity index of 1.45); this disparity was recorded in all the age categories (juvenile, adult, mature and senile) – Table 5, Figure 5.

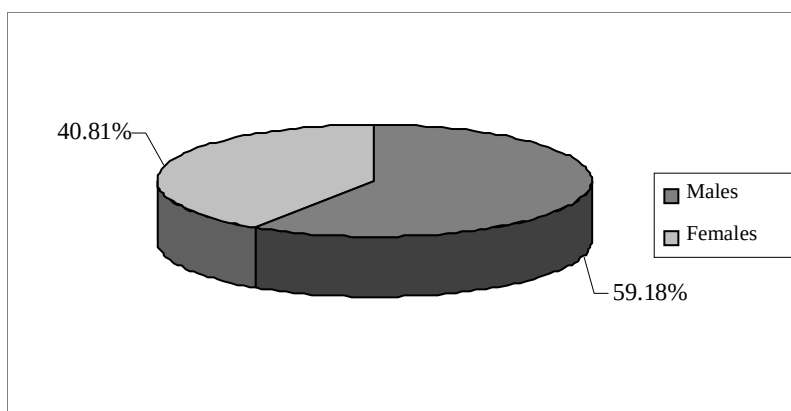


Figure 5. Mortality distribution percentage by gender (20-x years).

The average lifespan for the entire population (0-x years) is similar (35.63 years) to the values obtained for other series dated from the medieval period (Table 6). This value remains relatively unchanged up until adulthood and then it begins to drop almost uniformly in the following half decades until the senile period.

The life expectancy by gender for 20-x years is approximately four years higher in females compared to males (30.39 years as opposed to 26.76 years), which indicates an average age at death of approximately 50.39 years in the former and 46.76 years in the latter (Table 6).

Table 5, displaying the structure of the four investigated series by age and by gender, indicates a relatively higher mortality rate in the children (0-14 years) exhumed from the Banu Church necropolis (26.87%) in comparison with the “Sf. Maria” Catholic Church (20.23%) and the “Sf. Nicolae-Ciurchi” Church (17.94%).

We remark upon the absence of child mortality (0-14 years) in the necropolis discovered in the eastern part of Princely Court (“Curtea Domnească”). The mortality rate among teenagers (14-20 years) is relatively lower in the “Sf. Maria” Catholic Church (3.37%) and in the Banu Church (4.48%); on the other hand, the indicator recorded higher values in the Princely Court (13.51%) and in the “Sf. Nicolae-Ciurchi” Church (8.38%) (Table 5, Fig. 6).

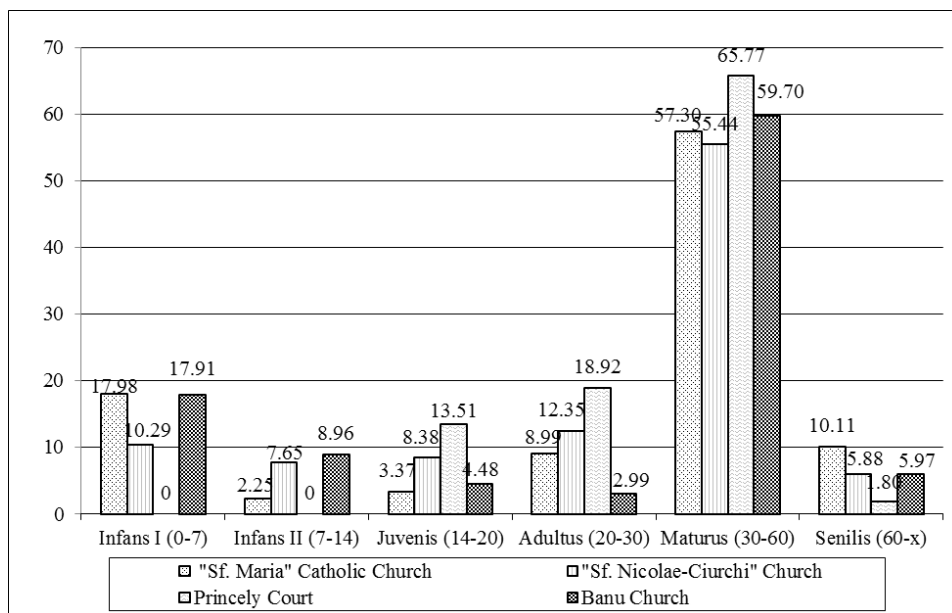


Figure 6. Mortality distribution percentages by age categories in the investigated series.

As regards the mortality distribution for the adult stage (20-30 years) in the four series, we can observe an asymmetry of the death rates. The highest rate is recorded in the Princely Court (18.92%), followed by “Sf. Nicolae-Ciurchi” Church (12.35%), the “Sf. Maria” Catholic Church and the Banu Church with considerably lower rates (8.99% and 2.99%, respectively) – Figure 6. In the mature stage (30-60 years) the death rates have similar values in the four series (the “Sf. Maria” Catholic Church – 57.30%; “Sf. Nicolae-Ciurchi” Church – 55.44%; Princely Court – 65.77% and the Banu Church – 59.70%). In the senile period we remark a lower death incidence in the Princely Court (1.80%) compared to the “Sf. Maria” Catholic Church (10.11%), the Banu Church (5.97%) and the “Sf. Nicolae-Ciurchi” Church (5.88%) – Figure 6.

The average lifespan, also known as the life expectancy at birth, has similar values in the four populations (36.94 years in the “Sf. Maria” Catholic Church, 34.06 years in the “Sf. Nicolae-Ciurchi” Church, 35.92 years in the Princely Court and 35.63 years in the Banu Church). This indicator is influenced, on the one hand, by the percentage of child skeletons and on the other hand by the frequency of deaths among elders (60-x years) (Fig. 7).

After analyzing the death rate by gender for 20-x years, we came to the conclusion that the female skeletons exhumed from the necropolis of the “Sf. Nicolae-Ciurchi” Church recorded a higher incidence (53.58%) compared to those unearthed from the necropolis of

the “Sf. Maria” Catholic Church (47.05%), from the premises of the Banu Church (40.81%) and from the necropolis located in the eastern part of Princely Court (27.08%). On the other hand, the male death rate in the skeletons exhumed from the necropolis located in the eastern part of Princely Court (“Curtea Domnească”) has a much higher value (72.92%) in comparison with the skeletons discovered in the other three necropolises dated from the same period: the Banu Church (59.18%), the “Sf. Maria” Catholic Church (52.94%) and the “Sf. Nicolae-Ciurchi” Church (46.41%) (Fig. 8).

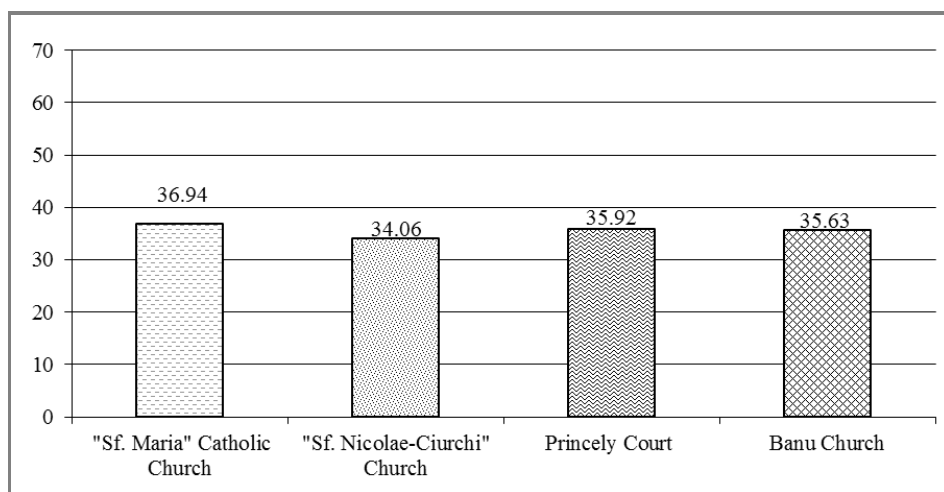


Figure 7. The average lifespan in the investigated series (0-x years).

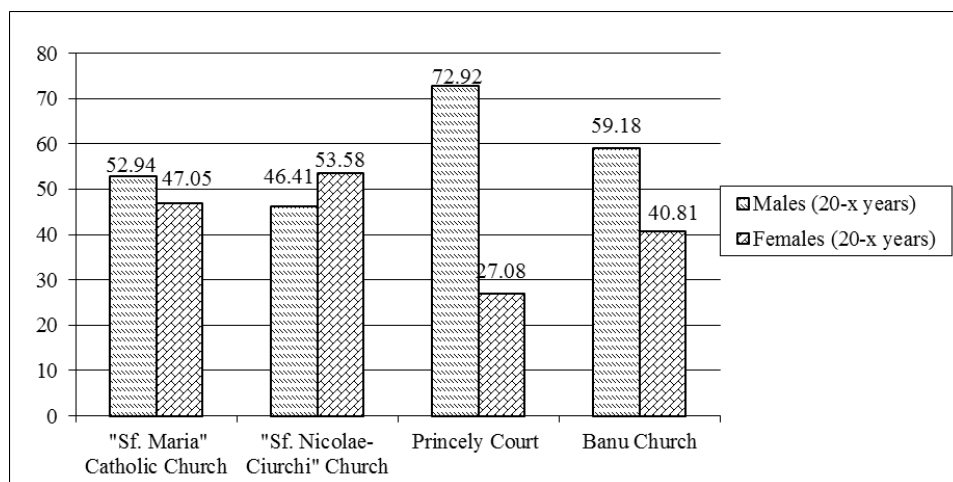


Figure 8. Mortality distribution percentages by gender in the investigated series (20-x years).

In the 20-x years populations, the average lifespan calculated separately by gender is, on average, higher in males compared to females (with approximately one year in the “Sf. Maria” Catholic Church, two years in the “Sf. Nicolae-Ciurchi” Church and three years

in Princely Court; the only exception is encountered in the population exhumed from the necropolis of the Banu Church, where the average lifespan in the female cases is approximately four years higher compared to the male cases (Fig. 9).

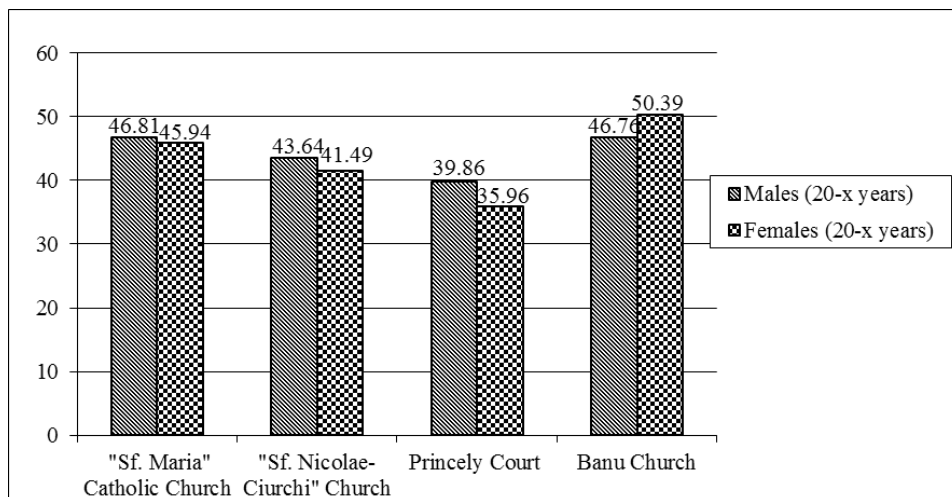


Figure 9. The average lifespan by gender in the investigated series (20-x years).

Conclusions

The four populations that lived on the current territory of Iași city during the medieval period display a relatively uniform demographic behaviour, excepting the childhood period (0-14 years) and the adulthood period. Thus, in the childhood period we recorded relatively similar death rates in three of the investigated necropolises (the necropolis of the “Sf. Nicolae-Ciurchi” Church, the necropolis of the Banu Church and the necropolis of the “Sf. Maria” Catholic Church) and a zero mortality rate in the necropolis located in the eastern part of the ancient Princely Court (“Curtea Domnească”) of Iași.

The high number of childhood deaths (mainly for the age interval 0-x years) could be interpreted both as a result of the transition from a milk diet to a normal diet and as a consequence of the precarious socioeconomic conditions which presented many risk factors to the unadapted organisms exposed to various epidemic diseases.

In the adult stage (20-30 years) we remark upon a death asymmetry: we recorded a maximal rate of 18.92% in the Princely Court (“Curtea Domnească”), followed by the “Sf. Nicolae-Ciurchi” Church (12.35%), the “Sf. Maria” Catholic Church and the Banu Church with much lower values (8.99% and 2.99%, respectively).

In the group of subjects over 20 years of age, the highest mortality rate is associated with the maturity stage in all the osteological series.

The death frequency among subjects over 60 years is relatively low in all the four series (ranging from approximately 2% to 11%). The average lifespan (for 0-x years) has very similar values in the investigated populations – between 34.06 years and 36.94 years, reflecting a relatively high longevity in contrast with other Moldavian necropolises dated from the same time period (32.40 years in Răchiteni – Miu *et al.*, 2002; 25.80 years in Siret - Botezatu *et al.*, 2004; 22.80 years in Brad - Botezatu & Cantemir, 1997).

The average lifespan in the populations over 20 years records higher values in males (approximately two years more in the “Sf. Nicolae-Ciurchi” Church and three years more in the series from the Princely Court). The only exception is encountered in the population exhumed from the necropolis of the Banu Church, where the average lifespan in the female cases is approximately four years higher compared to the male cases.

In the total population exhumed from the four necropolises, the average lifespan (for 0-x years) is 34.73 years, whereas the values recorded by gender (20-x years) are 43.45 years in males and 41.96 years in females.

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THE MEDIEVAL NECROPOLES (XVITH-XVIIITH CENTURIES) OF BERINDEȘTI AND SĂBĂOANI, NEAMȚ COUNTY (ROMANIA): PALEODEMOGRAPHIC DATA

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Abstract. The medieval necropolises of Berindești and Săbăoani (XVIth-XVIIIth centuries) are situated at a distance of 1.8-2 km one from the other, in Neamț County (Eastern Romania). The osteological material includes a total number of 937 human skeletons: 399 from Berindești and 538 from Săbăoani. In the segment of the adult population (older than 20 years) exhumed from the Berindești necropole, the average age at decease is of 41.9 years in men and of 36.7 years, respectively, in women, while the values recorded for the adult population exhumed from Săbăoani are of 43.1 years in men and of 38.1 years, respectively, in women. Life expectancy at birth (the 0-x year interval) takes quite close values in the two populatons, namely: 29.2 years at Berindești and 30.0 years at Săbăoani. For the populational segment of Berindești with ages older than 20 years, the calculated life expectancy after this age is of 21.90 years in men and of 16.70 years in women, the values registered at Săbăoani being of 23.06 years (men) and of 18.12 years (women). The mortality of the subadult segment of population (0-20 years – *infans* I, *infans* II and *juvenis*) is quite high: 33.9% at Berindești and 28.4% at Săbăoani. In the *adultus* category (20-30 years), the mortality ratios attain values of 15.8% in the population of Berindești, and of 12.3% in the Săbăoani one, while those of the *maturus* category are of 47.4% in the former case and of 55.9%, respectively, in the latter. Survival after the age of 60 years represents about 3% in both necropolises. The masculinity index records, in both necropolises, a significantly higher ratio of men, comparatively with women, especially for the 30-60 years category of age. The size of the Săbăoani population increased with the migration phenomenon, especially from the neighbouring locality, Berindești, whose members migrated in search of better living conditions, which caused, in time, vanishing, through depopulation, of locality Berindești.

Keywords: medieval necropolis, Berindești, Săbăoani, paleodemography.

Rezumat. Necropolele medievale (secolele XVI-XVIII) de la Berindești și Săbăoani, județul Neamț (România): date paleodemografice. Necropolele medievale de la Berindești și de la Săbăoani (secolele XVI-XVIII) sunt situate spațial la o distanță de 1,8-2 km una de cealaltă, în județul Neamț. Materialul osteologic însumează în total 937 schelete umane: 399 din necropola Berindești și 538 schelete din necropola Săbăoani. Vârsta medie la deces pentru segmentul populației adulte (trecute de 20 ani) deshumate din necropola de la Berindești este de 41,9 ani la bărbați și de 36,7 ani la femei, iar pentru populația adultă deshumată din Săbăoani valorile sunt de 43,1 ani la bărbați și 38,1 ani la femei. Speranța de viață la naștere (intervalul de vârstă 0-x ani) înscrie valori apropiate în cele două populații: 29,2 ani la Berindești și 30,0 ani la Săbăoani. Pentru segmentul populațional din Berindești care a depășit vârsta de 20 de ani speranța de viață calculată este de 21,90 ani la bărbați și de 16,70 ani la femei, iar pentru cel din Săbăoani, de 23,06 ani la bărbați și de 18,12 ani la femei. Mortalitatea segmentului subadult de populație (0-20 ani – *infans* I, *infans* II și *juvenis*) este destul de ridicată: de 33,9% la Berindești și de 28,4% la Săbăoani. În categoria *adultus* (20-30 ani) ratele de mortalitate înscriu valori de 15,8% în populația din Berindești și de 12,3% la cea din Săbăoani, iar cele ale categoriei *maturus* – 47,4% în primul caz și 55,9% în cel de-al doilea. Supraviețuirea după vârsta de 60 de ani atinge o pondere de circa 3% în ambele necropole. Indicele de masculinitate indică, în ambele necropole, o pondere semnificativ mai mare a bărbaților față de femei, în special în etapa de vârstă 30-60 ani. Dimensiunea populației din Săbăoani a crescut pe seama migrației populației, în special din localitatea vecină Berindești, membrii acesteia din urmă migrau spre condiții de viață mai bune, ceea ce a dus în timp, printr-un fenomen de depopulare, la dispariția localității Berindești.

Cuvinte cheie: necropole medievale, Săbăoani, Berindești, paleodemografie.

Introduction

Berindești and Săbăoani, two villages belonging to Neamț County in Easter Romania, are documented only towards the end of the XVIth century (Ion Neculce, 1982; Miron Costin, 1965; Mihondrea, 1966; Lascu, 1969). On the basis of the archaeological diggings and due to the presence of a church in service for other villages of the zone, the deduction may be made that these two communities have approximately the same age. Toponymy supports this assertion and, to a certain extent, it indicates the historical evolution of the area. Considering that the name of Berindești (vanished nowadays) reminds of the old Turkic tribe of „berendi” (in Turkish), the assertion that this is the oldest village center seems the most appropriate. Săbăoani – “tailor’s village” – appears as an extension of Berindești, as the result of a migration process. This hypothesis is confirmed both by the location of the two village centers and by written sources, such as the report of Bernardino Quirini, who makes mention of both villages (Holban, 1971), as well as some princely charters written in 1606, in Moldova (Leonte *et al.*, 1957) according to which the village of Berindești was donated by Prince Ieremia Movilă to the Secu Monastery. All the other information support the conclusion that involved here was a single village, Săbăoani, a human settlement with a long and uninterrupted history, continued up to the present time. Utilization of syntagm Săbăoani-Berindești in the documents of the epoch has a juridical connotation meant at evidencing the existence of two estates (Doboș, 2002).

The absence of documentary evidence for the period anterior to the end of the XVIth century is explained by the fact that these villages belonged to the outskirts of the townlet Roman. Instead, its community was a representative and important one, as, in 1599, the place was mentioned as a *citta* (townlet). Separation of the two villages from the townlet of Roman must have occurred, most probably, during the reign of Petru Șchiopul or even that of Iancu Sasul, and is related to the name of an extremely interesting and controversial character of those times – Bartolomeo Brutti (Doboș, 2002).

The necropole of Berindești dates, according to the funeral inventory, between the first half of the XVIth century and the beginning of the XVIIIth century, while that of Săbăoani – between the XVIIth and the XVIIIth centuries. The archaeological diggings have been conducted by specialists Vasile Ursachi and Domnița Hordilă, from the Museum of History of Roman, who put into evidence the permanent dwelling character of these localities, as early as the Neolithic age up to the present days (Hordilă, 2000). In the present study, the cemeteries of the two villages (Berindești and Săbăoani) have been considered as belonging to the same necropole, once the distance between them is only of 1.8-2 km. Nevertheless, the demographic investigation was performed separately for each cemetery in part, first because of the rich material at hand and also because the existing documentary references evidence certain differences between these two neighbouring localities.

As several anthropological researches have been devoted to the late Middle Age, a well-represented epoch on the territory of our country, the authors of the present study consider that a comparative investigation on the osteological material offered by the necropoles Săbăoani and Berindești will significantly contribute to a better knowledge of the demographic-type characteristics of these communities.

Material and Methods

The osteological material under analysis includes a total number of 937 human skeletons, as follows: 399 skeletons (158 men, 130 women and 111 of undeterminable sex)

exhumed from 425 inhumation tombs discovered in the necropole of Berindești (XVIth-XVIIIth centuries), and 538 skeletons (247 men, 160 women and 131 of undeterminable sex) obtained from 549 inhumation tombs discovered in the necropole of Săbăoani (XVIIth-XVIIIth centuries). Generally, they have a satisfactory conservation condition, even if, in some cases, the advanced extent of fragmentation made difficult a strict observance of the analysis stages.

The study of each skeleton in part began with its restoration, followed by determination of sex and of the age at decease.

For sex determination, a complex range of characters was employed; all bone pieces capable of providing metric and morphological data being analyzed. There have been established: the general shape and width of the pelvis, the opening degree of the greater sciatic notch, the curving degree of the sacrum bone, the massiveness and robustness of the entire skeleton, the extent of development of joints and of the muscular insertions, the development of the bone relief (especially of the cranial one), the shape and leaning of the forehead, the size and robustness of the mandible, the shape and type of the mandibular mental protuberance, the shape and size of the teeth, the size of the mastoid processes.

To determine the age at decease of the individuals younger than 20 years (*infans* I, *infans* II and *juvenis*), there have been followed: the eruption degree of temporary dentition and its replacement by the permanent dentition, the concrescence degree of the epiphyses of the long bones with the respective diaphyses and stages of epiphyseal union for vertebral centra, according to the methodology proposed by: Maresh (1955; 1970); Moorrees *et al.* (1963); Trotter & Peterson (1969); Fazekas & Kosa (1978); Ubelaker (1978); Jeanty (1983); Scheuer & Black (2000); Schaefer *et al.* (2009).

In the case of individuals who lived more than 20 years (*i.e.*, those who survived after the growth period), the characters employed as instruments for age determination were: pubic symphysis morphology, evolution of the sacro-pelvic surface of the ilium, modification of the spongy tissue from the epiphyses of the long bones, some phenomena of skeletal involution (loss of teeth, resorption of the alveolar margins, occurrence of osteophytes on the vertebrae, decalcification degree of the long bones), cranial suture closure (even if considered by numerous researchers as an imprecise method, the authors used it as a coarse mark), the abrasion/wear of the dental crowns (a characteristic also related to the alimentary habits of the community, which renders to it a relative significance).

In individuals older than 20 years (*adultus*, *maturus* and *senilis*), determination of sex and of the age at decease was based on the methods recommended by Genoves (1963); Necrasov *et al.* (1966); Ubelaker (1978); Ferembach *et al.* (1979); Brothwell (1981); Buikstra & Ubelaker (1994); Mays (1998); Bruzek (2002); Walrath *et al.* (2004); White & Folkens (2005); Schmitt (2005).

On making use of this complex of parameters, the authors of the study consider that their results are expressing quite faithfully the reality of the historical moment under analysis, on also diminishing the risk of an incorrect approaching of the demographic picture of the period.

Once known that distribution on sexes and categories of age of the deceases, alongwith the population size actually express a *post mortem* demographic representation of the populations, the frequency of deceases at various stages of age, the ratio of each sex, the

average age at decease as well as life expectancy at birth acquire a special importance (Ledermann, 1969). The sex structure of a population is expressed by the ratio between sexes, also known as *sex ratio*. It varies first with age, migration representing another important factor. In most cases, in skeletal populations, sex distribution is possible exclusively for adults (Chamberlain, 2006). The structure on categories of age refers to the numerical distribution of the members of a community or population, as a function of their age. This parameter will be different in an exhumed population, comparatively with a contemporary one (Hoppa & Vaupel, 2002; Chamberlain, 2006). The size of a population is expressed by the number of inhabitants occupying the same areal at a certain historical moment (Ubelaker, 1978). Life expectancy at birth, also defined as average duration of life, the most complete measure of the mortality level, represents the average number of years a person has to live from birth up to the age limit (Țarcă, 2008). Representing the most important index of the mortality picture, it characterizes most faithfully the mortality regime of some population and even the level of socio-economic development, under the influence of the biological, sanitary, social or environmental factors (Ghețău, 2002; Țarcă, 2008).

Following the inventory of the representative groups, the statistical calculation for each demographic index in part - namely: average age at decease, life expectancy at birth and after the age of 20 years, structure of the population on categories of age and sexes, and size of the population - was performed. Every demographic index was calculated separately for each of the two necropoles. In a final stage, the results obtained were analyzed and compared with the historical information available from the documents of that epoch, travel diaries and parish registers which, even if not always offering precise data, may provide useful hints. Undoubtedly, the historical data also indicate events that might have modified the size and structure of the populations (natural calamities, wars, epidemics, as well as some favourable events), which may finally either support and/or contradict, at least partially, the results of the present research.

Results and Discussion

The osteological material includes a total number of 937 human skeletons: 399 skeletons (158 men, 130 women and 111 of undeterminable sex) exhumed from 425 inhumation tombs belonging to necropole Berindești (XVIth-XVIIIth centuries) and 538 skeletons (247 men, 160 women and 131 of undeterminable sex) digged out from 549 inhumation tombs at necropole Săbăoani (XVIIth-XVIIIth centuries). Out of the total number of 937 analyzed skeletons, 405 were found as being males, 290 females, and 242 of undeterminable sex. Within this last category, 148 skeletons belong to the *infans* I stage of age (0-7 years), 83 skeletons enter the age stage *infans* II (7-14 years) and 6 skeletons - the *juvenis* category of age (14-20 years). As to the skeletons older than 20 years and of undeterminable sex - because of their poor conservation condition or of insufficient indications, 4 belong to the *adultus* category (20-30 years) and only 1 - to the *maturus* category (30-60 years).

Table 1, listing the structure on sexes and on categories of age of the medieval skeletal series under investigation, shows that, out of the total number of 937 analyzed skeletons, 288 individuals have been determined as having a subadult age (*infans* I, *infans* II and *juvenis*); 135 come from the necropole of Berindești and 153 from that of Săbăoani. These data indicate a high mortality among the children and adolescents of the two necropoles, namely of 33.9% at Berindești and of 28.4%, respectively, at Săbăoani,

comparatively mainly with the mortality values recorded for the same ages in the populations of today. There results from here that about one third of the population from the medieval Berindești-Săbăoani community did not reach the adult age (20 years).

As to the subjects who lived beyond the adolescent age, 649 skeletons of the total number of 937 pieces exhumed from the two necropoles were found as older than 20 years (*adultus*, *maturus*, *senilis*): 264 (150 men, 111 women and 3 of undeterminable sex) are from the necropole of Berindești and 385 (237 men, 146 women and 2 of undeterminable sex) from that of Săbăoani. Mortality among the adult and mature population is normal for those times.

The data listed in Table 1 show that, in the *juvenis* and *adultus* categories of age, mortality among women is almost double, comparatively with that recorded for men. In the necropole of Berindești, the *sex ratio* is of 29 men to 48 women while, at Săbăoani, the values are of 28 men to 52 women. This situation may be explained by the higher risk of decease in women along the period of their maximum fecundity, manifested at juvenile (14-20 years) and adult ages (20-30 years), when deceases during birth and *post partum* were quite numerous, being caused by the lack of a specific hygiene and of a suitable and prompt medical assistance.

Table 1. Structure of the populations exhumed from the medieval necropoles Berindești, XVIth-XVIIIth centuries and Săbăoani, XVIIth-XVIIIth centuries according to the sex and age categories (N = number of estimated individuals).

Age (years)	Sex	Berindești (XVI th -XVIII th centuries)								Săbăoani (XVII th -XVIII th centuries)							
		Male		Female		Undeterm.		Total		Male		Female		Undeterm.		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<i>Infans I</i> (0-7 years)		-	-	-	-	71	17.8	71	17.8	-	-	-	-	77	14.3	77	14.3
<i>Infans II</i> (7-14 years)		3	0.7	7	1.7	36	9.1	46	11.6	4	0.7	5	0.9	47	8.7	56	10.4
<i>Juvenis</i> (14-20 years)		5	1.2	12	3.0	1	0.2	18	4.5	6	1.1	9	1.7	5	0.9	20	3.7
<i>Adultus</i> (20-30 years)		24	6.0	36	9.0	3	0.7	63	15.8	22	4.1	43	7.9	1	0.2	66	12.3
<i>Maturus</i> (30-60 years)		114	28.6	75	18.8	-	-	189	47.4	202	37.5	98	18.2	1	0.2	301	55.9
<i>Senilis</i> (60-x years)		12	3.0	-	-	-	-	12	3.0	13	2.4	5	0.9	-	-	18	3.3
Undetermin.		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		158	39.6	130	32.6	111	27.9	399	100	247	45.9	160	29.7	131	24.3	538	100

For the 20-x year interval, in both necropoles, the highest frequency of deceases was registered in the *maturus* category (47.4% at Berindești and 55.9% at Săbăoani), while the ratios recorded for the *adultus* category are of 15.8% at Berindești and of 12.3%, respectively, at Săbăoani. As to the oldest persons of those times, namely the individuals over the age of 60 (*senilis*), the mortality ratios are around 3% in both cemeteries.

Analysis on sexes shows that the total number of deceases in the two medieval necropoles is “in favour” of men. After the age of 30 years, when the threshold of maturity is reached, the number of deceases among men is preponderant. The high decease ratio among men may be explained by the warlike events which the medieval population of the Săbăoani area had to support at quite short time intervals, which brought about, a high

decease ratio among *maturus* men (30-60 years) in both necropolises. Such a situation is actually evidenced both by the bone traumatism frequent in mature men, and by the accounts of the epoch, making mention of social disorders and wars bursting at short time intervals, thus supporting the here put forward hypothesis. The same events and turmoils, which brought about worsening of the living conditions, are responsible for the relatively high infantile mortality, causing an increased number of individuals of undeterminable sex.

Table 2 illustrates the chronological evolution of the average age at decease in the populations of Berindești and Săbăoani, calculated for the 0-x and 20-x year intervals of age. The available data show clearly a continuous increase of this parameter from one historical period to another. As to the 0-x year interval, a continuous increase of the average age at death may be observed starting with the IVth century (Botezatu *et al.*, 1988; Miu & Botezatu, 1991) up to now, with the exception of the first decade of the XXth century, when the registered value is of 21.93 years, about 8 years lower than that of the medieval period and approximately 1 year lower comparatively with the IVth century. A demographic analysis of this community along the XXth century (Știrbu, 1994; Știrbu *et al.*, 1999) evidences that the considerable decrease of the average age at decease is recorded since the beginning of the XXth century up to its fourth decade, followed, beginning with decade 5, by spectacular increases, up to a value of 64.35 years, registered in the last decade of the XXth century. A possible explanation involves an extremely high infantile mortality (40.02%), as well as an equally high mortality in the subadult segment (65.20%) in the first decade of the XXth century, whereas, in the ninth decade, infantile mortality is of only 1.44%, and that of subadults - of 4.91%. Accordingly, the high infantile mortality registered in the beginning of the XXth century may be explained by the demographic outburst of the times, even if not supported by a better living standard and by a corresponding pediatric medical assistance. On the other hand, the average age at decease in the first decade of the XXth century is also low, for both men (20.80 years) and women (23.05 years), followed by a considerable increase, up to 60.60 years in men and 68.10 years in women, in the last decade (Știrbu, 1994; Știrbu *et al.*, 1999).

Table 2. Evolution of average age at death, expressed as years, in the population of Săbăoani (Neamț County), along various historical periods.

Interval	Categories	Săbăoani IV th century (Botezatu <i>et al.</i> , 1988)	Berindești XVI th - XVIII th centuries	Săbăoani XVII th -XVIII th centuries	Săbăoani XX th century, 1900-1990 (Știrbu, 1994)	Săbăoani XX th century, 1990-1996 (Știrbu <i>et al.</i> , 1999)
0 – x years	Entire population	22.76	29.34	29.98	21.93	64.35
	Male	-	-	-	20.80	60.60
	Female	-	-	-	23.05	68.10
20 – x years	Entire population	39.46	42.32	42.86	55.98	67.25
	Male	41.59	44.38	45.63	57.55	63.70
	Female	37.61	39.86	40.35	54.25	70.80

The relative reduction of infantile mortality even along the second half of the XVIIth century is reflected in the increase of the average age at decease. In the medieval necropole of Berindești, mortality for the *infans* I stage is of 17.79% and of 33.86% for the 0-20 year stage, a highly similar situation with that of the medieval necropole of Săbăoani where, over the 0-7 year interval, mortality is of 14.31% and, in the 0-20 year interval - of

28.44%. In the end of the XIXth century, after the Independence War (1877), the *adultus* (20-30 years) and *maturus* (30-60 years) male population suffered a numerical diminution, followed by a decrease of the living standard and by a demographic outburst, continuing in the XXth century, with repercussions upon the extremely high infantile mortality registered in the first decade, which also reduced the average age at decease.

As to life expectancy at birth, a similar situation may be observed in the two medieval necropoles (Table 3). In the population of Berindești, this demographic parameter is of 29.2 years and, in that of Săbăoani, of 30.0 years. For the subjects having lived more than 20 years, life expectancy calculated after this age is of 21.9 years in the men of Berindești, and of 23.1 years in those of Săbăoani, respectively of 16.7 years in the women of Berindești and of 18.1 years in those of Săbăoani, all these values evidencing a pronounced sexual dimorphism.

Table 3. Synoptic values of life expectancy (years) and of mortality (%) in some medieval populations.

Life expectancy and mortality	Hudum XIII th -XIV th centuries (Miu & Simalcik, 2003)	Doina XIII th -XIV th centuries (Necrasov & Botezatu, 1964)	Traian XVI th century (Necrasov & Cristescu, 1957)	Străulești I XIV th -XV th centuries (Popovici, 1973)	Enisala XV th -XVI th centuries (Miu <i>et al.</i> , 1987)	Străulești II XVI th -XVII th centuries (Popovici, 1966)	Berindești XVI th -XVIII th centuries	Săbăoani XVII th -XVIII th centuries
At birth	19.6	22.9	27.9	23.9	26.1	29.0	29.2	30.0
Male, at 20 years	16.3	16.5	21.8	24.5	24.1	25.3	21.9	23.1
Female, at 20 years	10.7	17.5	18.1	10.4	14.0	20.8	16.7	18.1
Child mortality	44.6	45.4	28.6	46.0	38.5	34.6	29.3	24.7
Juvenile mortality	12.9	3.1	7.1	5.1	2.4	4.2	4.5	3.7

If considering only the segment older than 20 years and comparing the masculine and the feminine series, in both necropoles, for all classes of age, life expectancy is – with only few exceptions – higher in women than in men. Mention should be nevertheless made of the fact that, in the population exhumed from Berindești, 12 males and only 1 female reached the threshold of 60 years, quite different from the the skeletal series of Săbăoani, where 13 men and 5 women lived beyond the age of 60.

The results obtained in the present study for the medieval necropoles of Berindești (XVIth-XVIIIth centuries) and Săbăoani (XVIIth-XVIIIth centuries) have been compared (Table 3) with those registered for other synchronous necropoles, as follows: Doina, XIIIth-XIVth centuries (Necrasov & Botezatu, 1964), Hudum, XIIIth-XIVth centuries (Miu & Simalcik, 2003), Străulești I, XIVth-XVth centuries (Popovici, 1973), Străulești II, XIVth-XVIIth centuries (Popovici, 1966), Enisala, XVth-XVIth centuries (Miu *et al.*, 1987), and Traian, XVIth century (Necrasov & Cristescu, 1957). A slightly higher life expectancy may be observed towards the XVIIIth century. Infantile mortality is lower in the populations exhumed from the medieval necropoles of Berindești, Săbăoani and Traian. The last one, even if, chronologically, is synchronous with the necropoles of Enisala and Străulești I, evidences a lower infantile mortality than the other two. A possible explanation would be

that both the Săbăoani and the Traian villages were represented, in those times, mainly by a Catholic population, a situation continuing even nowadays.

The final objective of the present study was to approximate the size of the analyzed population, starting from the estimative formulas agreed by researchers (Ubelaker, 1978), once all information necessary for such calculations are available. For village Berindești, dated by archaeologists between the end of the first half of the XVIth century and the beginning of the XVIIIth century, the available materials (Doboș, 2002), permit the conclusion that the cemetery has been used for about 180 years. The calculations performed show that the 425 tombs discovered in the necropole indicate a population formed of 133 members. In the case of the Săbăoani necropole, dated between the end of the XVIth century and middle of the XVIIIth century, the interval over which the cemetery was employed is around 165 years, while the 549 tombs with rests of human bones indicate a population formed of 232 members.

Conclusions

The paleodemographic study of the skeletal series exhumed from the necropole of Berindești (XVIth-XVIIIth centuries) and also from the necropole of Săbăoani (XVIIth-XVIIIth centuries) offers precious information, thus enriching the already available historical data describing this period of time. The obtained results elucidate certain useful indices for the *post mortem* demographic representation of this medieval population, completing the existing written sources. Analysis of the demographic situation permits to follow the time evolution of certain demographic phenomena, within the context of some inevitable social and economic changes.

The data obtained for the two skeletal series (Berindești and Săbăoani), recorded along the XVIth-XVIIIth centuries, agree with the demographic context characteristic to late Middle Age. The situation is quite similar in the two investigated necropoles, which is explained by their quite close spatial vicinity (the distance between them being of only 1.8-2 km). Over long time periods of time, the two communities have shared the same history, being frequently in relation with one another, even as to the documents of land sale or donation from/to a landlord or another.

Sex distribution of deceases in these populations is unbalanced. In both necropoles, the value of the masculinity index indicates a significantly higher ratio in men, comparatively with women, especially for the 30-60 year category of age. The more numerous deceases among men may be explained by the armed conflicts with which the medieval population of the Săbăoani area was confronted at relatively short intervals of time. Such warlike events are mentioned in the documents of those epochs, being equally reflected in the bone pathologies evidenced by us mainly on male skeletons. Mention should be made of the higher number of deceases in women in the *juvenis* and *adultus* stages, which are correlated with the period of maximum fertility, with the higher birth and *post partum* risks, the main causes of such situations being the scarce hygienic conditions and the absence of any prompt and adequate medical assistance.

The population exhumed from the two necropoles is characterized by a high mortality among children and adolescents – namely of 33.9% at Berindești and of 28.4% at Săbăoani, which means that about 1/4th of the population of the medieval Berindești-Săbăoani community did not attain the adult age (20 years). The decease ratio among the *adultus* category (20-30 year-old ones) is of 15.8% in the population of Berindești, and of

12.3% in that of Săbăoani while, among the *maturus* persons (30-60 year-old), this value attains 47.4% at Berindești and 55.9% at Săbăoani. Survival after the age of 60 registers a value around 3% in both necropolises.

An internal analysis of the Berindești-Săbăoani community along different historical periods reveals that the structure on categories of age and sex is different. Mortality in medieval Berindești and Săbăoani is higher than in the modern population, being however integrated in the demographic context characteristic to late Middle Age.

Life expectancy at birth is quite similar in the two medieval necropolises here under investigation, recording values of 29.2 years for the population exhumed at Berindești (XVIth-XVIIIth centuries) and of 30.0 years, respectively, for that of Săbăoani (XVIIth-XVIIIth centuries). Along the history, longevity and, implicitly, life expectancy increased. This demographic index is closely correlated with mortality, especially infantile mortality. In the medieval population of Berindești, life expectancy after the age of 20 is of 21.90 years in men and of 16.70 years in women while, at Săbăoani, it is of 23.06 years in men and of 18.12 years in women.

The average age at decease is of 41.9 years in the men of Berindești (XVIth-XVIIIth centuries) and of 43.1 years in those of Săbăoani (XVIIth-XVIIIth centuries), and, respectively, of 36.7 years in the women of Berindești and of 38.1 years in those of Săbăoani. From one historical period to another, this parameter is seen as increasing, with the exception of the first decade of the XXth century.

The parameter expressing “the size of the population” evidences that the two communities follow the general demographic tendency of those times. At Săbăoani, the size of the population increased with the migration of the population coming from the neighbouring zones, especially from Berindești. The members of the Berindești community used to migrate in search of better living conditions, which they found at Săbăoani, which soon caused a depopulation phenomenon and, finally, extinction of locality Berindești.

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STUDY REGARDING THE VALIDATION OF AN ASSESSMENT PROTOCOL OF VO₂MAX ON CYCLE ERGOMETER

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Abstract. We set out to check the validity of an effort test that is aimed at assessing maximal aerobic power on electromagnetic brake bicycle with male subjects, aged between 20 and 30 years, untrained. The test was implemented at the Faculty of Physical Education and Sport with 8 untrained subjects with a mean age of 23.38 years, mean weight 80.9 kg and height 175.6 cm. The test protocol requires that the subject to follow the next steps: 5 minutes joint gymnastics, pedaling a bicycle at 133 W, then pedaling until exhaustion, the resistance increasing with 23.5 W/min. The evaluation was done using a Polar RS800 cardiofrecvențiometer, gas analyzer FitMate PRO and pulse oximeter Contech WK 50D. The bike model used is the Vision Fitness E3200. Each subject has sustained two effort tests at an interval of rest for 2 hours. Following data statistical analysis it was found a strong correlation between the maximal oxygen consumption and the maximal aerobic power determined for each test.

Keywords: untrained, VO₂max, maximal aerobic power, protocol, FitMate PRO, Vision Fitness E3200 bike.

Rezumat. Studiu privind validarea unui protocol de evaluare a VO₂max pe cicloergometru. Ne-am propus să verificăm validitatea unui test de efort ce are scop evaluarea puterii maxime aerobe pe bicicletă cu frânare electromagnetică la subiecți masculi, cu vârsta cuprinsă între 20 și 30 de ani, neantrenați. Testul a fost pus în practică la Facultatea de Educație Fizică și Sport din Iași cu 8 subiecți neantrenați cu o medie a vârstei de 23,38 ani, greutatea medie de 80,9 kg și înălțimea de 175,6 cm. Protocolul testului presupune ca subiectul să parcurgă următoarele etape: 5 minute de gimnastică articulară, pedalare pe bicicletă la 133 W, după care pedalează până la epuizare, rezistența crescând cu 23,5 W/min. Evaluarea s-a făcut cu ajutorul unui cardiofrecvențiometer Polar RS800, analizator de gaze FitMate PRO și pulsoximetrul Contech WK 50D. Modelul de bicicletă folosit este Vision Fitness E3200. Subiecții au susținut câte două probe de efort la un interval de repaus de 2 ore. În urma analizelor statistice ale datelor s-a constatat o corelare puternică între consumul maxim de oxigen și puterea maximă aerobă determinate pentru fiecare test.

Cuvinte cheie: neantrenați, VO₂max, putere maximă aerobă, protocol, FitMate PRO, bicicletă Vision Fitness E3200.

Introduction

Maximum oxygen consumption is a parameter often measured in physiology. The history of assessing this parameter begins before 1923. Before World War II, the maximal aerobic capacity was assessed by intermittent exercise tests which lasted several days. After 1960 start to be accepted in the evaluation continuous efforts complemented by electronic devices determining instantaneous the composition of exhaust air.

The introduction of continuous efforts in evaluation led to a series of testing protocols for maximal oxygen consumption (VO₂max). The test protocols differed among themselves by the levels duration (constant effort intensity intervals), intensity difference between them and test duration. Froelicher *et al.* compared in 1974 three VO₂max evaluation tests: Bruce, Balke and Taylor with 15 subjects. The three tests have durations

ranging from 3 to 31 minutes the VO_2max determined was significantly higher in the case of the Taylor protocol.

Three years later were compared four testing protocols: Balke, Bruce, Ellestad and Astrand, the subject number being 55 (Pollock *et al.*, 1976). The two studies have concluded that long duration of the VO_2max test leads to the determination of a lower oxygen consumption.

The problem of optimal duration for the maximum oxygen consumption determination was not put until 1983, when Buchfuhrer *et al.* tested different exercise protocols on 12 subjects, with levels of 1 minute, on the cycle ergometer and treadmill. Durations outside the range 8-17 minutes give lower values (>17 min.) or higher values (<8 min. of VO_2max (Yoon *et al.*, 2007).

In 1982, Myles & Toft, used in a test for assessing maximal aerobic power one minute levels, with growth of 37.5W, their study subjects pedaling at a rate of 75 revolutions/minute (RPM).

Another charging model was used for 36 cyclists and triathletes by Meyer *et al.* in 1999, they used 3 minutes levels, where the increase was of 50W, departing from 100W. Untrained healthy individuals were subjected to an exercise test in evaluation steps of the maximal aerobic power, the load being of 16.3W min (100kpm/min).

On 16 untrained subjects aged between 19 and 27 years, Lattanzio *et al.* (1997) conducted a study in which they evaluated the maximal aerobic power using a progressive test with a load of 20 to 25 W/min.

In 2002, Vercruyssen *et al.* conducted a study in which eight triathletes were evaluated in terms of maximal aerobic power. The cycling test involved a 6-minutes warming at 100W, then the resistance growing with 30W/min. The test was done in such a way as to bring the subject to exhaustion in 8-12 minutes.

A study by Buchfuhrer *et al.* (1983) demonstrated by testing the maximal aerobic power with different loads (15, 30 and 60W) that higher values of VO_2max are recorded when using small loads. They suggest that the progressive period of the test to be of approximately 10 minutes.

Monedero & Donne (2000) used in the evaluation of the maximum aerobic capacity of a group of 18 cycling a test with a load of 120W, for 3 minutes at the beginning of the test. After three minutes the resistance had increased by 40W, followed by the steps of 8W/s. Subjects performing physical exercise to exhaustion.

Two assessment tests were compared (Amann *et al.*, 2004): T1: 150W + 50W/min and T2: 20W + 25 W/min. Both tests have been supported by the same lot of riders (15) at a recovery period of 48 hours. Significant differences between the results of two tests were not identified.

Material and Methods

The determination of the maximum oxygen consumption can be carried out with priority through direct measurement devices when they are available. Thus, using a professional gas analyzer (FitMate Pro) we tried to determine the maximum effort consumption and maximum aerobic power, on a bicycle with electromagnetic brake, whose features we know from practical use.

We reported the testing protocol to the tests described in the specialized literature. Nieman *et al.* have tested in 2006 the analyzer FitMate Pro, by comparison with the

Douglas system of VO_2max assessment. Their study demonstrated no significant differences between the two assessment methods.

In our study, 8 subjects participated, male, with a mean age of 23.38 ± 0.89 years ($\pm$ standard deviation), mean weight of 80.09 ± 8.84 kg and height 175.63 ± 7.45 cm.

The study subjects were clinically healthy at the time of the effort testing, each declaring on their own responsibility (by declaration) that they are fit for exercise. During the exercise tests the subjects were assisted by skilled health personnel. In the study did not enter subjects who: have made intense effort the day before evaluation; have consumed alcohol or caffeine the day before evaluation; health problems (especially cardiovascular); age outside the range 19-30 years.

The first evaluations were: the height, the weight and arterial tension. After these evaluations, the subjects have entered the test room, where they were explained the testing protocol.

For each subject the chair height was adjusted according the individual particularities. The bike model used in this study is Vision Fitness E3200. The chair height (the distance between the highest point of the saddle and the axis center of the pedals arms) is calculated by multiplying with 0.885 the interior length of the interior member.

After the chair adjustment the cardio belt of the watch Polar RS800 is fixed, the gas mask of the FitMate PRO device and the pulseoximeter Contech WK 50D after 5 minutes of articular gymnastics.

The personal data of the subject are introduced in the FitMate device. The devices are simultaneous turned on to record the followed parameters: the heart rate, the oxygen consumption and the oxygen saturation of the blood (SpO_2).

The subject starts the pedaling on the Vision Fitness E3200 bike, at a frequency of 75 RPM (rotations/min.), with a load of 133W (corresponding to level 4 of the bicycle resistance), this rate was maintained for 6 minutes. It is a progressive exercise test on levels of a minute, the power increasing on each floor with 23.5W, from 6 minutes into the test.

The subject has to perform the levels maximum of which he is capable. The subject has the task of maintaining the pedaling frequency of 75 rpm for the whole duration of the test. The subject ceases the effort when they can't keep the pace in the last landing reached.

The support on the bicycle horns is based on subjective preference, except the one on the forearms. The leg contact with the pedal is made on the sole.

Subjects were encouraged to reach the moment of exhaustion and maintain a constant respiratory rate. At the end of the test, the subject remains on the bike for 3-5 minutes to assess the return of post-exercise cardiorespiratory function.

The exercise tests were conducted at a temperature of 24°C , 33% humidity and atmospheric pressure of 751.5 mmHg in the gym of the Faculty of Physical Education and Sport, in Iași.

For some subjects it was difficult to reach the highest point of exhaustion through the fact that they have accused inferior limb pain, which may be associated with lack of accommodation with cycling specific effort.

The statistical indicators are according to Tintiuc *et al.* (2011).

Results and Discussion

After the effort tests each subject's charts were analyzed with the used devices software, determining the parameters at several points of the effort. Through the following figures we represent the data of the study.

Following the stress test applied, the subjects achieved a maximal oxygen consumption of 47.81 ml/kg/min (± 8.49 ml/kg/min, $\pm$ SD) (Table 1).

The individual results and the test durations are shown in Figures 1 and 2.

The Pearson asymmetry coefficient (C_{AS}) of the data sequence has a value of 0.43, which is a small negative asymmetry, predominantly high values of $VO_2\max$.

The homogeneity of the group is good in respect of height and age, and in the case of weight the homogeneous is average, which confers a compact group character of evaluated subjects.

Instead, between the heart rate (FC) reached in the $VO_2\max$ moment and $VO_2\max$, respectively PMA is a weak correlation.

Table 1. Statistical indicators.

	Average	Standard deviation	Asymmetry coefficient (C_{AS})	Coefficient of variation (C_V)
$VO_2\max$ (ml/kg/min)	47.80	8.49	-0.43	17.76
Heart rate $VO_2\max$ (beats/min)	176.12	8.47	-0.46	4.81
Maximal aerobic power (W)	351	51.13	-0.85	14.57
Expiratory flow $VO_2\max$ (l/min)	125.70	24.72	-0.24	19.67
Respiratory frequency $VO_2\max$ (resp/min)	45.93	7.31	0.57	15.91

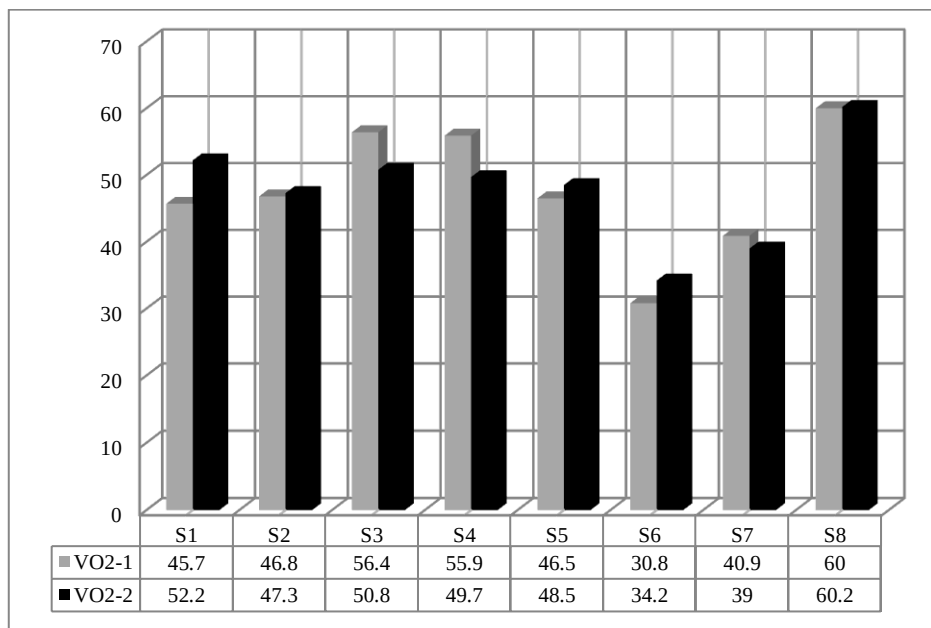


Figure 1. Maximum oxygen consumption (VO_2-1 - $VO_2\max$ determined in the first test; VO_2-2 - $VO_2\max$ determined in the second test; VO_2 - ml/kg/min; T - min).

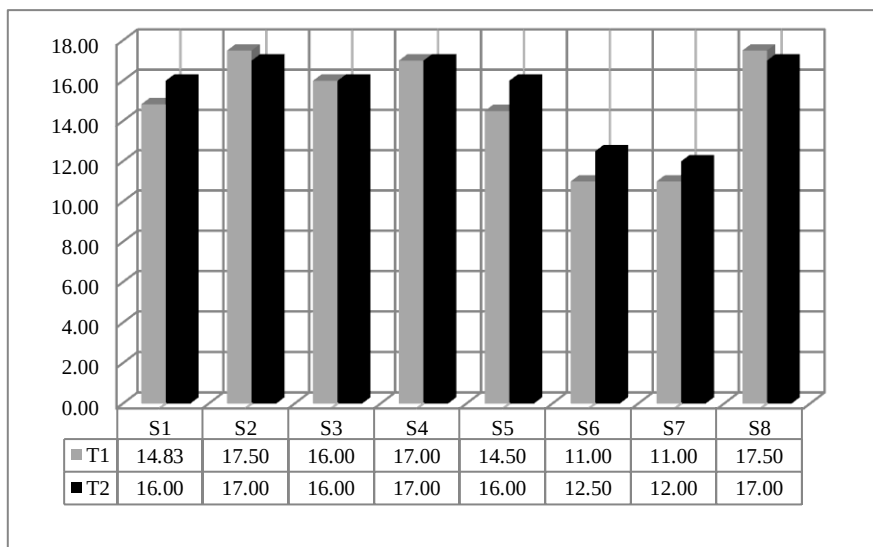


Figure 2. Time of exhaustion (T1 - the test moment of achieving VO_{2max} in the first test; T2 - the test moment of achieving VO_{2max} in the second test; T - min).

In Figures 3 and 4 we have graphically represented the FC when reaching VO_{2max} in each test as well as the maximal aerobic power determined (PMA).

As with VO_{2max} , FC has a small negative asymmetry (Cas = -0.46) and PMA has a pronounced negative asymmetry, which means that their high levels prevail.

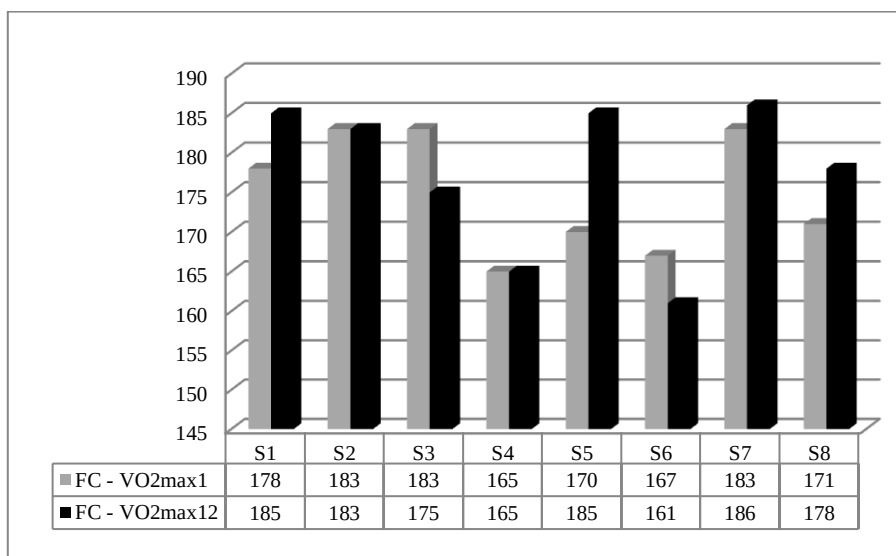


Figure 3. The heart rates (FC - beats/min) in the moments of achieving: VO_{2max1} in the first test (FC - VO_{2max1}); VO_{2max2} in the second test (FC - VO_{2max1}).

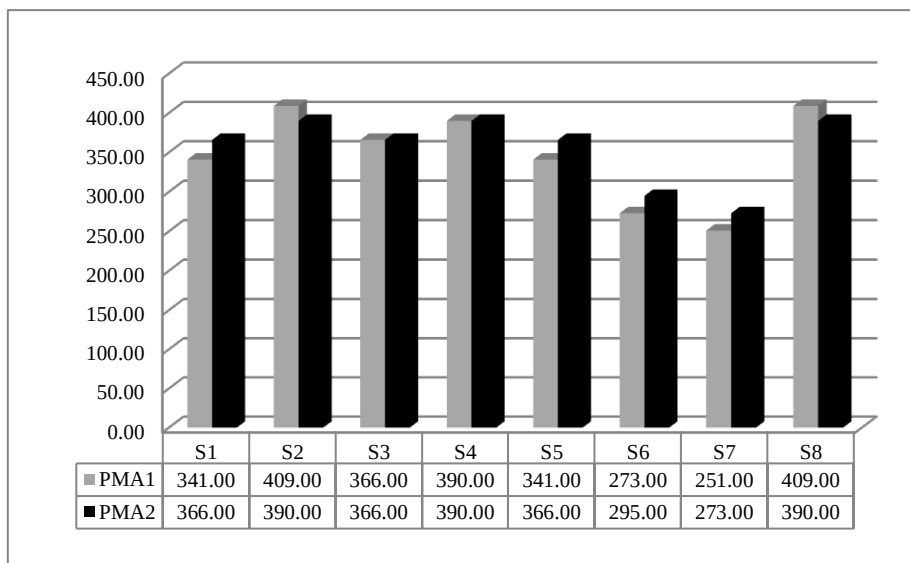


Figure 4. PMA1 - maximal aerobic power determined in the first test; PMA2 - maximal aerobic power determined in the second test; (PMA - W).

Expiratory flow (VE) and expiratory rate (FR) were represented in Figures 5 and 6. The VE data string presents small negative asymmetry, while the FR average positive asymmetry.

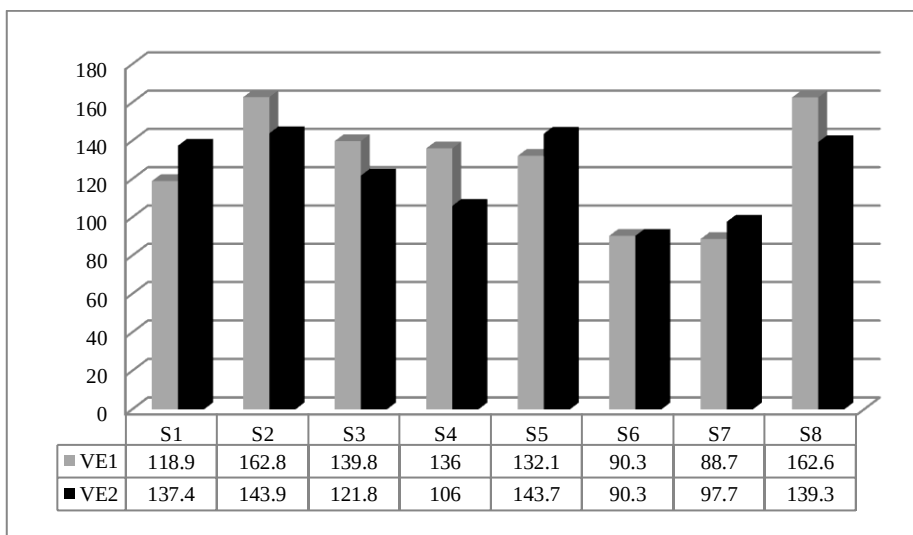


Figure 5. Expiratory flow at VO₂max (VE1 - Expiratory flow in the moment of achieving VO₂max in the first test; VE2 - Expiratory flow in the moment of achieving VO₂max in the second test; VE - l/min).

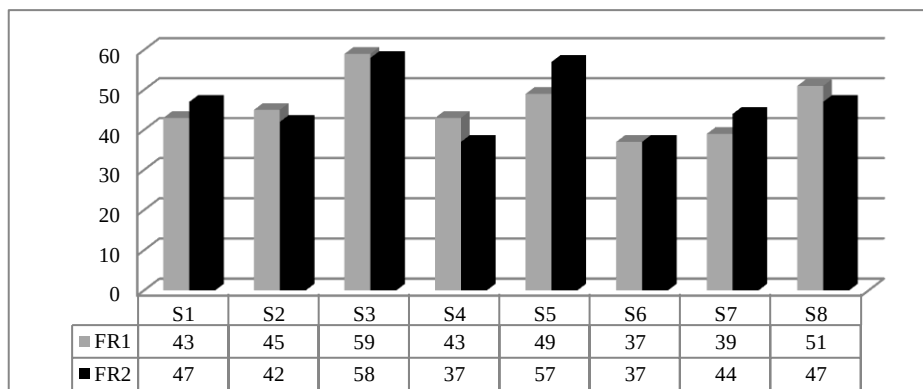


Figure 6. Respiratory frequency at VO_{2max} (FR1 - Respiratory frequency in the moment of achieving VO_{2max} in the first test; FR2 - Respiratory frequency in the moment of achieving VO_{2max} in the second test; FR - respirations /min).

By calculation a strong correlation can be observed between VO_{2max} and the time to reach VO_{2max} within the exercise test ($r_1 = 0.84$, $r_1 = 0.85$).

Also it shows a strong correlation between PMA and VO_{2max} in each test ($r_1 = 0.80$, $r_2 = 0.83$).

VO_{2max} presents an average correlation with VE and FR, except the second test, where the correlation is medium, but lower than the others ($r = 0.41$).

The two tests data shows a strong correlation for VO_{2max} ($r = 0.89$) and MAP ($r = 0.97$) and the difference between the results of the subjects two evaluations was not statistically significant ($p = 0.97$). These things validate the proposed exercise test.

Amann *et al.* (2004) tested 15 riders by two progressive exercise tests (T50x3:100 W + 50W/3 min, T25x1:20W + 25 W/min). The results of the two effort tests were different: 66.6 ml/kg/min and 67.6 ml/kg/min. Jeppesen *et al.* (2003) determined on a group of 18 healthy sedentary subjects the maximum oxygen consumption of 39.4 ± 2 ml/kg/min. 18 trained cyclists (25 ± 0.9 years, muscle mass 72 ± 1.6 kg) were tested by Monedero & Donne (2000) and it was determined a VO_{2max} of 68 ± 1.7 ml/kg/min and MAP 364 ± 9 W. To a group of 31 volunteers (25.4 ± 5.2 years, 70.2 ± 8.0 kg, 174 ± 7 cm, $16.8 \pm 4.8\%$ body fat) it was determined a VO_{2max} of 52.7 ± 6.1 ml/kg/min in the research of Myles & Toft (1982). Through a cycle ergometer test and one on the field, Vercruyssen *et al.* (2002) determined in a group of eight well-trained triathletes (24.0 ± 3.0 years, 71.1 ± 6.5 kg and 180.6 ± 8.1 cm) VO_{2max} values of 68.7 ± 3.2 ml/kg/min, respectively 69.9 ± 5.5 ml/kg/min. Through a progressive exercise test (100W + 50W/3min) a group of 36 cyclists and triathletes (24.9 ± 5.5 years and 71.6 ± 5.7 kg) was assessed with a maximum oxygen consumption of 62.2 ± 5.0 ml/kg/min in the study by Meyer *et al.* (1999).

The study revealed a VO_{2max} of 47.80 ± 8.49 ml/kg/min and a MAP of 351 ± 51.13 W.

It is difficult to compare the results with those of previously published research, given the difference between the groups studied and the conditions for evaluation. However, the results qualify the study group in the category of the untrained individuals. It can be observed a difference not very large between the untrained subjects PMA and that of those trained: 351 ± 51.13 W vs 364 ± 9 W - Monedero & Donne (2000).

Conclusions

The group homogeneity and the strong correlations established between the VO_2max , PMA and exhaustion time validates the test statistically for our group of subjects.

The proposed test can be used among untrained people to determine the maximum oxygen consumption and hence the PMA, on the Vision Fitness E3200 bike, by male subjects, aged between 20 and 30 years, able to exercise.

The proposed protocol can be validated not only through the values obtained, but also because it falls within other similar research findings.

By comparing the results with those of other studies, our protocol can be considered valid.

There is the possibility of extending the evaluation sample and its characteristics and taking into account different parameters than those presented by us.

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A REVIEW OF THE PTEROMALIDAE (HYMENOPTERA: CHALCIDOIDEA) PARASITIZING SYNANTHROPIC FLIES IN ROMANIA

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Abstract. The pteromalid genera that have been reared from synanthropic flies in Romania are reviewed. An illustrated identification key for the six genera (*Spalangia* Latreille, *Muscidifurax* Girault & Sanders, *Pachycrepoideus* Ashmead, *Nasonia* Ashmead, *Urolepis* Walker, and *Trichomalopsis* Crawford) is provided. For each genus, the species that have been reared in Romania are listed together with the corresponding references.

Keywords: Hymenoptera, Chalcidoidea, Pteromalidae, Diptera, synanthropic flies, parasitoids, key.

Rezumat. Pteromalidele (Hymenoptera: Chalcidoidea) care parazitează muște sinantropice în România. Genurile de pteromalide care au fost obținute din muște sinantropice în România sunt trecute în revistă. Este prezentată o cheie ilustrată de identificare pentru cele șase genuri (*Spalangia* Latreille, *Muscidifurax* Girault & Sanders, *Pachycrepoideus* Ashmead, *Nasonia* Ashmead, *Urolepis* Walker și *Trichomalopsis* Crawford). Pentru fiecare dintre acestea se menționează speciile care au fost obținute din creșteri în România, împreună cu bibliografia corespunzătoare.

Cuvinte cheie: Hymenoptera, Chalcidoidea, Pteromalidae, Diptera, muște sinantropice, parazitoizi, cheie.

The synanthropic flies (Diptera) are insect pests that develop in relation to some major human activities such as food processing and conservation, and animal husbandry. They include the common stable fly (*Stomoxys calcitrans* (L.)), the house fly (*Musca domestica* L.), the face fly (*Musca autumnalis* De Geer) and the horn fly (*Haematobia irritans* (L.)), and cause major health problems to both humans and livestock e.g. nuisance and irritation, pain, weight loss due to avoidance behaviour (the “fly worry” syndrome), transmission of various pathogens etc. (e.g. Ballesteros *et al.*, 2011).

The control of these insects is usually problematic since it is based mainly on chemical insecticides that are also a threat to humans and livestock and usually cause resistance of the pest. An ecological alternative to chemical control is biological control, which uses the natural enemies of the pest. In the case of the synanthropic flies, most natural enemies are small parasitoid wasps (Hymenoptera) that develop as larvae mainly in flies’ puparia and finally kill them.

The parasitoid wasps of the synanthropic flies in Romania belong to seven families: Braconidae, Ichneumonidae (Ichneumonoidea), Chalcididae, Pteromalidae (Chalcidoidea), Figitidae, Eucoilidae (Cynipoidea), and Diapriidae (Diaprioidea), and have been reviewed by Fabritius (1990). The main goal of this note is to give an illustrated key to the genera of Pteromalidae that attack the synanthropic flies in Romania in order to facilitate their identification by the non-specialist. In addition, all species that have been reared from synanthropic flies in Romania are listed for each genus, followed by references.

For other species in these genera, which have not been obtained from hosts, as well as for field records of the reared species, see Mitroiu (2008). Terminology follows Gibson (1997).

Key to genera of Pteromalidae reared from synanthropic flies in Romania (both sexes)

- 1 Antennae inserted very close to clypeus, almost touching it; head subprognathous; body entirely black, except sometimes the tarsi; head; pronotum and mesoscutum with conspicuous piliferous punctures; gaster petiolate; antenna 1171; marginal vein long, stigmal and postmarginal veins short (Fig. 1) ***Spalangia* Latreille**
- Antennae inserted at least slightly above clypeus, although sometimes distinctly lower than ocular line; head usually not subprognathous; body rarely black; pronotum and mesoscutum usually without conspicuous piliferous punctures; gaster usually sessile; antennal formula and wing venation usually different (Figs 2-6) **2**
- 2 Marginal vein distinctly thickened in anterior part, but normal distally, hence its lower margin sinuate; female antenna 11173, male antenna 11263 and hairy; posterior margin of first gastral tergite trilobed (Fig. 3) ***Muscidifurax* Girault and Sanders**
- Marginal vein either equally widened or slender throughout, hence its lower margin more or less straight; antenna in both sexes 11353 or 11263; posterior margin of first gastral tergite not or slightly trilobed (Figs 2, 4-6) **3**
- 3 Occipital carina absent; antenna 11353; marginal vein widened throughout; mesopleuron completely reticulate; gaster petiolate; first and second gastral tegites enlarged, posterior margin of first gastral tergite slightly trilobed (Fig. 2) ***Pachycrepoideus* Ashmead**
- Occipital carina present; antenna 11263; marginal vein slender throughout; mesopleuron partly shiny; gaster sessile; first and second gastral tegites not enlarged, posterior margin of first gastral tergite not trilobed (Figs 4-6) **4**
- 4 Mesoscutum shiny, reticulation shallow, mostly engraved; lower face strongly receding from toruli to mouth (Fig. 4) ***Nasonia* Ashmead**
- Mesoscutum duller, reticulation stronger, raised; lower face not strongly receding from toruli to mouth (Figs 5, 6) **5**
- 5 Fore wing almost entirely pilose except very small speculum (Fig. 5) ***Urolepis* Walker**
- Fore wing extensively bare in proximal part, speculum large (Fig. 6) ***Trichomalopsis* Crawford**

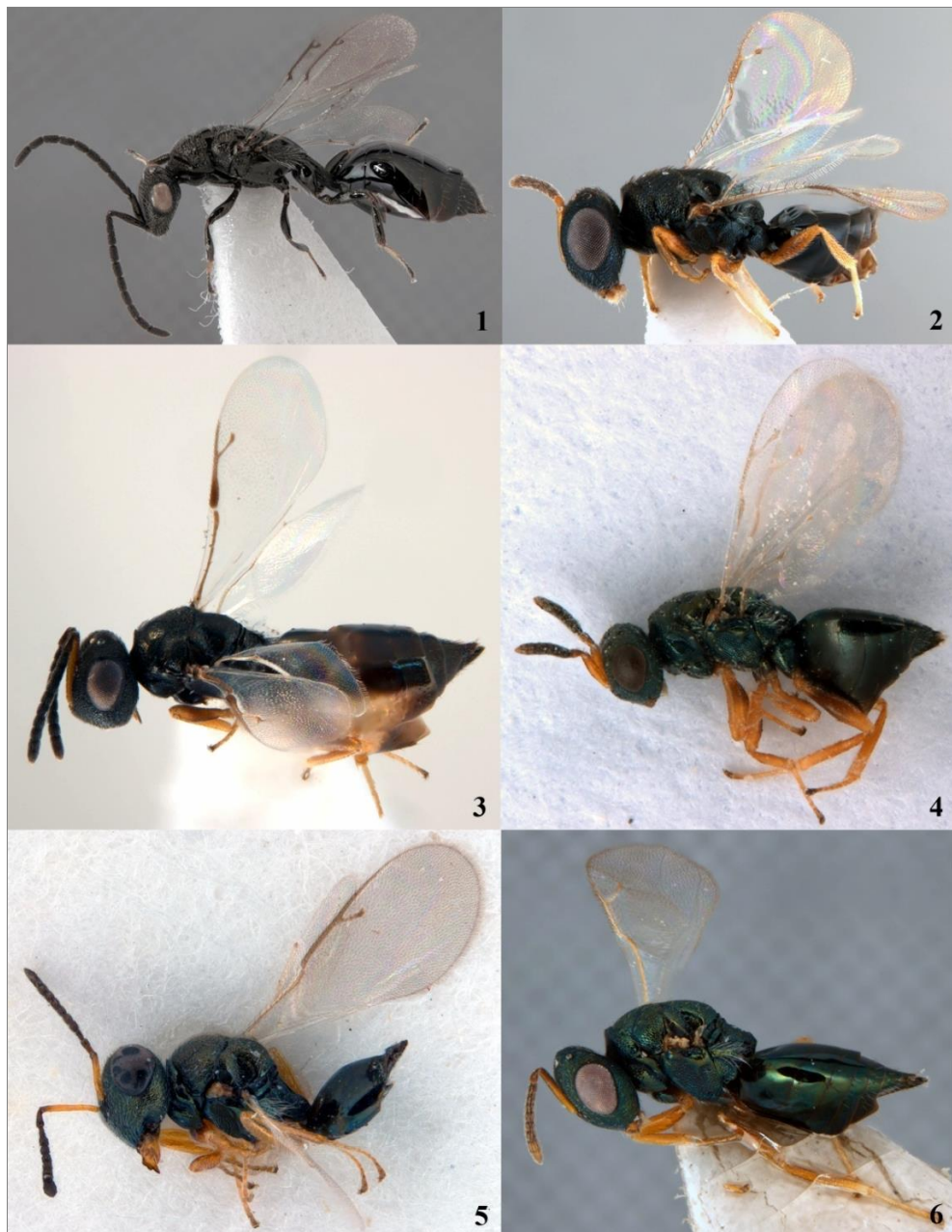
Subfamily Spalangiinae

***Spalangia* Latreille, 1805** (13 species in Europe. Identification: Bouček, 1963; Graham, 1969; Gibson, 2009) – Fig. 1

S. cameroni Perkins, 1910 (Fabritius & Gherasim, 1976-1977; Fabritius, 1980a, 1981, 1983, 1987, 1990; Mihalaşcu, 2004);

S. endius Walker, 1839 (Fabritius & Gherasim, 1976-1977; Ursu & Tudor, 1979; Fabritius, 1980a, 1981, 1983, 1987, 1990; Fabritius & Andriescu, 1984; Mihalaşcu, 2004);

S. erythromera Förster, 1850 (Fabritius, 1980a, 1981);



Figures 1-6. Pteromalid parasitoids of synanthropic flies. 1. *Spalangia nigroaenea*, ♂; 2. *Pachycrepoideus* sp., ♀; 3. *Muscidifurax* sp., ♀; 4. *Nasonia vitripennis*, ♀; 5. *Urolepis* sp., ♀; 6. *Trichomalopsis* sp., ♀.

- S. nigra* Latreille, 1805 (Ursu & Tudor, 1979; Fabritius, 1981, 1983, 1987, 1990; Mihalaşcu, 2004);
S. nigroaenea Curtis, 1839 (Ursu & Tudor, 1979; Fabritius, 1981, 1983, 1987; Mihalaşcu, 2004);
S. slovacica Bouček, 1963 (Fabritius, 1980a);
S. subpunctata Förster, 1850 (Ursu & Tudor, 1979; Fabritius, 1981, 1983, 1987; Fabritius & Andriescu, 1984).

Subfamily Pteromalinae

***Muscidifurax* Girault and Sanders, 1910** (1 species in Europe) – Fig. 3

- M. raptor* Girault & Sanders, 1910 (Fabritius & Gherasim, 1976-1977; Fabritius, 1978, 1980, 1980a, 1980b, 1981, 1981a, 1983, 1987, 1990; Ursu & Tudor, 1979; Mihalaşcu, 2004).

***Pachycrepoideus* Ashmead, 1904** (1 species in Europe) – Fig. 2

- P. vindemiae* (Rondani, 1875) (Fabritius & Gherasim, 1976-1977; Fabritius, 1980a, 1981, 1983, 1987; Mihalaşcu, 2004).

***Nasonia* Ashmead, 1904** (1 species in Europe) – Fig. 4

- N. vitripennis* (Walker, 1836) (Boţoc, 1967; Andriescu, 1972-1973; Fabritius, 1980a, 1981, 1983, 1987, 1990; Mihalaşcu, 2004).

***Urolepis* Walker, 1846** (1 species in Europe) – Fig. 5

- U. maritima* (Walker, 1834) (Andriescu, 1972-1973; Fabritius, 1981, 1983, 1987; Fabritius & Andriescu, 1984).

***Trichomalopsis* Crawford, 1913** (30 species in Europe. Identification: Graham, 1969) – Fig. 6

- T. terginae* (Andriescu & Fabritius, 1981) (Andriescu & Fabritius, 1981; Fabritius, 1981, 1983, 1987).

Acknowledgments

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PTEROMALIDAE (HYMENOPTERA: CHALCIDOIDEA) NEW TO ROMANIA (VII)

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Abstract. The paper continues the faunistic notes on the Romanian Pteromalidae (Hymenoptera: Chalcidoidea) and includes three genera and five species newly recorded in Romania: *Gbelcia* Bouček, 1961 with *G. crassiceps* Bouček, *Neanica* Erdős, 1953 with *N. clavalis* Erdős (second record in Europe), *Phaenocythus* Graham, 1969 with *P. glechomae* (Förster, 1841), *Ormocerus vernalis* Walker, 1834, and *Trichomalus perfectus* (Walker, 1835). For each species, brief information regarding their distribution and hosts is presented.

Keywords: Hymenoptera, Chalcidoidea, Pteromalidae, parasitoids, new records.

Rezumat. Pteromalidae (Hymenoptera: Chalcidoidea) noi pentru România (VII). Lucrarea continuă seria notelor faunistice asupra pteromalidelor din România (Hymenoptera: Chalcidoidea) și include trei genuri și cinci specii noi pentru România: *Gbelcia* Bouček, 1961 cu *G. crassiceps* Bouček, *Neanica* Erdős, 1953 cu *N. clavalis* Erdős (a doua menționare în Europa), *Phaenocythus* Graham, 1969 cu *P. glechomae* (Förster, 1841), *Ormocerus vernalis* Walker, 1834 și *Trichomalus perfectus* (Walker, 1835). Pentru fiecare specie se prezintă informații succinte referitoare la distribuția geografică și gazde.

Cuvinte cheie: Hymenoptera, Chalcidoidea, Pteromalidae, parazitoizi, semnalări noi.

Pteromalids are small parasitic wasps feeding as larvae on the immature stages of other species of insects, many of them phytophagous. Thus, they play an important role in most of the ecosystems, mainly as secondary or tertiary consumers.

This note is a continuation of the previous contributions that mention new faunistic records of Romanian Pteromalidae (e.g. Mitroiu, 2008; 2008a; 2011). Herein three genera (*Gbelcia* Bouček, 1961; *Neanica* Erdős, 1953; *Phaenocythus* Graham, 1969) and five species (*Ormocerus vernalis* Walker, 1834; *Gbelcia crassiceps* Bouček, 1961; *Neanica clavalis* Erdős, 1953; *Phaenocythus glechomae* (Förster, 1841); *Trichomalus perfectus* (Walker, 1835)) new to Romania are presented, indicating that the Romanian fauna of chalcid wasps is still poorly known despite recent progress (at least 75-80% of the pteromalid species in Romania are still unrecorded). Another species (*Spalangia nigroaenea* Curtis, 1839) is newly recorded in the eastern province of Romania.

The identified specimens are classified in the subfamilies Ormocerinae (1 species), Pteromalinae (4 species) and Spalangiinae (1 species). General data regarding their geographical distribution and biology are given. More information concerning these aspects can be found in Noyes (2012).

Most specimens have been collected using an entomological net between 2003 and 2009; some have been reared in laboratory from their hosts – Cynipidae (Hymenoptera), Curculionidae (Coleoptera) and Muscidae (Diptera) –, and one specimen has been collected using a yellow pan trap. All specimens are deposited in the Mitroiu Collection (MICO), “Alexandru Ioan Cuza” University Iași, Faculty of Biology.

Subfamily Ormocerinae

***Ormocerus vernalis* Walker, 1834**

Material examined. 1♀ reared from a gall of *Biorhiza pallida* L. (Hymenoptera: Cynipidae) collected in Leorda (Botoșani county), 15.iv.2009 (O. Popovici leg.).

Remarks. *Ormocerus vernalis* is distributed mainly in Western Europe and attacks many species of galligenous Cynipidae (Hymenoptera) on *Quercus* (Noyes, 2012).

Subfamily Pteromalinae

***Gbelcia crassiceps* Bouček, 1961**

Material examined. 1♀ collected near Ciric creek (Iași county), 28.vi.2007 (O. Popovici leg.).

Remarks. Associated with *Phragmites*, *G. crassiceps* is distributed from Western Europe to Central Asia (Noyes, 2012). The above record confirms this association.

***Neanica clavalis* Erdős, 1953**

Material examined. 2♀ near Babadag (Tulcea county), 15-17.v.2009 (L. Fusu leg.).

Remarks. *Neanica clavalis* is apparently a very rare or local species. This is the second record in Europe after the type locality in Hungary. Outside Europe it was recorded only from Kazakhstan. The hosts are unknown (Noyes, 2012).

***Phaenocythus glechomae* (Förster, 1841)**

Material examined. 1♀ forest near Călărași (Călărași county), yellow pan trap, 5.viii.2008 (M. Chițoran leg.).

Remarks. The species was reared by various authors from *Liposthenes glechomae* (L.) (Hymenoptera: Cynipidae) on *Glechoma hederacea* L. (Lamiaceae) (Noyes, 2012). Its distribution range include Europe and Central Asia.

***Trichomalus perfectus* (Walker, 1835)**

Material examined. 6♀, 6♂ reared from galls of *Ceutorhynchus cardariae* Korotyaev (Coleoptera: Curculionidae) on *Lepidium draba* L. (Brassicaceae) collected from Roșiori (Suceava county) and Osoi (Iași county), 11.v.2003 (M.-D. Mitroiu leg.).

Remarks. *Trichomalus perfectus* is widely distributed in Europe and parts of North America. Its hosts include many species of *Ceutorhynchus* Germar (Noyes, 2012).

Subfamily Spalangiinae

***Spalangia nigroaenea* Curtis, 1839**

Material examined. 1♀, 3♂ reared between 28.vii. and 7.viii.2013 from *Stomoxys calcitrans* (L.) pupae (Diptera: Muscidae) collected on 10.vii.2013 from sheep dung near Valea lui David nature reserve (Iași county).

Remarks. In Romania this species has been reported from *S. calcitrans* by Fabritius (1990) and Mihalașcu (2004), but this is the first record from Moldavia (the eastern province of Romania).

Acknowledgments

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PROFESSOR IONEL ANDRIESCU ON HIS 80TH ANNIVERSARY



With the cabinet door always open, the university professor Ionel Andriescu is not waiting for guests, but he ensures his necessary ventilation for the regeneration of creative spirit.

He has been working all the time; you can find him in front of his desk overloaded with treaties, doctoral theses, with finished or nearly completed papers, valuable works that you would like to have in your personal library. Surely, he is the possessor of the most valuable and modern entomology treaties in Europe and not only. If you want to guide a candidate for a doctor's degree, a student for a master's degree who tries to structure his dissertation in the field of general and applied entomology, the first recommendation you should give him, is the master, Ionel Andriescu. Even if he does not have a treaty in the respective moment, to which you might become dependent, you cannot leave without endless bibliographic information, without which you cannot start the desired research. If you approach in your modern research the eternally modern theme of entomophages and their role in preserving the natural balance, then certainly Professor Ionel Andriescu, can open you the most beaten ways, but also the most subtle ones. Not incidentally on the door of his office, at a visible place, it is the logo, "SOREGA", of a major scientific institution whose executive chairman and founder he is.

His Excellence in research of the entomophagous parasitoids, you feel it from the first contact; he is the master who has a passionate pleasure to help his disciples and collaborators and to support them to advance, as much as possible, on the winding and

often mysterious ways of the biological control against pest insects.

Belonging to the Strong School of Entomology from “Alexandru Ioan Cuza” University, whose foundations were put by the “Titan” of the Romanian Zoology, Professor Ioan Borcea, and that was developed impressively by one of the greatest entomologists of our nation, Professor Mihail Constantineanu, the colleague Professor Ionel Andriescu created, in his turn, a collective of great researchers, who open new research directions in the vast empire of the entomophagous insects.

The hostility of fate and the period of serious social and moral crises kept him for a while, away from a university department, which he greatly deserved; he was forced to work only in the field of science. The tenacity of his character, the native intellectual heritage, the passion and a big power of work, alongside with his talent of researcher helped him always be a model of excellence in the scientific research, no matter he was working at the “Prof. Ioan Borcea” Marine Biological Station from Agigea, at the Biological, Geological and Geographical Research Station “Stejarul” from Pângărați - Neamt, or at the Biological Research Centre of Iași.

Though later, the erudite human of science, Ionel Andriescu re-entered on the track which was destined for him, that of academic education, contributing to the raising of the prestige of the Iassiensis biological academic education. The fruits obtained by him opened an impressive like the flowers of “Queen of the Night” which opens its corolla at the nightfall.

Ionel Andriescu saw the light of the day on June 7, 1933 in the town of Botoșani, in the family of Dumitru and Adela Andriescu. The son of the great social crisis of 1933, Ionel had to go in his existence from one crisis to another, each with its colour, blacker or grayer up to the moral and economic crisis of our time. His father, adjutant in the Roșiori 8 Regiment had to go away at just 42 years, in the “hell of Siberia”. Consequently, the mother remained with two boys and a girl and she had to push through the hardships of the times to survive and to provide a selected education to her children. The war, the refuge, the loss of the home, the devastating drought that put Moldova on the ground, were just some of the many trials of time.

Having good educators both in primary school and in secondary one, and proving a native intelligence and love for learning, Ionel was admitted at the famous “August Treboniu Laurian” High School in Botoșani. At the High School, he had great teachers. It seems that the biology teacher, Remus Cehovschi had a decisive influence in the professional orientation of the high school young pupil, being much stimulated in the knowledge of nature. Going on the footsteps of his father, who was endowed with some poetic inclinations, Ionel felt drawn by the poetry and symphony of nature, and especially by its secrets. The successes obtained at High School, where he graduated with a high average, encouraged him to knock at the doors of the Faculty of Natural Sciences - Chemistry, “Alexandru Ioan Cuza” University.

As a student, Ionel Andriescu quickly integrated into the university life. At the faculty, he enjoyed again a great variety of personalities of the Romanian academic science and education, among who there were shining: Mihail I. Constantineanu, Petru Jitariu, Olga Necrasov, Petru Suster, Feider Zicman, Neculai Macarovici and others.

Being impressed by the courses and the halo of the European class of entomologist professor Mihail Constantineanu, he had asked him to receive him among the members of the Student Scientific Circle of Invertebrate Zoology. So, there began the first expeditions

in nature to which there took part also the professors: Mihai Peiu, Constantin Filipescu from the “Ion Ionescu de la Brad” Agronomic Institute and the famous and exotic lepidopterist Alexei Alexinschi. The professor Mihail Constantineanu was speaking to the students, with a boundless respect about the Titan of the Romanian zoology, about the promoter of the biological control of pest insects, so that the students were feeling connected, not only by their professor, but also by the great forerunner. Thus, Professor Mihail Constantineanu managed to polarize around him the best of his students and to put the bases of the strong entomological school initiated by professor Ioan Borcea.

Ionel, the student Ionel Andriescu, was perfectly anchored in the student life; he took part to the cultural life of the town and had close relationships with many students from other faculties.

Through his charm and social intelligence, Ionel Andriescu easily established friendly relationships with the colleagues and their professors and was present at many of the meetings of the students. One of his best friends was Victor Ciochia. He had a peculiar behaviour in his way of being, through the passion for hunting, for birds and insects. Native of Brașov, Victor came from another world and had a special charm, attracting the attention of many of his fellow men. Ionel and Victor, having some common affinity to Professor Michael Constantineanu, the passion for traveling and of knowledge of the secrets of nature, they became inseparable friends. They both were good connoisseurs of the history of the nation and were self-contained by a hot and clean patriotism, although they belonged to different historical and geographical regions. Bearer of a Transylvanian blood, Victor was a Romanian with a hardened soul in the historical clashes of survival of the people from Ardeal and Ionel had his roots in that “locus geniuses” that Nicolaie Leon glorified, a place destined by God, from which many personalities of the Romanian science and culture have sprung up and manifested with an impressive vitality: Mihai Eminescu, Nicolae Iorga, George Enescu, Andrei Popovici Bâznoșanu and two of his idols, professors Mihail Constantineanu and Petre Suster. If we put on the map of Romania, all the personalities of the Romanian science and culture in each county, we shall find that in Botoșani county is the highest density of truly enlightened minds, hence started Nicolaie Leon, too, who considered that the land of Botoșani is a “genius place” blessed by God.

Though they had different structures, the two friends felt obliged, in their souls, to participate in the great social events of the Romanians. So, we can explain ourselves their physical and spiritual participation in the celebration of 500 years of the rise on the throne of Moldavia of Stephen the Great, who was one of the greatest Romanians of our nation for ever. The destiny had to make to those two friends somewhat parallel roads that sometimes overlapped, roads loaded with many pits dug with enmity and unconsciousness by the so-called founders of the communist Romania.

Shining among their colleagues, Ionel and Victor were named after graduation, in 1955, junior teaching assistants at the Department of Zoology at the proposal of Professor Mihail Constantineanu, who was the head of the department. In front of them, there was opening a bright future full of hopes. Both embraced the field of scientific research in which their Professor was shining like a star.

They embraced the field of fundamental and applied entomology. In the same year, Ionel and Victor, along with Paul Borcea, will become authors of their first scientific papers within the Students’ Scientific Society of Invertebrate Zoology, led by Professor Mihail Constantineanu. The paper was the result of some research destined to the

knowledge of malophagous species that attack some domestic and hunting species. A year later, in 1956, Mihail Constantineanu, Ion Suci, Ionel Andriescu, Victor Ciochia, and Constantin Pisciă published the first paper devoted to the knowledge of chalcidoids in some species of gallicolous cinipeds from *Rosa canina*. Also, in 1956, it is published a paper by the same authors: "Contributions to the study of chalcidoids from the Republic of Romania, parasitic in the *Aporia crataegi* from the surroundings of Iassy". In two years, the young teaching assistant, Ionel Andriescu could praise himself, alongside with his colleagues of department, with the publication of no fewer than seven papers in prestigious academic journals. For the respective times, the launching of such a success in the scientific research was downright impressive.

The two friends were learning to fly, their wings had already grown for the solitary flight. Ionel Andriescu was determined to devote his life to the study of chalcidoids; he had alongside the regretted professor Ion Suci, who did not want to study ichneumonids any longer.

Both Ionel and Victor had participated to some entomological scientific expeditions organized by the Professor Mihail Constantineanu, along with his research team in Dobrogea.

The young teaching assistant accompanied his master at the course of invertebrate zoology and took part at some practical works. Also, he participated at the summer practices of students, already proving himself a very good connoisseur of insects. Victor was also never-failing at these activities and he manifested himself not only as a good entomologist but also as an ornithologist worthy of envy.

Everything seemed to be part of the normal, there were following just the due accumulations from the scientific research and from teaching career too. The two friends seemed to be destined by God to follow a successful university career. The fate, however, would have to be cruel to them. Following the great political "purges" in 1958, applied in the first place among intellectuals, Victor Ciochia would have to be arrested and sent to prison for five years, and Ionel Andriescu would have to be removed from the higher education to allow to authorities the time to ensure "the improving of social composition of higher education". That was the "reward of the patriotic sacrifice" that was the measure applied to those, who with pure soul, tried to be Romanians and to honour their predecessors. And so, the road of the two friends was separated. In 1959, the young assistant and aspirant to doctorate, Ionel Andriescu, was dismissed from the Department of Zoology on political grounds. Nobody heeded his vocation of researcher and the grace of teacher; it did not count any healthy origin of that who lost the father in the carnage of the Second World War.

Delation, envy and contempt to humans and society had carats that "were shining" in the eyes of the "princes" of those times.

Like Petrini, Marin Preda's hero in the novel "The most beloved among the earthly humans", Ionel found himself alone in the social desert in which all turned their backs. He did not find a job at ORACA; he was helped by a noble soul, by an outstanding researcher, Professor Dr. Ungureanu Ernest, and he joined to the inter-district Sanepid from Bârlad. Thus, in the 1959-1960 period he became a specialist in the eradication of malaria.

The return to the Alma Mater was done somewhat through the service door. In 1961, the newly appointed director of "Prof. Ioan Borcea" Marine Biological Station in Agigea, the lecturer Paul Borcea, detached there by the Rector of the "Alexandru Ioan

Cuza” University, Prof. Dr. Ion Creangă, accepted him as a researcher. Through this gesture the Rector Ion Creangă “washed his hands” for the purge in 1959. The already formed entomologist had to turn his steps to the field of marine biology. Entomology remained only as a “hobby” and we must say that the Reserve of dunes from Agigea was a real “paradise” of insects. The native intelligence and his immense ability to adapt to the social conditions of life allowed the young scientist to penetrate into the mysteries of the Black Sea. If in 1962 he was employed as a researcher at the Agigea Station, we must mention that in 1963 he became already the author of a scientific paper: “Contribution à l’étude des Desmoscolecidae (Nematoda) roumaines des eaux de la Mer Noire” published together with G. Paladian. In 1963, he published with Mrs. researcher Dr. Florica Porumb the paper: “On the presence of two copepods in the palaeal cavity of the mussel (*Mytilus galloprovincialis* L.) in the Romanian waters of the Black Sea”.

The entomologist did not give up. In 1962, the year of reaching to Agigea, he published a new genus from the family Torymidae (Hymenoptera), and in 1963 he discovered a new species to science, from the same family, *Chalcimerus borceai* and *Mymaromma anomala*, the representative of a new family for the Romanian fauna.

Engaged with all forces in the scientific research, Ionel Andriescu had in mind to recover the lost time. He was like the bird Phoenix reborn from its proper ashes, strengthening his wings and taking off the flight in the high universe of the scientific research. Recovering the lost time, the researcher Ionel Andriescu became an associate Professor of the Pedagogical Institute of 3-years of Constanța, whose Rector was the regretted Professor Paul Borcea. Thus, in the 1964-1970 period, he taught the General Biology and Genetics.

His qualities of excellent manager and the social intelligence were value “documents” that weighed much in his appointment in 1966 as a principal researcher and as the director of “Prof. Ioan Borcea” Marine Biological Station.

His appointment as a director of the Station by the leadership of the “Alexandru Ioan Cuza” University seems a paradox. Without being a Party member and with his pretty stained political past, Ionel Andriescu was rehabilitated and fully integrated into the Institution which trained him.

Receiving with a natural enthusiasm the function of Director, Ionel Andriescu committed with responsibility in the management of the Station collective. We can consider that in the 1966-1970 period, when he worked as director, the Station reached its highest peaks. In this period, the Director assured and developed some new directions, among which: the biology of the marine benthos, the study of weeds from the Dobrogean crops, the study of auxiliary insects to substantiate the biological control of pest insects, the realization of a collection of Dobrogean plants, etc.

The Station from Agigea had become the most powerful School of Marine Biology from Romania. Annually, more than 60 researchers were working in the Station, among which about 30% were foreigners; the Library of the Station, included also the donation of Lucia Borcea. The personal library of the professor Ioan Borcea was, at that time, the largest library in the country in the marine biology field.

During his direction, Ionel Andriescu organized two scientific sessions and a summer course organized under the aegis of the Mediterranean Association of Marine Biology and Oceanography (MAMBO), to which, 22 researchers from 12 Mediterranean countries and 40 Romanian researchers attended. The Station was open for the practice of

students from all the universities in Romania and the Romanian and foreign researchers.

The Station management activity was carried in particularly hard conditions because there had already started the struggles for the taking over of the Station from the “Alexandru Ioan Cuza” University and its union with other similar stations to form a giant institution, which was happened too, on March 1, 1970.

The 1966-1970 period it was the golden period of the Station. In this period, new laboratories were arranged, their number reaching to 12, seven new young researchers were appointed, among them Ciochia Victor, too, released from prison.

So, the ways of the two friends overlapped and they started to collaborate in the field of Entomology.

The Station had three transporting means and the “Gilortul” researching vessel. The “Emil Racoviță” Ship had been transferred to the Potoci Station, Pângărați, and “Alexandru Ioan Cuza” University.

In this period, the accommodation space for students and researchers was much increased. Up to 30 researchers and teaching staff could sleep and a number of 80 students, for which, special rooms were built.

Dark clouds that were gathering above the Station, driven by hidden and selfish interests of some great scientists, who wanted themselves leaders, unbridled like a typhoon and led to disaster. The Station ceased to exist on March 1, 1970, entering into the structure of the so-called Romanian Marine Research Institute. Not the union caused the disaster, but the fact that the headquarters of the Station was abandoned and its material dowry was shattered without too much use. The research collective was disintegrated. Some of them became researchers of the new institute, others were forced to go in different directions.

The Rector of the University took care to protect the two friends and to keep them within the University, detaching them to “Stejarul” Station of Biological, Geological and Geographical Research from Pângărați- Neamț. And thus, starting from the sunny coast of the Black Sea, from the expeditions practiced in the Pontus Euxiny waters with the “Gilort” ship “that to the brave director was squeezing the last drops of energy, too, causing him an unbearable” seasickness, the two friends reached to the stately peaks of Ceahlău, of the Sacred Mountain. The Director from Agigea became thus, the director at Pângărați in the stronghold of Alexandru Lăpușneanu. He could have seen the future with optimism, but having other perspectives. The new director would have to confront himself with new problems. Aiming to apply the Western model, the upper bodies of the scientific research decided, in the Romanian research too, to be applied the principle of self-financing to the research institutions. Of course, this principle has its own reason, but it must be applied with great intelligence and discernment. This principle starts from the idea that scientific research is a veritable “golden mine” that if you know how to household it, you get only benefits. This means that the state needs such a mine and it should be able to manage such a treasure with intelligence. But it is enough to remember of those who were in the forefront of the Romanian scientific research that we can assess the mode in which the self-financing principle was applied in Romania. The collective from Pângărați was upset and discouraged, and many thought that they must go to other horizons. Being a good manager and having a social intelligence that would allow him to attract the colleagues, the Director Ionel Andriescu tried to anchor the Station and to give it the necessary stability to resist to the future shocks. In those six years as a Director of the Station, no researcher left the Station, on the contrary, the number of these rose from 17 in 1970 to 41 in 1976. The

Station budget increased twice and the research was oriented according to some requirements.

Being a known and recognized entomologist nationally and internationally and having alongside his friend and colleague, Victor Ciochia, Ionel Andriescu took the responsibility to establish at Pângărați the first Laboratory of Biological Control in the Romanian Higher Education, thus fulfilling the golden dream of the predecessors. Of course, here he needed the help of Victor Ciochia who had gained the necessary experience at the Station INRA from Antibes, in France. Some researchers were appointed within this laboratory such as: Ion Moglan, Veronica Moglan and Irinel-Constantineanu Oancea, who would become during the time renowned researchers who have enrolled golden pages in the Romanian Entomology. Within this laboratory, there were established two themes with fundamental and applied character:

- Increasing of the entomophage *Encarsia perniciosi* and its introduction in the control against the louse Scale of San José, *Diaspidiotus perniciosus*;
- Microbiological control of the white butterfly *Hyphantria cunea* and of other caterpillars with biopreparations on the basis of *Bacillus thuringiensis*.

In what concerns the control of the species *Hyphantria cunea*, we mention the demonstration made in the town of Roman, where the ornamental and fruit trees had fallen prey to this species.

We have to mention that in this period there were published a number of scientific papers carried out within the Laboratory of Biological Control; these papers are of reference in the field.

The Station from Pângărați has represented for the “Alexandru Ioan Cuza” University and not only, a true breeding nursery of researchers and teaching staff who would have to carry out their activity then in different universities and research institutes. It is enough to nominate just a few of the personalities of the Romanian science that started their activity at Pângărați: Ion Bojoi, Ion Băra, Victor Ciochia, Ghiorghită Gogu, Klaus Battes, Ioan Moglan, Veronica Moglan, Irinel Constantineanu, Ichim Ioniță, Constantin Grasu, etc.

Like the eternal Topârceanu’s tenant, Ionel Andriescu had to move the job, leaving the Station and the collective which was crumbled, forming several independent research centres. In the 1974-1976 period, a part of the researchers from the Pângărați Station was integrated within the Biological Science Research Centre from Iași, forming a Section whose chief would have to be the scientific researcher, Ionel Andriescu; at the same time, he was a scientific secretary too of the Biological Centre of Research, Iasi.

We want to mention that the researcher Victor Ciochia would have to leave in 1974 to the Research Institute for Potato and Sugar Beet from Brașov. Back in Brasov, in the region of childhood, Victor Ciochia settled the bases of a laboratory of growing and using of some species of Trichogramma in the biological control of butterflies that cause damages in the agricultural crops.

Arriving in Iasi, Ionel Andriescu together with his research team, composed of the researchers: Ion Moglan, Veronica Moglan and Georgeta Gaidău, in collaboration with the researcher Klaus Fabritius from the Institute of Hygiene and Public Health in Bucharest put the bases of a Laboratory of Biological Control in which different species of Trichogramma were reared and released in nature, in view of control of some lepidopterans in vineyards and orchards. A special role within this laboratory had Mr. Ioan Moglan. In 1991, they were

made the first releases of Trichograms in the vineyards of the IAS Bucium and Copou.

It was too beautiful to be true; in 1991, it was stopped the funding due to the “epochal” reforms after 1989.

We have to mention that in 1991, the researcher, Ionel Andriescu became a director of the Institute of Biological Research in Iași (I.C.B.). Within his laboratory, he worked with the team of researchers led by him at several projects:

- Biodiversity of entomophages (systematics and faunistics) in the natural and anthropogenic ecosystems;
- Ecology of entomophages, parasitoid complexes;
- The effect of chemical treatments;
- Production and utilization of entomophages in the biological control;
- Protection, stimulation and optimization of the efficiency of entomophages in the integrated control;
- Knowledge of natural enemies of some European plants that have become invasive and dangerous weeds in North America. (Project funded in collaboration with the International Institute of Biological Control of the Commonwealth, CIBC).

In 1991, the researcher Ionel rejoined the “Alexandru Ioan Cuza” University after 33 years from the odious political punishment he suffered in 1959. Thus, he applied and obtained a position at the Department of Zoology, Faculty of Biology. Until 1997, he continued to be the director of ICB Iași. In this period, he has succeeded to build, together with the Faculty of Biology, a modern Bioinstallation for the growth of some species of Trichogramma. He worked in this field until 2003, when he was forced to quit because he could not stand the lack of professional ethics of his collaborator, Diaconu Alecu.

In his capacity of university professor, Dr. Ionel Andriescu has honoured several disciplines among which: Ecological bases of the control of pest insects, Systematics and the biology of the predatory and parasitoid entomophages, Methods and the principles of the productivity of terrestrial ecosystems, integrated control, Biology of animal pests and Biodiversity.

His teaching grace with which he was endowed from nature and the vast accumulated experience in the scientific research allowed Professor Ionel Andriescu to teach lectures of high academic level with the latest scientific information and with many aspects of applied research, verified in the personal researches, being appreciated particularly by students and masters. The experience allowed him to make the happiest correlations between the fundamental research and that applied one in the field of Entomology.

The colleague, Ionel Andriescu has perfectly integrated into the collective of the Department of Zoology. In the 1997-2000 he was the Scientific Secretary of the Professorial Council of the Faculty. Since 1990 he has become a Ph.D. supervisor. Up to the present (2013), he completed 17 doctoral theses, 3 of which appreciated with the “Cum Laude” mention.

In his capacity of university professor he was part of multiple committees for granting of some titles to the teachers from the pre-university education, in the doctoral committees in Romania and the Republic of Moldova. It impresses pleasantly the relationships that Professor Ionel Andriescu has established with the colleagues from the Republic of Moldova. We can state that he is one of the most active colleagues of ours, who devotes a great deal of his work to coordinate the research activity of some colleagues

across the Prut. The devotion and the warmth with which he treats our colleagues start from his deep patriotism and his boundless generosity. I am impressed by this behaviour, which in the moral fall of our days almost disappeared; today being a patriot means to be lost, to be a man without the sense of reality.

Of course, all his efforts are appreciated with the same measure. He is a member of the High Commission of Certifications and of the Specialized Scientific Council of the Institute of Zoology and the National Institute of Ecology of the Academy of Sciences of Moldova. He was an official reviewer on numerous doctoral committees and of habilitation of some researchers in Kishinev.

It is impressive the activity of contractual research made by Mr. Professor Ionel Andriescu. His research of systematics and taxonomy of some families of Chalcidoidea can be passed to what we call hobby to contractual research. And yet his achievements in systematics and taxonomy are impressive. It is worth to mention only some of these achievements:

- I. New taxa for science, confirmed by modern revisions and included in the databases Fauna Europea and Universal Chalcidoidea Database:

Phylum ARTHROPODA

Class INSECTA

Order HYMENOPTERA

Superfamily CHALCIDOIDEA

Family EUCHARITIDAE

Eucharis borceai Andriescu, 1968 – new species

Eucharis dobrogica Andriescu, 1968 – new species

Family EULOPHIDAE

Boucekastichus homocerus Andriescu, 1971 – new genus and species

Pediobius worelli Andriescu, 1971 – new species

Family EUPELMIDAE

Calymmochilus dispar Bouček & Andriescu, 1967 – new species

Family TORYMIDAE

Chalcimerus borceai Steffan & Andriescu, 1962 – new tribe, genus and species

Family PTEROMALIDAE

Trichomalopsis terginae (Andriescu & Fabritius, 1981) – new species

Phylum NEMATODA

Order DESMOCOLECOIDEA

Family DESMOSCOLECIDAE

Tricoma bacescui Paladion & Andriescu, 1963 – new species

- II. New contributions to the study of the Romanian fauna:

- a) In the field of parasitoid Hymenoptera:

- Parasitoid complexes of numerous phytophagous species of insects.
- A new family (MYMAROMMATIDAE) for Romania and numerous new genera and species for Romania (some new for the fauna of Europe).

- b) In the marine field (Black Sea):

- Phylum NEMATODA: one order (DESMOSCOLECIDEA), one family, 3 genera, 3 species new for Romanian waters
- COPEPODA PARASITICA: 2 families, 2 genera, 2 species new for Romanian waters and for the Black Sea.

c) In the terrestrial field – other groups:

- Phylum ARTHROPODA, Class ARACHNIDA, Order ARANEAE: 14 species from the 7 families new for Romania.

Together with Professor Ion Moglan, he made the first international contract with the International Institute of Biological Research of the Delemont-Commonwealth Station in Switzerland in the 1959-1973 period. He co-ordinated over 30 contracts in his capacity of Director with various research institutions, ministries and companies, co-ordinating and realizing nearly 130 phase reports, totalling over 6,000 pages, in the 1971-2004 period. He collaborated to the elaboration and publication of five books referring to the foundation of integrated and biological control of pest insects.

He published over 150 scientific papers, among which:

- Books of theoretical and applied entomology: 5
- Scientific papers devoted to the study of biodiversity of some animal groups: 129, of which 29 are published in prestigious journals from 14 countries in Europe;
- Papers referring to the history of biological sciences and of some personalities of the Romanian university Biology.
- Opinion articles, reviews and prefaces of some books: 21.

As recognition of his experience and of the results of excellence in the scientific research, Professor Ionel Andriescu was and is a member of an impressive number of committees and councils:

- The Evaluation and Accreditation of national research institutions in the MCT (ANSTI) - 1966 Evaluation Commission of grants in CNCSU;
- Member of the editorial Committees of numerous scientific journals (B, B+);
- Annals of the “Alexandru Ioan Cuza” University - Iasi, Department of Animal Biology;

- Entomologica Romanica - Cluj Napoca;

- Oltenia, Journal for Studies in Natural Science – Craiova;
- Research in the Piatra Craiului National Park. Transylvania University, Braşov, volume II and III;
- Bulletin of the Academy of Science of the Republic of Moldova, Life sciences;
- Noosphere - National Academy of Ecological Sciences, Republic of Moldova.
- International University of Moldova and the Institute of Researches for Environment and Sustainable Development.

Professor Ionel Andriescu has a particular merit in what concerns the organization of some national and international scientific manifestations.

- Two scientific sessions organized at “Prof. Ioan Borcea” Marine Biological Station from Agigea whose works were published in two impressively large volumes;
- International Course of Marine Biology (brinish waters), MAMBO, at the Agigea Station in 1969;

- The 15th International Symposium of Entomophanistics for Central Europe, SIEEC, Iaşi, 1996, being the chairman of the Organizing Committee;
- He participated in the organization of 8 SIEEC symposia abroad (Switzerland, Yugoslavia, Germany, Slovenia, Ukraine, Hungary, Austria, etc.);
- The Third National Conference of Entomology from Iaşi, 1983;
- The Second National Congress of Biology, Romania, 1986.

We cannot include here all the Scientific Societies from abroad and Romania

whose member Professor Ionel Andriescu is:

- Member of the Permanent International Committee (SIEEC, International Society Entomophanistic Europaea Centralis) in 1982;

- Founder member and chairman of the Romanian Society of General and Applied Entomology (SOREGA).

- He is also member of 10 societies abroad and seven in Romania.

The excellence in the scientific research has been honoured in various ways:

In 1980, the Ministry of Research and Technology awarded the third prize on country to the collective formed of: Dr. Ionel Andriescu C.P.III, university Reader Dr. Constantin Pisciă, Dr. Ioan Moglan C.P. III, and to the collective of researchers who worked on “The substantiation of integrated control of pest insects in apple orchards”, and the documentary film “The weapons of nature” by V. Gaspar, Victor Ciochia and Zoe Beratlief, whose scientific consultant was the researcher Andriescu, was awarded with the Second prize for the scientific film in Yugoslavia.

Also, Professor Ionel Andriescu received numerous Diplomas of Excellence from prestigious universities and research institutes in Romania.

Sufficiently, harassed and oppressed in life, the researcher and the Professor Ionel Andriescu, the MAN, Ionel Andriescu has managed to get up every time, like the Phoenix Bird, from the proper ashes and to soar himself to heights. He has never declared defeated. Each time he was surrounded by close collaborators who he knew to coordinate in the scientific activity.

Happy Birthday, Dear Colleague!

Professor Gheorghe MUSTĂȚĂ

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PROFESSOR IORDACHE ION ON HIS 75TH ANNIVERSARY



Professor Ion Iordache reached the age of 75 years. Forever young and dynamic, the ornithologist Ion Iordache wants to prove that “sparrow everything stays put” and we cannot argue him because somatic he really looks like that. Although they are a lot of ornithologists, just one presented his doctorate with the thesis “Biostatistics and ecological study on populations of two species of sparrows *Passer domesticus* and *Passer montanus* in Moldova” And if we take in consideration the fact that he has been for much years the tenured of the Ethology course, he must have the secret of the youth without senescence and the secret of the life without death. The experience accumulated in the field of Vertebrate’s Zoology allowed him to be an elite hunter and more than that, a great theoretician of the wildlife resources. Such all the hunters and fishermen, Professor Iordache Ion is a skilful narrator; He offered to his students and to all animal lovers some captivating books as: The wonderful world of birds, The zoo-VIP Curiosities from the creatures world, Wild mammals from Romania, The stunning exotic birds and much others.

Endowed by nature with the gifts of writing and narrating, he managed to put in his books enough information to awake the interest, the pleasure of reading and the

ambition to go all the way.

Didactician and methodist of academic rank, Professor Iordache Ion managed not only to polish generations and generations of biology teachers and gave them several valuable editions and versions of the valuable textbook of "Teaching biology", but also to give his lectures of Vertebrates Zoology, Ethology, Phylogenesis, design.

The zoologist, ornithologist, hunter and ethologist Ion Iordache without abilities in the preparation of the biological material would be, still, an unfulfilled specialist. His specialization in this field appeared like a hobby from the moment he took the hunting rifle in his hands and he became assistant at the Department of Zoology. The secrets of biological material preparation were shared to his students in the course and the practical work of "The technique of biological material preparation", course that he honoured it for a number of years.

Experience was required being harnessed not only in the field of academic education, but also socially. I still think that the birth Fates have foreshadowed his road of life. How else, Professor Ion Iordache became director of the Natural History Museum in Iași, which belongs to the "Al. I. Cuza" University. "The right man in the right place." This is the first Museum of Natural History from the Romanian Countries. It has been honoured by a number of great personalities, including: Ioan Borcea, Nicolae Leon, Ion Botez, Nicolae Macarovici, Constantin-Visarion Mândru, Nicolae Valenciuc that was followed by Professor Ion Iordache. Trying to implement a Museum of Man in the framework of the Museum Complex honoured him, pity that was not understood and was not helped by the leadership of the University. I hope that this dream will be accomplished in the future.

The leading activity of the Museum was smartly and happily correlated with that of the Head of the Department of Zoology, Ecology, in the period 1993-2005.

The involvement in the social life, at the level of a scientist had to be accomplished as President of the Scientific Council of the National Park Ceahlău. The function would seem purely scientific, actually, there were and still are a lot of conflicts of interest between organizers and beneficiaries, which shouldn't appear in a State law, but which to us appear; in solving them it is required tenacity and social intelligence.

Born on 15.08.1938 in the village "Alexandru Odobescu" from Buda, Buzău, in a family of working people, who made all the efforts to give children in schools, Iordache (Tache) he went to school in his native village (1944-1948). He still remembers the troubles caused by the Great World War. He made middle school to Dumitrești, Putna county, today Vrancea (1948-1951), and secondary school at "Middle School for 10 years" from Râmnicul Sărat, today College "Al. Vlahuță". Being a child who loved books, his parents decided to maintain him at college, although times were hard and there were many children. Thus, in 1954, became a student of the Faculty of Natural Sciences-Geography at the University "Al. I. Cuza" from Iasi.

In college he enjoyed the existence of a great throng of professors and scientists, between the: Mihai Constantineanu, Zicman Feider, Olga Necrasov, Petre Jitariu, Constantin Papp, Nicolae Macarovici etc. Through his adolescent look, his nice aspect of the image and personal charm he was quickly loved by his co-workers, especially of girls. With a social intelligence developed, proved that he is a witty and a great colleague, Ion Iordache became meanwhile the famous Tache or Tachiță, that is how I met him too and it was a real pleasure being around him. With a developed sense of observation, a curious type, always willing to jokes and pranks (more or less innocents) Tăchiță became this

agreeable and searched by both colleagues and the young academics. Our approach has been favoured by the fact that during studentship we did some practical applications together. It remained in our memory the beautiful and educative practical applications made through the country by train (with carriages equipped for sleeping).

Noted for its qualities, the young graduate became in 1960 assistant at the Department of Zoology, at Vertebrate Zoology discipline, honoured at that time by the eminent Professor Zicman Feider. The year 1960 was a memorable year for the history of the “Al. I. Cuza” University; it was celebrating the centenary of the establishment of the University. This event attracted the attention of the authorities, encouraging the boost of students and teachers.

From the beginning I found some similarities between the young assistant and his teacher: stature, social intelligence, the size of cranial capacity and not only this. Being assistant, he was closer to us, the students. I was in the final year of study and living in the “Olga Bancic” house, next to University. We were playing cards at meal. Suddenly Mister Tache opens the door speaking out loudly: “come in Mister Dean!” We remained as paralyzed, we got no cards to hide, we experienced great emotions until we realized it was a prank.

In 1962 we became work fellows, with me being assistant at Invertebrate Zoology, at Professor Mihai Constantineanu. Becoming colleagues our relations became closer too. We had met better in the applications made in the nature with the students. Meanwhile we became organizers of practical applications together with other colleagues: Constantin Pisciă, Constantin Toma, Mihai Mititiuc, Gheorghe Vițelariu, Dumitru Mititelu etc.

In the hierarchy of teaching the success was more difficult, time policy putting his stamp: assistant 1960-1965, head of laboratory 1965-1969, assistant 1969-1978, lecturer 1978-1991, associate 1991-1994 and full Professor since 1994.

The young teacher made some postgraduate training courses both at home and abroad:

- The use of radioactive isotopes at the Institute of Atomic Physics in Bucharest (1963);
- Method of teaching sciences at the University “Al. I. Cuza” Iasi (1972);
- Stages of specialization and documentation in Germany, Poland, USSR etc.

Apprenticeship in scientific research had made it to the teacher Zicman Feider. In some happy circumstances he associated in the scientific research with the heads of work Nicolae Valenciuc and Viorica Simionescu, who already were dealing a specific theme, the order Chiroptera, respectively rodents (Small rodent mammals).

His first scientific paper was published in 1962, in collaboration with Zicman Feider, N. Valenciuc and V. Simionescu “La croissance relative chez l'Atherinapontique (*Atherinapontica* Erch. 1831) et considerations sur le rythme de croissance des deux sexes ches la poissons”.

Follow a series of papers on bats made with his late colleague N. Valenciuc, with who makes a friendship in the real sense of the word, based on collaboration and mutual respect; they published together 31 scientific papers.

Being initiated in the Ornithology field, Mister Ion Iordache begun to channel his efforts into this area, publishing a series of papers alone or in collaboration. Become an ornithologist recognized and appreciated, he began to initiate into this field some of his students or ornithology enthusiasts from other Universities, who are today known

ornithologists. In this sense we could nominate numerous publications with Carmen Gache, M. Grebinișan, T. Glăvan, S. Trelea etc.

Deserves particular attention how Professor Ion Iordache managed to initiate and form his son as ornithologist, Lecturer dr. Ion Constantin. The first works published together, father appears as first author, and then, after the son became a good sistematician, he turns into the first author, then takes off and independently publishes the results obtained in research. This algorithm we meet either in the collaboration with Lecturer dr. Gache Carmen, who is a famous ornithologist both at home and abroad.

Being a skilful pedagogue Professor Ion Iordache understood that you cannot really be academic and scientist if you do not form in your area a number of disciples to continue your research and to develop them. There are many ways how you can form a number of specialists: graduation papers, dissertation, degree works, the doctoral specialization. It is enough to mention that, through the leadership of 158 graduation papers, more than 50 dissertations and 106 degree works, an impressive number of disciples enjoyed his precious and relevant guidance. The successful completion of 26 doctoral theses, most of them from the ornithology field, enable us to consider that Professor Ion Iordache contributed at the formation of high academic specialists, in this manner initiating a School of Ornithology at the University "Al. I. Cuza" from Iași.

Research of chiropterology and ornithology are particularly important through both their theoretical value (fundamental) and practical (applied). Professor took an impressive research activity under contract. He coordinated eight research grants with internal financing and one with external financing. Most of them are devoted to the complex study of the protected areas from Moldova. In the same area of research enrolls the International Grant too, realized with Scanagri-Denmark: "Present situation of forestry and ecosystems in the Ceahlău Nature Reserve as a result of the word felling and the human activities".

The scientific work of Professor Ion Iordache honours him. He published more than 130 scientific papers in prestigious journals in the country and abroad. He printed alone or in collaboration a number of 26 books, of which ten are university textbooks.

Especially rich is the didactic activity of the teacher Ion Iordache.

Being stopped at the Department of Zoology, the young assistant participated at Vertebrate Zoology practical work and practical applications of students. As assistant he led the Vertebrate Zoology practical work for long time together with his predecessor and friend, Professor Valenciu Niculae. They published together in 1983 a practical volume of Vertebrate Zoology. Leading the students practice at the Marine Biological Station "Professor dr. Ioan Borcea" from Agigea, he elaborated in collaboration with Professor Mustata Gheorghe, a Practical Guide to the Black Sea, being helpful for the students.

Regarding the teaching of Vertebrate Zoology course that he honoured for a long period we have to mention that he had as model his predecessors, Professors Zicman Feider and Valenciu Neculai; such as they had, he provided a special design for his lectures, to make it more enjoyable and appreciated by students. Endowed with the gift of teaching and valences of pedagogue, Professor Ion Iordache delivered lectures of high academic appearance. Except the Vertebrate Zoology, he also taught: Ethology, The method of Teaching Biology, The Damage and the Rebuilding of Ecosystems, Hunting and Forestry Resources, Vertebrates Phylogeny, etc. His courses had been appreciated by students, and the optional ones had been preferred both for the richness of scientific information and the

emphasis on environmental issues and ethological ones and the illustration of the lectures with images from animals' life.

For 34 years the colleague Ion Iordache led the pedagogical practice at the Faculty of Biology. And he wasn't just a pedagogical practice organizer, but an expert in the area. He honoured the course of "The method of teaching Biology", an initiation way in the profession of Biology teacher.

At the Faculty of Biology had been organized, without interruption, practical applications with students in nature, from the beginning of XX century, from the ones initiated by Professor Borcea Ioan. The practical applications in nature and the summer biological practice of students ensured them the direct knowledge of nature, in his entire complexity and beauty. The organization of this activities demands knowledge, audacity and responsibility. It can only be realized in team, by specialists that encase different areas of research (Botany, Zoology, Entomology, Herpetology, Ecology, etc.), which reunited ensure a pleasant, workable and educative atmosphere. Professor Ion Iordache had been irreplaceable from that kind of teams. In the practical applications is realizing the bound between students and teachers. According to its realization, the Biology teacher will go out, as well, in the nature with their students.

The knowledge, managerial capacities, social intelligence and the particularly charm of Professor Iordache made him an appreciated teacher, courtly by students (especially by girl students), Tache, Tăchiță, being one of "the most loved between tellurians".

We cannot include everything here, but it is appropriate to say a few words about his involvement in the university life. As Head of the Department of Zoology-Ecology managed to coordinate the activity of his colleagues and to solve a series of managerial problems that assured a quality academic education. He involved directly into the organization of Faculty's scientific sessions and put the bases of the Ornithology laboratory.

As a recon of his methods from the didactic and scientific activity, Professor Ion Iordache had been chosen in different functions:

- Head of the Department of Zoology-Ecology;
- Director of the Museum of Natural History;
- Member of the Board of the Faculty of Biology;
- Member of the Commission no. 4 CNCSIS;
- President of the Romanian Society of Ornithology (1997-2005);
- Member of the "Working groups of Granivores Birds" Institute of ecology

Warsaw.

Professor Ion Iordache is a member in the Editorial Committee of several journals:

- Scientific Annals of the University "Al. I. Cuza", Animal Biology Series;
- Studies and Scientific Communication. The Museum Complex of Natural Sciences "Ion Borcea" Bacău;
- General aspects of biology, chemistry, informatics, mathematics and physics. Oradea University.

The didactic, scientific and social work of Professor Ion Iordache has been rewarded by various degrees and diplomas:

- Diploma of PROFESSOR EMERITUS of the University "Al. I. Cuza";
- Honorary citizen of his native village Buda, Buzău;

- Founder of the Church in the village Alexandru Odobescu.

But the greatest reward comes from his post-graduate students and from dozens of graduated generations that he built during his academic career.

After retiring, Professor Ion Iordache managed to coordinate the work of a big number of post-graduate students, who successfully sustained their post-graduated theses. He participated at the Faculty's scientific sessions and of other academics institutions. He developed and still develop a mentoring activity within Scientific Council of the Park Ceahlău and not only.

When you are looking for Professor Ion Iordache, you do not find him; it is said that he is home, to Buda to take care of his mother, in Călimani, in Ceahlău or in different PhD commissions.

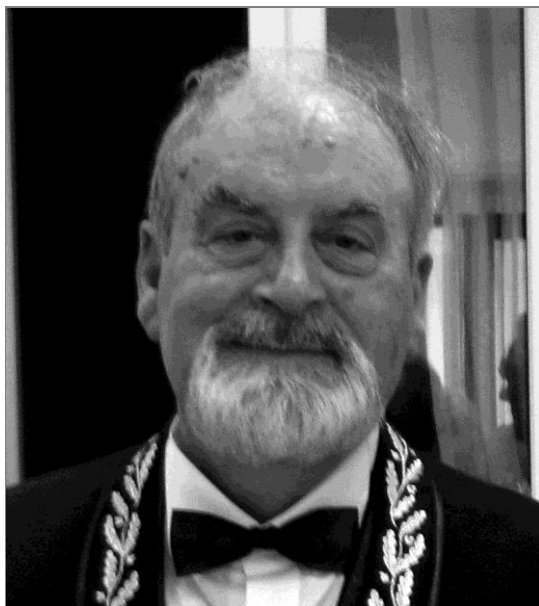
Professor Ion Iordache is a true Ahasverus of retired academics. Very dynamic, with an enviable youth for the third age, he can become a model for those who passed from Chair to Holiday eternal kingdom.

At the age of 75 years we wish him health, peace of mind and the love of those close to him (especially from the feminine side).

Gheorghe MUSTAȚĂ

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PROFESSOR GHEORGHE MUSTAȚĂ ON HIS 75TH ANNIVERSARY



As professors, we belong to a social class that does not interrupt, usually, the teaching and scientific research activity, but with the life. Our achievements, more modest or brighter are the measure of our existence, in these fields: The way in which, through personal achievements, we have pushed forward the progress of our society, nationally or even more, we have enriched the international scientific heritage through the penetration and recognition of our achievements by the international scientific community. As a matter of fact, it should be the permanent goal of every university professor who loves the institution in which he lives and works, the prestige in the world and the place among other universities.

Maybe, we can pass daily some besides others, but being taken each with their own affairs, we do not succeed to get to know each other, from the point of view of personal achievements and the sessions and other scientific manifestations are not sufficient for this thing.

But here is that everyone's birthdays after a certain age, at us as in other countries, too, become personal or collective land marks, moments in our existence, as that to which we are participating in, which with serenity, we are celebrating, the fruitful balance of a colleague and in our own self, we analyse it ours.

Through the richness and the multiple aspects, the today's balance gets a special

value for the “Alexandru Ioan Cuza” University and the Faculty of Biology. Therefore, we must be grateful to the University leadership for hosting this important event under the cupola of the soul University of the Romanian nation. Let's congratulate, at the same time, our colleague, Professor Emeritus Gheorghe Mustață for the beautiful anniversary of 75 years of life and for what he has achieved in 50 years of teaching, organizational - administrative, social and scientific activity. Happy birthday, dear colleague, with health and new achievements in all the planes of life!

As a complex personality, with activity and results equally complex, it is impossible to grasp and characterize in a casual presentation, even if it is such an important an event. Indifferently, in what of the labour domains he has activated, the results were marked by excellence. As he alone confesses, he has always struggled with what he did to be well done, and where he put his hand, the mind and the soul, God has put his mercy too, according to the saying and Romanian faith. He was given himself totally to the serious professional training, with passion and perseverance, in the student days, graduating the faculty with a Diploma of merit, governmentally distributed in 1962, at the request of the Faculty and of Professor Mihail Constantineanu, Head of the Department of Zoology, as a junior teaching assistant at this Department. Until 1971, as a junior teaching assistant and assistant, he formed himself a solid basis of knowledge and teaching experience in the work with the students, that passionated and inspired him. He sustained practical works at the disciplines of Invertebrate Zoology, renowned and extremely useful applications in the field, whose reduction at the present, he regrets it now. As far back as in this early period, he cultivated his tendency for the interpretation of results and their synthesis, continuing his doctoral training where, in accordance with the supervisor, professor M. Constantineanu, he chose as a topic subject “Biology and ecology of the parasitic insects in the pest insects to vegetables in Moldova” and the presentation took place in 1974, bringing numerous new data for Romania and for science.

As a matter of fact, the thesis remains for the young Gheorghe Mustață, the spring of all subsequent entomological research fields.

In 1971, he occupied, through competition, a post of Lecturer at the Central Institute for Teacher Training, Iasi Branch, where, he carried on his activity until 1979. As a professor, Gheorghe Mustață acknowledges this period accounted for him a real school teaching, by the specific requirements and by many teaching tasks and of great responsibility, to which he had to face. Thus, the teaching of numerous biological disciplines for which he had to make the respective courses which coincided with his natural tendencies toward synthesis, allowed him the formation of a solid biological general culture, rarely encountered. On the one hand, it meant a lot in the successes achieved in the field of increasing the quality and of the progress in the Romanian pre-university education from that period, and on the other hand, it used him enormously, as he admits himself, in the next period of teaching activity within the Faculty of Biology, where he returned in 1979.

From the period of perfecting of the teaching Staff 1971- 1979, Professor Gh. Mustață appreciates as having a great significance, the over 200 special inspections for the first degree in the secondary teachers in Moldova, as well as numerous courses and conferences realized within that specialized training for all the teachers in Moldavia. The professor Gh. Mustață as far as back in the student days he manifested a great, justified and beautiful respect for the teachers he had, in general, important personalities of the

Romanian and universal Biology. Among all of them, however, a special place was occupied by Professor Dr. Mihail Constantineanu, to him he practically owns the success of his teaching and scientific career. To this titan of Entomology, the most abundant ram of the tree of the Romanian Zoology, created by the primordial of the Romanian Zoology, Professor of our University, Ioan Borcea. The Independence of outlook and the work done by Gheorghe Mustață within the Central Institute for Perfecting of Teachers allowed him, among other things, to put in the light of present, the achievements of the important biological personalities from Romania and to start from here one of his preferred fields of activity, the history of the Romanian science. And it is not accidental the fact that to the life and activity of his master professor Mihail Constantineanu, the most papers were dedicated to him, seven of the 60 written in to this field. Criticising the numerous negative aspects of the organization and development of the actual pre-university education and of its quality, in general, Professor Gheorghe Mustață regrets that there is no such an institution at present, for training and continuous perfecting of the teachers and education. As a matter of fact, too, he fully capitalized the experience got then within the National Council for Academic Evaluation and Accreditation, in his capacity as Chairman of the Exact Sciences Committee II, between 1994 and 2004.

In 1979, he came back to the University, Faculty of Biology on a position of lecturer for the disciplines, Biology of Animal pests and Biogeography. On that time, the promotions were made with difficulty, due to the lack of funds and of excessive savings, therefore, the revolution caught almost all of us at the rank of Lecturer, Scientific researcher III. Thus, the colleague Dr. Gheorghe Mustață was passing the revolution at the age of 51 years with the rank of lecturer, and the undersigned with the same rank at the age of 56 years. Were there exceptions, too? Yes, there were! Truly, rare and like any exception, hard to explain!

So that, hardly in 1991, he accessed, through competition, for the position of a Reader.

Beginning with 1979, using his experience made at the Central Institute for Perfecting of Teaching Staff, biological general culture, the eloquence and the enthusiasm of the new beginning, the Lecturer, and then the Reader (1991), and the Professor (1993), Gheorghe Mustață represents particularly brilliant grace, the quality and teacher duties for another series of thirty of students, biologists. In 1985, he got the course of General Biology for which he was ready and that he wanted it. He drafted it with enthusiasm, helped by his wife and collaborator, Reader Dr. Mariana Mustață and by his son, doctor Georgian Tiberiu Mustață. As the professor confesses, it was the course of his life, which he published it in two editions in 1999 and 2001: “Origin, Evolution and Evolutionism”. Shortly, he obtained also the course of Hydrobiology, an opportunity with which he modernized the respective laboratory, too.

The year 1990, after the revolution, was a crucial year for the University and Faculty. In that context, with the effort of several local personalities, under the aegis of the University and with the benevolent support of some important local personalities from Constanța, “Professor Ioan Borcea” Marine Biological Station in Agigea, which was included in the Institute of Marine Research from Constanța, in 1970, and the only building in other local institutions in 1975, was taken aback by the Alma Mater, the University of Iași.

The main role in the development of that approach was played by Professor Dr.

Gheorghe Mustață, to whom the leadership of the University entrusted him the function of director of the Station and who, in a short time, put it back in function on all levels. This was a great success for the University and Faculty, being able to resume the training of students and the traditional marine researches. The big provocation did not find professor Mustață unprepared. The organizer qualities and the legendary attachment to the University and the duties to the predecessors were the moral support and substantiated the courage with which he soared in the reorganization of the Station and the rebuilding of its prestige and reputation. And all in this goal, to link the education from Iasi to the marine environment, he introduced into the curriculum a course of marine Biology, which he supported and published later. He also introduced and taught a course of Saprobiology, after he had introduced the first course of Ecological Monitoring in 1990. Following his renewing spirit, in 1995, he reintroduced the course of Anthropology in the biology curriculum, taught other time by the renowned Academician, Professor Olga Necrasov. The preparation and multilateral and multidisciplinary competence of the professor allowed him during the teaching activity to take also other optional and master courses: Biodiversity in Aquatic Environments, Productivity of Aquatic Environments, Pests of Ornamental Plants and Vegetables, Animal Phylogeny, Evolutionary Strategies in the Animal World, Relationships between Species. And finally, another category of courses that transcend the exact science, according to the professor's spiritual philosophy, the festive courses treated problems as Logics of Living in Eminescu's thinking, From the Music of Spheres to the Music of Genes; Homocromy, Mimicry and Anthropomorphism; Time and the Existence in Time, etc.

These conferences were, otherwise, bundled into two volumes of essays. But, professor Mustață was equally interested in the organization and conduct of examinations, which had to take place calmly, with full respect for the student and full objectivity, as he had learned from his master, Professor Mihai Constantineanu, at whose exams he assisted, as the good habit of time. The manner of preferred examination was that oral through as students could better prove their knowledge, the power of synthesis and the way of presentation. Professor confesses "I did not find another moral satisfaction for the work done in my career as a professor than the good answers given by students in the exam". But the education process does not stop here; there is the dissertation paper, the master, the dissertation. Here are the professor's opinions: "the coordination activity of some licence and dissertation papers requires experience and teaching grace, too. The professor had to introduce the student in the field of scientific research; to initiate him in the field of scientific research; to initiate him in the methodology of scientific research and even in the concrete scientific investigation ..." and further: "Now in the twilight of the teaching activity, I realize how complex this activity is, but also how important and what influence can it have to direct the activity of a disciple". But surely, the most important and responsible among the activities of the professor was the conducting of doctorate theses. In this field, professor Mustață has conducted a special activity with those 23 Ph.D. students since 1996.

The professor's opinion is that "You cannot be a good professional if you are out of touch with collective social problems in which you are working, and even of your nation". That is why he did not refuse when he was elected a Scientific Secretary of the "Alexandru Ioan Cuza" University Senate, 1996-2000. Then, in 2000-2001, he became head of the Department of Zoology and Ecology, and for the 2001-2003 period, he was

elected Dean of the Faculty of Biology. In these functions, he did some very important things, as the bringing of the Biochemistry Section within the Faculty and the arrangement of some laboratories, the modernization of the classroom 339 and the laboratories of Hydrobiology, Animal Morphology, Animal Physiology, Biophysics, Cellular Biology and a significant achievement, the establishment of the Biology-Geography specialization and some master specializations.

As particularly special achievements, we can mention the redeeming of the Aquatic Ecology Laboratory from Piatra Neamț, separated from the former ”Stejarul” Biological, Geographical and Geological Station from Pângărați – Neamț and the Ecological Research and Aquaculture Station from Iași. These could be achieved with the support of the university leadership, in the period of the Rector, Professor Dr. Dumitru Oprea. Professor Gheorghe Mustață was also elected, in the legislature 2004, general Chancellor of the Senate. As I outlined above, in the 1994-2000 period, Professor Gheorghe Mustață, as Chairman of the Exact Sciences 2 Committee, within Central Institute for Perfecting of Teachers and later as a member of this committee, contributed fully to impose of the requirements of the Central Institute for Perfecting of Teachers and to highly maintain education quality. The scientific research occupies in the professor's Mustață concerns a place as important as teaching activity, and the results are equally brilliant.

As a result of the concerns and the complex professional activities of the Professor Gheorghe Mustață, his scientific research has embraced several fields. Thus, he begins his scientific research work within the vast theme and of great present-day importance, formulated and promoted by the Professor Mihail Constantineanu, regarding the knowledge of entomophagous insects and their role in the natural balance and in the biological control of pest insects.

Within this theme, Professor Gheorghe Mustață tackles some of the most important aspects, such as the knowledge of biodiversity especially of Ichneumonids, the knowledge of complexes of pest insects of the vegetable plants and of their natural enemies that is of the complexes of entomophagous insects that adjust their populations. The special merit of the Professor Gh. Mustață is that, starting from the knowledge of the parasitoid complexes of phytophagous insects (many harmful), he deepens the knowledge of structure and of their complex role in the providing of population balance.

As a model, in the personal researches, he took mostly the parasitoid biocoenoses particularly complex of aphids (plant lice), establishing, detailing, enunciating the role of the hyperparasitoid species in the parasitoid biocoenosis. On the other hand, especially in relation to the parasitoid biocoenosis of the *Plutella xylostella*, and other parasitoid biocoenoses in our geographical zone, particularly efficient in limiting the populations of hosts and extremely rich in species, he explains the richness and efficiency of these biocoenoses, by their age and their formation in the genetic centre of the host plant and of the respective phytophagous insects.

As a matter of fact, a part of these results and concepts was the basis of a fruitful collaboration of the Professor Gh. Mustață with “The Asian Vegetable Research and Development Centre” in Taiwan, referring to parasitoids of the species *Plutella xylostella* (important pest of the cabbage) and its control.

On the basis of these researches and collaborations, Professor Gh. Mustață was recruited in 1990 as a member of the International Working Group regarding the biological control of this pest within the International Organization for Biological Control (IOBC).

We have to mention the fact that a good part of these researches of the professor Gh. Mustață were made in collaboration with his wife, Reader Dr. Mariana Mustață, a close collaborator in almost all the fields of research of the professor.

Over 40 papers and three books were thus dedicated to the results of these researches referring to the parasitoid biocoenoses of phytophagous insects. This category was much amplified by several Ph.D. theses, coordinated by Professor Gh. Mustață. Remaining in the field of Entomology, another category of researches, even in the beginning years, was that relating to the biodiversity of ichneumons and of other Hymenoptera, a field in which new species were discovered for the fauna of Romania, but also a genus *Dolichochorus*. Referring to this field, of great importance at present, regarding the knowledge on biodiversity, Professor Gh. Mustață has published 30 scientific papers and a volume in the fauna of Romania in collaboration with his master, Professor M.I. Constantineanu.

Beginning with the '70s, along with his wife, Reader Dr. Mariana Mustață, Professor Gh. Mustață has promoted researches on the pest insects of the patrimony objects, especially by the 4 coordinated theses. By the scope and results, these studies, published papers and Ph.D. theses, can be considered as launching of a new research. In 1990, by taking the Station from Agiea and the quality of its director, Professor did not accept only to be director, but, actually, he identified himself with the goal and the profile of the station, from all points of view, bringing it back again to the rank of science teaching institution of the "Alexandru Ioan Cuza" University. Thus, besides the hydrobiological field, as teaching and research discipline, Professor Gh. Mustață tackles, together with his collaborators and Ph.D. students, current problems of Ecology and the researches of Hydrobiology were related to some aspects of the Cladocera - in the complex of Cîrc-Chirița lakes (Iași) and to the biodiversity and the dynamics of invertebrates in the Golovița, Razelm and Sinoe lakes. They constituted the second big direction of research, honoured with an extraordinary effort and results in a short time, concertized in 20 papers, three academic books, three scientific sessions at Agiea on problems of Aquatic and Marine Biology, etc.

The third field of scientific concerns of the Professor Gh. Mustață is an ample proof of generosity and responsibility towards the nation to which it belongs. It is about the history of science, giving back, evaluation and introduction in the modern utilization of the Romanian Biology achievements, values belonging to the world scientific patrimony and of the life of creators of these values. Besides these, however, the professor and his collaborators and especially his wife, Reader Dr. give to all Romanians interested in the field, and the achievements and lives of great biologists from abroad: C. von Linné, G.L.L. de Buffon, J.B. de Lamarck, E. Haeckel, AL. von Humboldt.

This field is illustrated by Professor Gh. Mustață in over 50 papers referring to 40 personalities of the Romanian Biology and supplemented with 5 papers related, strictly, to the History of Biology in Romania. The latter deals with the Evolutionism in Romania, One hundred years after the introduction of the term biological Control in Romania, "Professor Ioan Borcea" Marine Research Station from Agiea, 100 years of entomology at Iași.

Like other disciplines of the curriculum, General Biology, preferred discipline, have inspired to the professor original analyses and considerations on some theoretical aspects and phenomena such as: Synergetic Theory, the Metaphor of Nature as Language, Evolution and Crystallization of Mental Meanings, etc. To these, we have to mention the unique works in the Romanian biological literature, in collaboration with Reader Dr.

Mariana Mustăță; and one with their son, doctor, Georgian-Tiberiu Mustăță. It is about “Origin and Evolution” (1998 and 2000), “The Origin and Evolution of Man” (2000), “Origin, Evolution and Evolutionism” (2001), “Evolution and Evolutionism at the Beginning of the Millennium II” (2003), “Mimicry, Homocromy and Anthropomorphism”.

Also, the great problems of Ecology were in the attention of the family of the Professor Gh. Mustăță, who published a series of works, some for the first time in the Romanian literature or even the European one. We mention the most important, excepting the field of Entomology, “Problems of General and Human Ecology” (2003), “Somatic Ecology” (2001), “Ecological Decalog, The Commandments of the Christian Ecology or the Divine Commandments Interpreted Ecologically” (2005).

There is however interesting to note that the philosopher in the mind and soul of the biologist Gh. Mustăță, eventually is pushed by the amount of exact knowledge, on the way of transcendence. We discover this in those 6 papers published together with his wife in the Journal Orthodox Dialog, Epiphany, between 2010 and 2013, and we especially refer to two titles: “Mirror Neurons (The Neurons of God), Learning by Imitation and Empathy and “The Memory of Cells and Organs, the Double Personality and the Power of Thought”.

Another category of scientific research of the Professor Gh. Mustăță was that of the contracts and projects carried out during the years 1991-2008. The professor coordinated 16 such projects of which two international, as a partner from the Romanian part. These contracts had values comprised between 3,000 and 370,000 RON and they referred to the fields of research of the Professor Gh. Mustăță and to the organization and the endowment of the “Prof. Ioan Borcea” Teaching and Marine Research Station from Agigea. In his capacity of Ph.D. supervisor, Professor Gh. Mustăță coordinated 23 theses through which he led further his research, forming already recognized professionals in museums, institutes of research and education. These 23 theses were referring almost equally to the Biodiversity in the Terrestrial and Aquatic Entomofauna, Biology and Ecology of Marine Invertebrates and pest insects to the patrimony objects.

Professor Gh. Mustăță had particularly important preoccupations with regard to the supporting of the scientific research by organizing, alone or in collaboration, of some important scientific manifestations. It is about 11 national and two international Symposia as well as a series of 15 annual symposia (1985-2000), dedicated to the Romanian Biology personalities. Among these symposia, we can mention those specific to Entomology in Iași, scientific soul manifestations of the Professor Gh. Mustăță, initiated and organized by him and remarkable through the content and their scientific importance. We refer specifically to the symposia dedicated to entomophagous insects and their role in the keeping of natural balance, organized in 1998, 2004, 2008 and 2010.

In his turn, Professor Mustăță attended as a guest to numerous scientific manifestations in Romania and abroad, among which, very important for the subsequent collaborations of the professor, was that in Taiwan, in 1990, referring to the *Plutella xylostella* and other pest cruciferous plants. Also, Professor Gh. Mustăță as a guest, gave numerous lectures at the University of Chișinău (Republic of Moldova), the Romanian Academy and some Universities in Romania. At the same time, he belongs and activates in 11 scientific societies among which two abroad, including the Directing Committee of the International Working Group for the Biological Control of *Plutella xylostella* species - from the Asian Centre of Research, Development for Vegetables, from Tainan – Taiwan.

One of the particularly important and fruitful activities of the professor Gh.

Mustață is that of Editor of the Annals of the “Alexandru Ioan Cuza” University (new series), Animal Biology, The soul Journal of our Faculty. In this sense, Professor Gh. Mustață activates as a member of the editorial committee of other Journals in Romania, too: The Scientific Journal “Vasile Adamachi Iași” Studies and Research of Animal Biology of the Romanian Academy, The Scientific Journal of the University of Bacău, Journal of Orthodox Dialog, Epiphany, etc.

On the whole, Professor Gh. Mustață alone or in collaboration published 16 volumes with character of university handbooks and 5 chapters in volumes with didactic character and 27 volumes of scientific book. To these, there are added 178 papers and 8 scientific summaries, among which six abroad and 60 referring to the history of science.

The prodigious publicist and teaching scientific activity of the Professor Gh. Mustață is appreciated both in Romania and abroad. Thus, abroad he was co-opted in a scientific organism as mentioned above, as well as in the International Society of Hymenopterologists from the United States, member of the Academy of Ecology from the Republic of Moldova, member of the National Committee for Accreditation in the Field of Ecology Moldova. In Romania, he has received numerous leaderships.

Also, the brilliant achievements under the aegis of the University and for the University and Romania have been rewarded with appreciable distinctions: “The Emil Racoviță” Romanian Academy Prize, 1994; The Merit for Education in the Rank of Commander – 2004, Emeritus Professor - 2007, and as a corollary, Titular Member of the Academy of Scientists of Romania.

It is fitted that, alongside of these appreciations and distinctions for the impressive balance to join our sincere congratulations and collegial wishes of health and new successes to the colleague and our magister, Professor Emeritus Dr. Gheorghe Mustață!

Happy Birthday!

Professor Ionel ANDRIESCU

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READER MARIANA MUSTĂȚĂ ON HER 65TH ANNIVERSARY



The other days discussing with some colleagues about the “state” of the Faculty of Biology, I was informed about the fact that Mrs. Mustăță Mariana, University Reader PhD is the Dean of age of the Staff within the Faculty. This occurred for period of time because by a fundamental note of the Constitutional Court of October first 2013, it was decided that: *“The recognition of the position of titular in education by the school boards in schools and the University Senates, by other modality than competition, is unconstitutional. In short, the teachers who have the retirement age can no longer hold the titular position by the decision of the two forums”*. Therefore, on the day of retirement, you retire, and then everything remains in the God’s mercy.

Mrs. Reader PhD Mariana Mitrofan (married Mustăță) was born on October 17, 1948, in the city of Iași. At the primary school, she learned in different localities (București, Cluj-Napoca, Zalău, Oravița), because of the nature of her father's service as a superior officer with high functions of leadership. She attended the courses of “Vasile Alecsandri” High School in Iași. After graduating the High School, she enrolled at the Faculty of Biology and Geography from the “Alexandru Ioan Cuza” University of Iași, at the Section of Biology, which she graduated in 1971.

As a student, she remarked herself through her native intelligence, through the passion for the knowledge of mysteries of nature and through her spirit of initiative. She participated in the Students' Scientific Botany Circle led by Lecturer Adrian Volcinschi. She elaborated the graduation paper under the guidance of Adrian Volcinschi in the field of

phytopathology; the researches effectuated in this field were a kind of introduction for the research of applied mycology effectuated within the Centre of Biological and Chemical Researches from the Enterprise of Antibiotics Iași, and then at the Institute of Chemical-Pharmaceutical Research, Bucharest.

As a result of graduation of the Faculty, in September 1971, she was appointed as a replacement biologist within Enterprise of Antibiotics, Iași, at the Department of Biostimulants. Here, she worked directly in the production process for a period of eight months. During that time, she studied theoretical and practical aspects of the directed biofermentation. Being appreciated for her qualities, in 1972, she was transferred to the Department of Biological Research and preparation of the material of inoculation. In this section, she worked at the maintenance, selection and the preparation of seed material of several strains of penicillin and griseofulvin. The research and documentation activity requested a deep understanding of the biological processes staying at the basis of the synthesis of bioactive substances. On the basis of documentation in the treaties and specialty journals and prosecution of biotechnological processes for obtaining penicillin and griseofulvin, she drafted two scientific papers that have been well appreciated by her colleagues and the leadership of the Section: "Methods for maintaining highly productive strains" and "The influence of medium constituents and of determinant factors in the synthesis of penicillin".

In the year 1973, through unification, the Laboratory of Biological Research passed within the Institute of Chemical-Pharmaceutical Research. In the new situation, she worked at a scientific contract concerning the obtaining of new producers of active substances in the soil. This very important and vast theme requested her intense documentation and experimental work. There were performed researches on isolated actinomycetes and fungi from different soil types, from different zones of the country and foreign soils. There were made multiple cultures and were isolated a number of highly productive strains in bioactive substances. The crude concentrates were tested on pathogenic germs -positive and -negative Gram for the identification of new hybrid substances. The identification of fungi and micromycetes was done through modern methods of physiological, biochemical, genetic analyses and electronic microscopy.

For health reasons, due to a professional poisoning Mrs. Mariana Mustață was forced to look for another job. Thus, in November 1975, she was appointed as a biologist at the Zonal Laboratory of Conservation and Restoration of the patrimony assets within the Museum Complex of Iași (for the zone of Moldavia). She worked within the District of scientific investigations to know the aggressive biotic factors on the objects in cultural patrimony: books, documents, wood, icons, textile materials, painting on frame, fresco, stone and of all material supports characteristic to patrimony assets.

In order to carry on such an activity it was necessary to lay the foundations of a proper conservation biology laboratory of the patrimony assets. The foundation of this laboratory was made possible by a permanent link that she established with the Departments of Zoology and Botany from the Faculty of Biology and Geography-Geology.

She attended courses of postgraduate training for the Conservation and Restoration of patrimony assets and the history of Art. By the abolition of the Office of Historical Monuments in 1976, she had to deal too with the conservation status of the monuments of history and architecture of Moldova.

In the period 1970-1980, as a result of a finding out of an active focus and spread of the species *Serpula (Merulius) lacrymans* at Putna Monastery, she organized her first active conservation site with specific interventions in the liquidation of the biotic factors (extremely aggressive and expanded in the entire monastic complex since 1954) in the treasure tower, “Eminescu” refectory, chapel, cellars and infirmaries. The National Commission of the Historical Monuments in which Mrs. Reader PhD Mariana Mustață was a member decided that through the demolition of the old refectory to be recovered the Royal Palace and to be built the church porch of the bidding prayer.

In 1981, through a program of cultural cooperation, she followed a specialized training stage in the conservation of the opera of art in Norway at some of the great museums of history and art, ethnography and natural sciences in Oslo, Bergen, Trondheim, Lillehammer.

In 1982, as a result of an expertise of the conservation state of Peleş Castle, after extensive restoration interventions, for a few years, it was necessary the organization of a new re-restoration site for a period of two years and a half, together with the specialists of the Carpathians Trust.

Biotic factors, especially *Serpula lacrymans* were developing for many years and they were not discovered in the previous restoration works. The entire assembly had affected numerous wooden support beams, but they were also full of stone and brick walls penetrated by mycelia in great quantity.

The contaminated zones were removed and replaced by healthy material. The whole extracted material was burned and then buried. The interventions were made on 3 levels: inner, middle and outer structure.

The working zones were carried on in museums, stores and monuments in Moldova through active conservation programs of the patrimony assets at the monasteries: Voroneț, Humor, Moldovița, Sucevița, Dragomirna, Bogdana Church in Rădăuți, Agapia, Văratec, Neamț, Râșca.

“Dosoftei” House in Iași represented a very important point of work. With a burdened history, the house was restored by the Department of Historic Monuments and it shelters books, manuscripts, documents, but also the first printing press in Moldova, medieval incunabula, etc. Although restored with much effort, the beams, the exhibits, but also the windows were heavily infested by xylophagous insects, particularly voracious species that degraded the wood, the book, the leather, the textiles materials, etc. Among the most harmful species, we mention *Anobium punctatum*, *A. pertinax*, *Stegobium paniceum*, *Ptinus fur*, *Rhyncolus truncorum*, *Lyctus imprint*.

The intensity and the extension of the attack required radical measures. Together with the specialists of “Spicul” Enterprise, there was performed a treatment with hydrocyanic acid, and to be effective for the thick beams the concentration was very high (for about 22,000 people), taking special measures of envelopment.

In order to raise the awareness of responsible bodies, there was a direct collaboration with the specialists of “Gh. Asachi” Technical University. The following professors participated: Nițescu, Ciongradi, Grol, Radu, Adrian, specialists in hydraulic engineering, elasticity and seismic construction, materials and mortars, etc.

All the efforts did not remain without an echo. The Church of the Three Hierarchs in Iași was really renovated.

At Iași, the Church of the Three Hierarchs affected by centuries of fires and incorrect restorations - was severely hit by earthquakes and an extensive and aggressive vegetal bioderma on the "stone" and mortars of the interior painting. The memorial drafted in 1985 by the Romanian Academy, with the direct support of the President of Iași Branch – Academician Petru Jitaru allowed the "Andar" of the two detached towers, to stand out by their own weight.

In 1990, the actions were resumed: there were written memories to the Presidency, to the Romanian Parliament and to UNESCO. Following the interventions made together with his Eminence, the Metropolitan Daniel Ciobotea, with the regretted Academician Liviu Ionesi and with Mr. Academician Constantin Toma there took place the visit of the General Director of UNESCO, von Draste and of the economic Director, the Swedish Anderson in Iași to have in view the real situation of the monument and to develop rescue measures. Their efforts polarized both the interest of the specialists and decision makers from the Ministry of Culture and from Iași.

In 1998, Mrs. Mariana Mustață effectuated a training stage in the Great Britain. She visited big museums, storages and research laboratories of the state and private patrimony assets. On this occasion, she has been integrated in the International Project, Summer Schools Course at Marischoal Museum, University of Aberden. She made some theoretical and practical applications on the theme Anoxie Enclosed and Microenvironments in Museum Storage.

In 1978, Mrs. Mariana Mustață was admitted to doctorate with the theme: "Contributions to the knowledge and control of the injurious coleopterans to the objects of the cultural and national patrimony". The researches were effectuated on pest insects from the families: *Anobiidae*, *Lyctidae*, *Dermestidae* and *Curculionidae*.

There was investigated the attack on books, manuscripts, wood-manufactured objects, on fabrics, garments, embroideries, leathers, parchments, furs and naturalized animals in museums and different collections. The researches emphasized particularly strong and dangerous attacks on the books from libraries, from state and private collections, and especially on some religious books of great value, from the ecclesiastical patrimony. Moreover, at "Dosoței" House in Iași, there was discovered an active and particularly dangerous attack of *Anobiidae*, *Lyctidae* and *Curculionidae* on some books of great value and on the wooden structure of the building. There were particular problems of conservation at "Frumoasa" Church in Iași and "Bogdana" Church in Rădăuți, where the iconostasis and the icons of great value had been damaged for a long time, their structure becoming spongy and they were breaking under their own weight.

The effectuated researches have revealed the true state of health of the ecclesial and museum patrimony in Moldova as well as in the country. The thesis of doctorate was presented in February 1994. A part of the researches effectuated has been published in multiple scientific papers and two books of value in the field of research of the patrimony assets: "Coleopterans injurious to patrimony assets and pest insects to books".

Militating and insisting on the recovery and conservation of the works of art, Mrs. Mariana Mustață was understood and supported by His Eminence Daniel Ciobotea (the Metropolitan of that time), to establish a department of conservation and restoration of cultural patrimony, which in Romania is ecclesiastical in the proportion of 87%. Thus, the experience accumulated in research and conservation activities on the ground, had to be revaluated in the academic education at the Faculty of Orthodox Theology, Department of

Orthodox Theology - Cultural Patrimony. The model has been adopted too by other faculties of Theology in the country.

Mrs. Mariana Mustață has organized a master training of biodeterioration and active conservation at the Faculty of Biology and also at the University of Arts - Faculty of Plastic Arts, Iași.

Mrs. Mariana Mustață has begun her academic career together with the setting up of the Department of Orthodox Theology - Cultural Patrimony at the Faculty of Orthodox Theology of “Alexandru Ioan Cuza” University. First, she has worked as an associate lecturer, and from 1997, she has taken up, on a competitive basis, the position of lecturer. The accumulated experience of over two decades in the domain of conservation of patrimony assets would help her in procuring and equipping the Section - ensuring the material basis for a quality education.

She has become Head of the Department of Orthodox Theology - Cultural Patrimony in 1998. In this capacity and as a recognized certified specialist in the domain of conservation and restoration of the patrimony assets, she has succeeded in equipping the laboratories of the Section and in organizing and coordinating the practical activities of the students (practical training and graduation papers). Consequently, in 2002, she has succeeded in obtaining the accreditation of the Section by the specialists of CNEAA.

Mrs. University Reader PhD Mariana Mustață has also put the bases of the “Resurrectio” Research Centre, which belongs to the Metropolitan Church, focused on the issues of restoration and conservation of the assets in the ecclesial patrimony. She has organized and led the students’ training in the domain of conservation and restoration of the patrimony assets both during the year and in the period of the summer practice. She has opened working sites with students at the monasteries: Putna, Horaița Horăicioara, Golia, Cetățuia, Câmărzani and at the Three Hierarchs and Horodniceni churches, The Saints Emperors Constantine and Helen in Iași, the Saint John the Baptist, the Saint George Lozonski, etc. She has succeeded to attract the students and then the master students in the activity of research of the state of conservation of patrimony assets and their scientific conservation. She has guided more than 125 graduation papers and multiple dissertations closely guiding the students and master students’ activity.

In her capacity of a lecturer and then as a Reader, Mrs. Mariana Mustață put the bases of the following disciplines:

- Biology in conservation and restoration;
- Elements and interventions of active conservation;
- Ethnopathology of the opera of art.

In order to come in the support of students and masters, she has published the books:

- Insects injurious to books;
- Biology in the conservation of the opera of art;
- Ethnopathology of the opera of art (in press).

In the 2003, Mrs. Reader PhD Mariana Mustață occupied the position of Reader at the Faculty of Biology of “Alexandru Ioan Cuza” University. Since 2003 up to 2013, she has continued to honour the courses of Biology in conservation and restoration and Ethnopathology of the opera of art at the Department of Orthodox Theology-Cultural Patrimony. She has also taught in her capacity as an associate Reader at the Faculty of Plastic Arts.

At the Faculty of Biology, she taught and honoured the courses:

- Human Ecology;
- Biology of pest animals;
- Deterioration and reconstruction of ecosystems;
- Environmental bioindicators in collaboration with the colleague Mihai Costică.

By setting up the master section - Conservation of Patrimony Assets at the Faculty of Biology, she has succeeded to give value to the whole accumulated experience for a quarter of a century in the field of patrimony assets. She taught the following subjects at this section:

- The Ethnopathology of the opera of art;
- Conservation of the patrimony assets;
- Animals injurious to patrimony assets.

Guiding numerous dissertations, she succeeded to attract in the activity of conservation of the patrimony assets numerous master students who became specialists and work in this field.

In order to come in the support of the students from the Faculty of Biology, Mrs. Mariana Mustață has provided the course support publishing some university textbooks such as:

- Problems of general and human ecology;
- Kingdoms of living world;
- Biology of animal pests.

Working together with her husband, the university professor Gheorghe Mustață, Mrs. Reader PhD Mariana has succeeded to publish an impressive number of scientific papers (74) and scientific books and university textbooks. It is enough to name some of them:

- Origin, Evolution and Evolutionism;
- *Homo sapiens sapiens* L. Origin and evolution;
- Evolutive and semiotic strategies of life;
- The kingdoms of living world;
- Pest aphids and the complex of parasitoids limiting the populations;
- The role of the parasitoid biocoenoses in keeping the natural balance;
- Homocromy, mimicry and anthropomorphism.

In the domain of conservation of patrimony assets, she has succeeded to attract and guide an impressive number of students and master students who now works in this field. Some of them, namely: Moldovan Georgiana, Moșneagu Mina, Ungurean Bogdan and Axinte Loredana have elaborated their doctoral theses under the leadership of her spous Mustață, achieving works of exceptional scientific value in the field of conservation of patrimony assets. We can appreciate that, at “Alexandru Ioan Cuza” University, there developed a strong academic school dedicated to the conservation of patrimony assets. Without a false modesty, we have to mention that it is the most powerful school in Romania in the field of conservation of patrimony assets.

From the Department of Orthodox Theology, Cultural Patrimony, there are many graduates spread in different countries of the world: Italy, the Netherlands, Greece, France, Canada, USA. They are appreciated for the excellence training in the field of conservation of patrimony assets. Through them, The Romanian School of conservation of the patrimony assets is recognized in many countries of the world.

Although she worked in different institutions (Enterprise of Antibiotics Iași, Institute of Chemical-Pharmaceutical Research, National Museum Complex of Iași, Faculty of Orthodox Theology and Faculty of Biology, University of Arts), Mrs. Reader PhD Mariana Mustață has succeeded to integrate herself harmoniously into these collectives and to carry out a work of a specialist that honours her.

Through her work and kindness she has attracted herself the sympathy and esteem of the colleagues, students and master students she worked with. It remains the exemplary fruitful collaboration that she has performed with her husband, the Professor Gheorghe Mustață, a collaboration that has materialized in numerous scientific papers, university handbooks and scientific treatises.

The moral reward of the didactic and scientific work as an expert in the conservation of the patrimony assets carried on for more than four decades (47 years) is represented by the respect of her colleagues and disciples who will be proven during this beautiful holiday - the retirement.

We wish Mrs. Reader PhD Mariana Mustață good health, peace of mind and the joy of fulfillment.

Many Happy Years!

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PROFESSOR MIRCEA VARVARA ON HIS 80TH ANNIVERSARY



Introduction

After I have lived eight decades of life and specialty, Biology, Ecology, Zoology, Entomology, achievements, feelings, family, sons, grand-daughters, when I have the power to compare, to understand much better, I feel the need to write, and I feel it like it would be the main content of the obligatory stages of life. Why? because, “For every man, life is a school from cradle to grave. All we are, what we do, what we think, produce, acquire and possess, is nothing else but a certain scale on which we climb more and more to reach as high as possible without ever being able to reach the supreme stage” (Comenius, *Didactica Magna*, 1970, apud Pedagogy, 1998).

A great and talented Romanian actor at the age of 93, addressing to his listeners on the occasion of launching of one of his books, said: “Do not speak about you, write about you”! Gustave Flaubert, a great novelist stated that a senior understands more sitting on a chair than a young man standing, because of knowledge, experience, intelligence, work, which distinguishes, differentiates the professionals, the specialists from the large public. Painters realize portraits, but sometimes, a painter realizes his self-portrait. It should be a correlation between how you perceive yourself and how you are perceived by those beyond

you. I do not like at all the extreme contrast. "You are the heaven and the other one the hell".

The objectives of this presentation, subjective in form and objective as facts, are to present the content of the activity till now (2013), synthetically, orderly, systematically according to modern requirements from general to particular, to specific, to concrete.

The stages of life of any individual of the Homo sapiens sapiens species, from that microscopic point, the egg cell, but very valuable in content towards the light stages, training, work, achievements, are: childhood, adolescence, youth, maturity, old age. I believe in the holistic action and influence of factors: hereditary, social, personal. Man is a bio-psycho-social human.

The ordering of information will be held on the following structure: 1. Village, family and childhood, 2. Further studies, 3. Academic work and the fruits thereof, 4. The self-psychological and intellectual profiles, 5. The Place of the Professor Ph.D. Mircea VARVARA in the Gallery of Iasi Biologists. 6. Activity in the retirement years.

1. Village, Family and Childhood

I had the great and unique chance to come into the world of life, light, work, and joys, on the 13th of August, 1932, in a beautiful summer month, in the 20th century.

The village, Dealul Morii in which I spent my childhood was just a growing settlement, today, 2013, is the most beautiful village in the Valley of Berheci, equidistant (60 km) between the towns of Tecuci and Bacău, the today capital of the Bacău County. The well-organised settlement with its attractive buildings and its well-laid out network of roads, nestles in its natural surroundings, with farms and fruit trees and village gardens. Stately limes guard the main highway and perfume with the smell of their blossom the beautiful nights and summer days, attracting the diligent bees and generously offering them their nectar and their pollen, which are miraculously converted into honey, propolis and wax.

I spent my beautiful, healthy childhood in the native village with snow-rich winters, when it began to snow exactly on the 5th of December in each year, in the family, with the brothers and sisters: In the order of years, Stefan, Speranța, Aneta, Maria, Viorel, at present (2013) all alive, the last sister, Maria at the age of 72 years, and the brother Viorel died at the age of 7 years, in August, 1948. Our parents, the mother (Anica), the father (Dumitru) were examples of moral dignity, diligence, honesty and devotion to family, to bring up us healthy. In our family, we have developed ourselves well because of parent's affection and their material efforts to ensure the existence, food, clothing, protection and very important the upbringing. All of us were sent to secondary school, by our parents, with one exception.

The mother was honest to perfection, without vices, energetic, with a very good soul, she loved her children, respecting and understanding them. When, we, the children, were squabbling, calling each other names or pushing each other around, she would tell us: "You should understand each other, love one another, and eat, all of you, from one egg".

She ensured the maintenance of the house-hold, daily food for the 9 family members, the cleaning, and on summer and autumn, she coordinated the work of the field together with her father and our grand-father, Vasile Plugaru, a respected member in our family and in the village, who lived 91 years. He lived with us in our family for 31 years, without our grand-mother, who died in 1947. The father was a handsome, intelligent and determined man, interested in the bringing up of children with a superior understanding in

comparison with the villagers because he was a secretary and notary of the Commune until 1952. During the work he was coming home after six in the evening. Then he worked in the post of accountant in the Dealul Morii village until his retirement.

During the war years, 1940-1944, the father was called up on a military service. He worked in a clerical capacity with a military company. He had a good habit, he was telling us from time to time, stories from the war with a happy ending, or different stories with tragic end.

We have a permanent gratitude for the care, work and devotion manifested by our parents, because, we, the children and young men that were, to benefit from the light of learning, from the light of school.

In the village, I learnt to write on a slate and to read the beloved ABC primer under the guidance of two competent teachers, who both taught two classes simultaneously, each one with alternative activities. On Saturdays, all those four forms were taught together in one class with the pupils sitting three to a bench. A beneficial internal state that manifested all the time was that I liked to go to school, to learn. The mother at home helped me from time to time how to read better, especially in the first primary class.

As a war-time school-leaver from a rural area, when I graduated from primary school in 1945, I had to choose between remaining at home and going on to secondary school. In this, I needed my parents' approval. I liked books and wanted to learn. The mother, confessed to me much later, was insistent with my father that I should follow an academic path. The same happened in due course with the other children, both boys and girls, who all benefitted from being enlightened by an academic education.

The most suitable and appropriate school for what my parents destined me to become was to be found at Bârlad. I did not refuse, having as models my teachers, the notary and the priest. The school was near the famous Normal School of Bârlad whose buildings were destroyed in the final part of the Second World War and never rebuilt.

2. Further, at studies

In 1945, in the month of January, my father entered me to the Normal School, Bârlad, where I attended the courses between 1945 and 1952. It was also still seen the traces of the war. It was not easy! In the beginning, it was the first separation from the family atmosphere, parents, brothers, sisters, so that I hardly supported the period of accommodation period. Then, I learned in a transition period from one social system to another, in building, without textbooks, the lack of proper local school, for the Normal School was destroyed during the war, the drought of 1947, the life of boarding for eight years

In terms of boarding accommodation, but in class, in the activity of school instruction, I learned and absorbed knowledge for 8 years, from teachers who had didactic works at the Normal School at that time. I discovered my pleasure, love and interest for the biological sciences due to the teacher Velicu Vasile, a teacher of Biology who stimulated my interest, pleasure and passion for Zoology, Botany, and Anatomy. I was answering the questions to which those asked were not answering. The colleagues were laughing! Why are you laughing, high? The teacher retorted them. "I found a pupil who knows the three r,s", which for me it was a refreshing feeling, a very important incentive for my future. I learned well, I was appreciated with high marks in all subjects at school, a proof being the Diploma of Merit obtained at the graduation of the Pedagogical School, 1952, but during

the School there missed two main teaching subjects, important for life, Logic and Rhetoric. The Logic, an essential discipline for the correct utilization of thinking and the Rhetoric, a discipline for the correct expression of thinking.

The Pedagogical School meant for me, not only knowledge but also the habituation and training with the difficulties, with work, with discipline, with the community of pupils, with patience and tolerance. I did not quarrel and I did not fight with a colleague! I had a leading position in the youth organization. This indirectly helped me not to start smoking, a dependence that ruins your health and reduces your wages.

In the last years at the School Pedagogical, I developed and cultivated a durable and beneficial friendship with the pupil, colleague and then my devoted friend, Valeriu Zanoschi, until his disappearance from the world of life, in 1996, a model of work, preparation, and dignity. After the graduation of the Faculty of Biology, Iasi, he became a professor at the Agronomic University in Iassy. From the Pedagogical School there remained in my soul the dominant images and the main knowledge taught by teachers, Velicu Vasile and Maxim Iancu. The teacher Velicu, during his years spent at the University of Iasi, was a good friend with that who later became professor, Dean and Academician, Jitariu Petre. The teacher Maxim Iancu impressed me with his mode of thinking and teaching, determination, firmness, his knowledge and advice. He lived lucidly and coherently until the age of 101 years and two months, the flame of his life extinguished on November 14, 2012. In the last nearly 15 years of his life, I have been in a good friendship with him, discussing problems of Philosophy, Religion, Biology, evolution, Geography, social. For example, he was wondering. "Flight pilots have knowledge, equipment for orientation, etc. and the large migratory birds (cranes, storks, etc.) leave and return annually from migration without such equipment" For me, the teacher Maxim was a shining example of revaluation of knowledge, the talent and the years of retirement, writing, "The Ethnogenesis of the Romanian People", at which he has accumulated material for 25 years. The work was published in four editions.

At the graduation of the Pedagogical School, based on qualification awarded, I was recommended for further study in the higher education. Naturally and necessarily, I had to follow at the Faculty of Natural Sciences and Chemistry.

In the autumn of 1953, I remember today too, in an amphitheatre of the "Alexandru Ioan Cuza", over 100 young boys and girls were waiting with excitement, the writing subjects for admission to the Faculty of Natural Sciences-Chemistry. Only two young people seemed complacent about what will follow, I and Valeriu Zanoschi because we were allowed in without entrance examination on the basis of our Merit diplomas from the Pedagogical School.

From 1953 to 1957, there followed for years of intense, tenacious academic study at the courses, practical works, field biological practice with the revaluation of knowledge at exams, 6 for each semester, plus the colloquia. The first exam in the life of student was at the discipline of General Biology, taught and honoured by the Professor Dr. Petre Șuster, an outstanding Professor, close to students, with a less accustomed storage capacity, who died in 1954. From that group, I was the penultimate student and the last one, Valeriu Zanoschi. After he wrote the marks in the student note- books, the professor Peter Șuster made a comment: "Mircea Varvara has known and answered like a Lion and Zanoschi Valeriu like a Para-lion".

In those four years of intense, interesting, pleasant and profound studies, I had the

privilege to be guided by people with many years' didactical experience, at the speciality courses taught by distinguished professors with long apostolate and experience. These included: Mihai Constantineanu who lived 99.6 years, Petre Șuster, Constantin Papp, Academician Olga Necrasov, Petre Jitariu, academician professor, and Matilda Jitariu, the brothers Sergiu and Dumitru Căraușu, Zigman Feider, Filimon Cârdei, Constantin Dobrescu etc. Knowledge from knowledge, professional light from professional light! In July 1957, I passed the State Examination gaining a Diploma of Merit.

3. Academic work and the fruits thereof

“What is written for you, it is put on your forehead”, says a Romanian proverb! I doubt! Work, knowledge, education, chances, and luck determine what you will become and you really are! As a young teacher I taught Biology for one year (1957-1958) at the Theoretical High School in Podul Turcului, in Bacău County.

On the 15th of October 1958, I was appointed as Head of Laboratory at the Faculty of Biology, Geography-Geology Science, later the Faculty of Biology (1990), where I have worked until 2002, when, due to the age of 70 years, I have retired from teaching. I enjoyed and enjoy a very good health because I inherited a good inheritance, I applied the knowledge to cultivate and the maintenance of health, I had and have a balanced and healthy mode of life without to be friend with gods of ephemeral and injurious pleasures (alcohol and tobacco etc.).

On the 12th of October, 1958, I and my wife Elena said “yes” at the Register Office in the little town Podul Turcului, Bacău County, a moment which has meant the beginning of a stable family life, with the ideal of education of the two sons of us, Viorel and Cătălin, who have become the support, pride and family honour, well realized in society, with sound moral characters. Viorel, today, 2013, 54, years old, Professor Ph.D., former Head of Department and Pro-Dean at the “Gh. Asachi” Technical University Iasi, and Cătălin, manager of firm, 44 years now. Since 2011, he has been working and living with his family in the EU capital, Brussels, as an I T. Manager. The first son who said in 1982, “Mother I brought to you a daughter-in-law, beautiful and wise, she will be from now on my warmest gift” was Viorel at the age of 23, and then Cătălin in 2005. Both daughters-in-law, Roxana and Beatrice are doctors. In their families there appeared, to the joy of the grandparents, one grand-daughter: Sorana, who graduated the Faculty of Economic Sciences at the University of Bern, Doctor of Economic Sciences, 2013, at the “Alexandru Ioan Cuza”, Iasi, the second one, Karina, 8 years old (2013), a schoolgirl at the “Jean Monnet” High School, Brussels, a prestigious and specific High School with the teaching language in French and English.

During the activity, academic career, arm in arm with the effort, work, hardships, I have evolved and got over the following steps and academic degrees:

1958-1960 Chief of Laboratory, Faculty of Biology, Iassy;

1960-1966 Teaching Assistant at the Pedagogical Institute of three years, Iassy while also continuing at the Faculty of Biology at Iassy;

1966-1990 Lecturer (Ph.D.) Faculty of Biology, Iassy;

1990-1994 Reader (Ph.D.) Faculty of Biology, Iassy;

1994-2002 Professor (Ph.D.) Faculty of Biology, Iassy;

1972 Doctor of Biology;

2002 Emeritus Professor by the Decision of the Senate of the Alexandru Ioan

Cuza, Iassy, no. 4879, July 2002;

2003 Certificate of inclusion in the first edition of the Book: "The Contemporary Who's Who", edited by the American Biographical Institute, USA;

2004 Diploma of Excellency granted by the Faculty of Biology, University of Iassy, for strengthening, developing and raising the prestige of the Entomological School of the University of Iassy;

2005 Associate Professor (Ph.D.).

In the year 1964, I was admitted to prepare for a higher academic qualification, a Doctorate, within the framework of the "Alexandru Ioan Cuza" University from Iassy. My supervisor was Emeritus Professor Doctor docent, Mihai I. Constantineanu, a well-known and respected entomologist both in Romania and abroad, with the title of the thesis "**Pest insects of the plum tree in Iași County and their natural enemies (entomophagous insects)**".

In a beautiful day, with clear sky and sunshine, December 2, 1972, very emotional for me, I presented the thesis content before the Commission and an audience who occupied all the seats of the B2 amphitheatre of the Faculty of Biology, the great majority, students of the first year to whom I taught the practical works of Invertebrate Zoology.

The Examination Board for the doctorate, a prestigious one, was composed of:

- The President: Professor, Doctor Docent Sergiu Cărăușu.
- The official Reviewers: Professor, Doctor, Docent Constantin Bogoiescu of the University of Bucharest; Professor, Doctor, Docent Mihai Peiu of the Agricultural Institute, Iassy; Reader Dr. Gheorghe Boguleanu of the Agricultural Institute Bucharest, and very nice man, remaining in relationships of respect and friendship till the end of his life.

My thesis of Doctorate represented a study, with multiple ecological features, of the partnership (association, consortium) of the plum tree and its entomocoenosis from the orchards of plum trees in the Moldavian Central Plateau (Iassy County).

The main quantitative results of the thesis regarding the pest-insects / predators / parasites, were cited by Professor Mihai Ionescu, entomologist, Corresponding Member of the Romanian Academy, in a scientific article published in "Science Progresses" no. 4/1973, p. 183-189.

In my professional work, I manifested particular diligence, seriousness and responsibility and worked with perseverance. I had confidence in people and especially in students who listened to my explanations in the practical work and in the courses that I taught, courses that were held both for them and for the teachers who came to prepare for teaching diplomas in the earlier stages of academic education.

Directly or indirectly, I asked my students, and those aspiring to perfection, not to merely scratch on the surface, but that they should dig deep down to the hidden roots, searching for the causes of phenomena and the relationships of things. For many years in the course of my teaching activities, I undertook field work in different ecosystems. The principles of Zoology, Entomology, and Ecology were all applied and thus an important link for the use, application and consolidation of knowledge from laboratories and lecture theatres at one end of the spectrum to the wider world of nature at the other, was created.

The wealth and diversity of my teaching activities, performed with work, dedication and competence, result in from those synthetic as shown in the following:

The course of my normal teaching covered the performance of practical laboratory work with students in 14 subjects. Just a few of those disciplines are here enumerated: Invertebrate Zoology, General Entomology, Agricultural Entomology, Palaeontology, Principles of Ecology, Ecology and the Protection of the Environment, General Ecology.

All these did not have a negative influence of discouragement but, on the contrary, they have had a positive impact. They motivated me in the search for explanations for the links between the processes of adaptation, survival and reproduction of the species.

Another direction of application and revaluation of knowledge and experience was the guidance of biological practice of students from the Faculty of Biology on the zoogeographic territory of our Moldavia over 35 years; then, as a unique and personal activities I led the practice of some groups of students from the faculty who benefited from a privilege, based on their merits, to do the biological practice in Germany (1982, 1987), France (1993), also I guided a group of German students from the University of Jena (1982-1985) who performed practice of Zoology and Ecology in terrestrial and aquatic ecosystems in Romania.

As a teacher and educator, I organized, led and guided the teaching practice of the students at general schools and high schools a number of years to face, discover and realize their aptitudes of future teachers, teachers of Biology in the pre-teaching.

On the scientific line of speciality and methodical, I guided theoretical and mainly practical the elaboration of 83 works of license of the undergraduate, covering various topics of Zoology and especially Ecology in agricultural ecosystems, forest and steppe ecosystems.

Thirty-four teachers of Biology from different communes, cities and schools from on the territory of Moldavia obtained the teaching degree in the pre-teaching as a result of their works elaborated by them and guided by me, putting a special accent on authentic, zoological, ecological material, collected by candidates, on the determination and interpretation of it. The variety of these activities required, first, competence, physical health, a behaviour of stimulating all those who came in contact spiritually and didactically with that who activated all his career at the Faculty of Biology, Iassy.

I was a member of 40 commissions of inspection. I valued the teaching qualities and organizational skills of aspiring Biology teachers, deciding whether they merited to receive a first degree in the teaching of Biology and whether they had duly attended their courses and taken part in discussions; I evaluated and weighed up the results of the candidates and objectively decided whether they had demonstrated the qualities of a good teacher.

There was said long ago, all we have, what we have gained, we carry with us and convey to others too, according to the saying “Light from Light”, from what you've become, have accumulated and you are.

Another important aspect of my didactical activity was the teaching of courses for students enrolled in the courses for Master degree and the teachers come for training courses of the didactical degrees. The activity of transmission of knowledge requires synthesis, clarity, application, examples and the control of boredom of listeners. According to my zodiac, that of Lion, between 22 July and 22 August, and especially of the activity pleasure to work, learn and study, I have manifested good didactic qualities, reflected by those colleagues, teachers, students, well-meaning people whose education allowed them the freedom of words of reflection for the activity of others too.

I drafted and taught whole and part-time courses for 13 Subjects for undergraduate students at level: courses for resident students, and for extra-mural degrees. Also, I supervised courses for Candidates for Master's Degrees, courses, which along the years have required a lot of work and concentration. Thus, I enumerate: Courses of Invertebrate Zoology, General Ecology, Historical Geology and Palaeontology (part-time courses for students) General Ecology, General Ecology and The Protection of the Environment, Principles of Ecology (for the students in full-time education), Pests of Cereals and Technical Plants, The Effects of Pollution on Animal Organisms (Courses for Candidates for M.Sc. Degrees).

For the teachers of Biology in the pre- education in Moldavia (teachers in ordinary, for obtaining the second degree, and training) especially in the quality of Lecturer and Reader, I taught courses of synthesis, cantered on the problems of speciation, evolution, adaptation. For example, The evolution of digestive, respiratory, circulatory, excretory and nervous systems in invertebrate animals. Evolution and adaptation are cardinal, reference problems in Biology.

In view of supporting the students in their specialized training and other biologists I have published alone or in collaboration the manuals:

- Invertebrate Zoology: Manual of Practical Work Vol.1 (1978), Vol. II (1980);
- The Palaeontology of Vertebrates –Handbook of Practical Works (1985);
- A Course of Geology-Stratigraphy and Elements of Palaeontology (1993);
- A Course of Ecology (First Edition 1998, Second Edition 2002);
- Practical Works of Ecology (2001);
- General Biology and Ecology (2001) for students studying from a distance.

As general features, the courses taught and spoken are characterized by synthesis, clarity, explanations, unseen being the intense and prolonged effort to prepare them.

For the long and fruitful didactic and scientific activity, with the energetic effort included, in the limit of my powers and capacities in the fields of Invertebrate Zoology, Entomology and General Ecology, the Senate of the “Alexandru Ioan Cuza” University at the proposal of the “Scientific Council of the Faculty of Biology”, under the leadership of the former Dean, Professor dr. Georghe Mustață, offered me the title of Professor Emeritus, Decision no. 4879, July, 2002, the year of withdrawal from didactic activity, for upper limit of age.

The two main components of the structure of activity in the higher education, didactic activity about 70% and scientific activity 30% expresses the profile, image and intellectual training of any academic.

The Scientific activity of over 48 years has been focused on several directions: personal scientific activity, scientific activity with students, scientific activity with teachers of Biology, scientific activity of specialization, scientific activity of realization of scientific contracts, scientific activity as a participant in symposia, international congresses, activity in doctoral commissions.

Personal scientific activity has evolved and resulted on two directions: the taxonomic direction and ecological direction, modern.

In the ecological direction I have tackled as a priority aspects of the ecology of insects in the zoo-geographical region of Moldavia. For example, I have researched and specified the phenology, the food consumption, the behaviour, the prolificity of the following species in the climactic conditions of Iassy: *Melasoma populi*, *M. tremulae*,

Malacosoma neustria, *Aporia crataegi*, *Lymantria dispar*, *Coccinella septempunctata*, *Neurotoma nemoralis*. On the basis of the wealth of material collected, I specified the complex of parasitoids of the stages of egg, larva, and chrysalis in the species of harmful Lepidoptera (*Aporia crataegi*, *Yponomeuta padellus*, *Euproctis chrysorrhoea*, *Lymantria dispar*, *Malacosoma neustria*) in the ecosystem of the plum tree orchards of Central and Northern Moldavia.

The richest field of activity concerning different ecological aspects, and the one which has resulted in the most published material, has been carried out upon the Carabidae (Coleoptera) family, from the terrestrial, natural and agricultural ecosystems of Moldavia. I specified the diversity, distribution, phenology, dynamics, abundance, dominance, etc. of some species of Carabidae from the forest associations of Querco-Carpinete, Carpino-Fagete, Abieto-Fagete, as well as from natural meadows, apple tree orchards, agricultural crops (winter wheat, maize, potatoes, sugar beet) on the basis of the material collected from different Moldavian localities in the course of many years.

I published over 110 scientific papers, the great majority being drafted in the English language by me. On the basis of the authentic scientific material collected from different ecosystems, I also drafted 62 contracts and scientific grants, for 35 (56%) of which I was the sole author.

In my scientific research, I took a keen interest that my papers should be backed up by a wealth of natural data, and I manifested a particular care in the drafting of papers and in synthesising the presentation of the results in front of the specialists and the biologists.

My scientific research activity was appreciated and I was invited to attend scientific conferences (Symposia and Congresses, and 8 Internationals), where I presented 13 communications: Hungary (1983, 1989, 1991), England (1994), Czech Republic (1998), Switzerland (1999), Austria (2003). At the 5th European Congress on Entomology, York, England” (1994), I participated with two papers which I presented them in the English language. At the Scientific Conference “The 6th European Conference on Entomology” Ceske Budejovice, Czech Republic (1998), I attended with two other presentation papers.

Some of my scientific results are cited in several doctoral theses from Romania, or in papers in other countries abroad (for example, Thiere Hance, 1998), or in specialist scientific journals.

In the line of my scientific work, I made trips abroad for information, specialization, documentation and exchanges of experience, in the course of which the means of communication was mainly in English. We cite: The Institute of Ecology, Warsaw, 1974 and 1991; The Institute of Zoology, Freiburg, 1986 and 1995.

In appreciation of my contribution to the science of Entomology, biologists Traian Ceuca (of Cluj) and Irinel Popescu (of Iassy) have dedicated to my name the following species: *Entomobielzia* (*Moldovobielza*) *varvarai* n. sp. (1985), (Diplopoda) and respectively *Torymus varvarai* (Chalcidoidea, Torymidae, 2005) (Insecta).

On account of my scientific competence I was named by the doctoral Commissions as official reviewer for the analysis and evaluation of the contents of doctoral theses. I was also a member of numerous Commissions for the examination of candidates for the degree of Doctorate.

I was named for merit in scientific research and in academic didactic activity, essential data from my activity and the stages of my life are included in 13 publications of

which five in Romania and eight international. For example in Romania, Who's Who in Romania (2002, p. 697), Nature and the Biological Research in Bukovina (2004, p.180-182). Of those abroad, England, The United States of America, Canada: Who's Who of Intellectuals. Edition 13, 1999, Cambridge, England; Contemporary Who'sWho. American Biographical Institute, 2002-2003, p. 302; The Contemporary Who's Who of Professionals, 2004 USA.

Besides all of this, between the years 1958 and 2004, both as a young man and in more advanced age, I have carried on a rich and varied array of communal and public activities. These consisted of the organization and guidance of the productive practice of students (1970-1978); the organization of the trade-union group (1967-1970); president of the Syndical Section of Biology (1986-1989); vice-president of the Red Cross Commission (1980-1987); member of commissions for analysis of courses, commissions for the promotion of teaching staff (lecturers, readers, professors). Since 1990 I have been a member of the Drafting Committee of the Scientific Annals of the "Alexandru Ioan Cuza" University with the task of verifying the translation of scientific papers into English.

Since 2005 up to the present (2013), I have been a member of the Editorial Board of the Journal for Studies in Natural Sciences, Oltenia.

Some personal features reflect more differentiated the inside of a man. It was my pleasure and induced me a morning-freshness, a good spiritual disposition the fact that I have come on foot to the faculty, days, months, years, decades, almost all career.

I have had difficulties, but also many personal satisfaction from learning of English. The English language has favoured me a broad communication with scientists from abroad, at Congresses, Symposia, and then through letters, Internet and the personal drafting of the scientific results: Learning of English language has been a pleasure of which I have been aware since the age of 13 years. My own regret was that I did not know from the beginning the effective methods of increasing and the possession of the universe of that language.

4. Data on the self-psychological and intellectual profile

I have made myself a synthetic thinking from general to particular; I have a good and well-developed visual memory. I have a normal self-esteem, being preoccupied by the understanding of phenomena with tendencies to Philosophy, Psychology and Pedagogy. I use a manner of speaking with beautiful nuances. I like beautiful under all its forms, especially music. I have formed a malleable, open character, respectful to others and to students, with will, perseverance, always for the better, sensitive in interhuman relationships, patient, silent, tolerant.

I have always struggled to find ways of keeping order. I have liked English and German. I read, speak and write in English. When I need, I translate from Russian and French languages.

I have been devoted to my activity. I am calm, reserved, and prudent. Prudence has protected me from accidents, and other misfortunes. I do not know how many dangers I have avoided during my entire life. I did not have a practical, social, special intelligence. I did not like to be a leader! I did not like to gossip, to discuss about the others. I have been delicate in language with my colleagues, students, those who assess more objectively, with people, in other words, cooperative. I have guided myself according to good principles, humanism, and generosity.

I have been and I am a realistic, serious, reliable, logical man, with a permanent concern for better organization. I have relied on my work, my family and I was stable in feelings, thus achieving a thorough family that has been stable for more than 55 years.

My wife is a hardworking person, a fundamental quality in the household and in profession, intelligent, with a pleasant appearance, courage in action, very resourceful. She has had a prominent role in the growth and household care of the two descendants of ours. They are already mature men, very well realized in society only due to their merits and qualities: Viorel, aged 54 (2013), Professor, former Head of the Department and Vice dean, Cătălin, aged 44, a business manager in Brussels. Both have achieved serious families and have brought us the joy of two daughters-in-law, physicians, endowed physically and intellectually, two grand-daughters, beautiful, intelligent, hardworking, with beautiful characters. They both speak two international languages (English and German, (Sorana, Zurich, Switzerland, PhD. in Economics (2012), French, English, (Carina, Brussels, Belgium) I have cultivated health by natural means: ecological varied nutrition, walking, activity, moderation, natural rest. I have never been in the hospital, with one exception at the age of 74, due to an acute cholecystitis. I have always been confident in the future. I have never been tired with my work!

How have I become a professor?

I was born into a loving children family. By the example of my parents, we were educated to love work, seriousness. Our mother was diligent with a perfect morality and goodness.

My parents gave me a good genetic inheritance without hidden diseases. I have really enjoyed working, I have loved learning. I particularly liked Biology and this was due to the teacher of Biology from the Pedagogical School in Bârlad, who appreciated and always encouraged my results.

It was a pleasure to attend the courses of the Faculty of Natural Sciences and Chemistry, 1953 to 1957. In 1958, October 15, I was employed at the Faculty of Natural Sciences and Chemistry (as it was then called), where I have contributed to the preparation of students over 48 uninterrupted years, without a day of sick leave.

That was the fortune of my life that, after a year of teaching in the pre-university education I was invited to come to the faculty.

The Lion was lucky to me. I have worked, I have had results, I was and I am healthy, but I have had luck too.

The dictum of our family is: All of us, we have shaped our destinies through labour and our qualities in dependence of the favouring circumstances of development conditions and of social environment.

5. The Place of Professor Mircea VARVARA in the Gallery of Iassy Biologists (by Mihai Bejinaru, Teacher, first degree)

Because he has from his very beginnings had the fundamental principles of behaviour of the workers of the sacred Homeland deeply rooted in his personality, both country people and town folk consider him to be one of them.

He has been and remains a biologist, teacher and researcher well-known in Iassy as well as in the whole of Moldavia, for his contribution to the training and perfecting of our pre-teaching staff, and of numerous generations of students, and to the advancement of the study of Biology in our schools.

For amiability, generosity, team-spirit in research, professional altruism and openness to collective activity, he has been liked without reserve as much by his older colleagues and those of the same generation as him, as by a younger generation aspiring to knowledge about nature and its conservation.

Through contracts and scientific grants of practical importance he has travelled beyond the borders of Moldavia, and has had influence, as a research scientist on young researchers in Transylvania, Oltenia, the Barsei Country and the Republic of Moldavia.

For contemporaries and for posterity, Professor Mircea Varvara, is seen as the embodiment of reason and seriousness of expectation. For his intellectual endeavour and prolonged physical efforts, for his lack of self-interest and his kindness in his relationships with people, a well-deserved place of honour has been reserved for him in the rich gallery of Iassy biologists.

This presentation cannot be brought to a close without emphasising the fellowship, the co-operative spirit, the particular understanding of which the relationships with all those who would wish to call him their friend are proof. I myself count myself such a friend and realize the full advantages and the pleasure this friendship has brought me.

At this time of celebration we wish him simply, sincerely, and from the bottom of our hearts as with his past full of work and health, a future still full of joy!

6. Activity in the years as a pensioner

I retired from the professional activity on October 1, 2002, at the age of 70.

Ten years have passed since then. An overseas ironic wondered himself as for others. "What does a pensioner do?" From Monday through Friday, he does nothing, and on Saturday and Sunday he takes a rest"! Another one wrote, "I did nothing yesterday, and today I shall continue what I started yesterday" These statements are false by generalization. Tudor Arghezi, a great poet and writer, said that the country needs young seniors and not old young men.

Retirement has its advantages: the objective time belongs to you entirely. A pensioner may be benefiting from the results of his development and professional accumulations, knowledge, experience, comparisons, wisdom. The big and permanent problem is the state of health. The state of health is a result of the genetic dowry and the investments performed so far. Activity and exercise are at the basis of development, becoming, evolution. Physicians draw our attention that activity, under the physical and intellectual form, is absolutely necessary to maintain the physical condition and to avoid diseases of old age such as Parkinson's, Alzheimer's. A great Romanian actress has begun to improve her learning and communication in English, after she retired.

For me, the retirement has not meant a stage with problems of adaptation to a new lifestyle, with episodes of physical, mental and intellectual discomfort, but the continuation of the scientific activity, activities in the household, trips, etc.

After you "revive" every morning, you have to ask yourself: what shall I do today? One can be asked the same question for a week, a month, or a year. Once you reach the retirement age, the most productive hours are between 9 and 14.

First, every morning, I realize my walk under the form of going on foot in the Tătărași Quarter on the sidewalks nicely paved by the Town Hall of Iassy, for 40 minutes in the fresh air, in spring, summer, autumn, with deep breaths to use more oxygen. This pleasure is a continuation of the habit of coming to faculty on foot, since 1970, when we

moved into an apartment in the Red Bridge Quarter.

The main activity has been carried out on the scientific research. I published (2003-2012) 22 papers: 12 (55%) as a single author, 10 papers (45%) in collaboration. All papers were written in English by the main author and published in the Scientific Annals of the “Alexandru Ioan Cuza” University, 13 papers (59%), Studies and Communications, Natural Sciences, Museum Craiova, 6 papers (29%), Studies and Communication, Museum, Bacău, 2 (9%). Most of these papers are large synthesis with material collected for 10-12 years, from the crops of wheat, maize, potatoes, sugar beet, clover in the zoogeographical region of Moldova. As an example, I mention the following title: The genus *Carabus* (Coleoptera, Carabidae) in the wheat crops of Moldavia.

In the academic year 2004-2005 I taught again the course of Ecology and the practical works.

In the period, 2002-2011, I participated as a member in Commissions of examinations for the PhD title by various candidates in the disciplines of Zoology, Biology, Ecology.

I have made reviews of acceptance of doctoral theses and participated in 5 doctoral committees, as a member, to deliver the doctorate at the Faculty of Biology, Iasi, and Faculty of Agronomy, Timisoara.

I served as a member of the superior Committee for granting the title of Habilitated Doctor for two candidates at the Institute of Zoology and Institute of Plant Protection, Kishinev (2003, 2012).

I have made three reviews for launching the books at the Faculty of Biology since 2005 until now (2013). I have activated as reviewer for reviewing and approving the scientific papers of Zoology, Entomology for their publication in the Scientific Annals of “Alexandru Ioan Cuza” University, Studies and Communications, Natural Sciences, Museum of Oltenia, Craiova, on average 8-12 papers per year.

It is a pleasure for me to mention, it was an honour for me that, in 2008, for 13 days, July 23-August 4, I was an American. I benefited from a very kind invitation of a special friend in North of America, PhD. Lathrop Richard, in the State of Wisconsin, a prestigious Limnologist. I was accompanied up to the north of Superior Lake, a large freshwater sea. On the way to that objective, I saw the traces left on the microrelief by the melting of glaciers in the Quaternary.

Also, in 2008, October 11, we celebrated 50 years of marriage, within the family, at the “Gaudeamus” Restaurant, to which 45 persons attended, most of the family, the sons, the daughters-in-law, granddaughters, brothers, sisters, brothers-in-law, sisters-in-law, great-grandsons, friends, guests.

In 2012, July 21, at the same “Gaudeamus” Restaurant, “Alexandru Ioan Cuza” Iasi, we celebrated eight decades of life, a special anniversary to which 53 people attended, members of the extended family, colleagues of faculty, friends of the family, guests. Two colleagues had the kindness to present their opinions about the activity, behaviour, the influence of that celebrated. It is about Professor PhD. Mustata Gheorghe, member of the Academy of Scientists, Iasi Branch and the Readers PhD. Costică Naela a talented lady, and her husband, Costică Mihai. Their speech content is published as annexes to this material.

It is much better to see once, than to hear speaking several times. And then, in the beautiful years, as pensioners, we made excursions organized by different Agencies to know the physical and geographical conditions, social, and cultural aspects in some

countries and cities from Europe, in the following order: Greece (Athens, the Isle of Corfu), Bulgaria (Albena), Austria (Vienna), Italy (Milan), Spain, Sweden (Stockholm) Finland, the Baltic countries, Turkey (Ankara, Antalya, Istanbul).

Life is understood looking backwards and it is lived looking forward in the future!

Anniversary moment. Professor Dr. Varvara Mircea, at 80 years

The life cycle of a man can be likened to the post-embryonic development of a vertebrate. It can pass through several stages, which cannot be neither skipped nor reversed: Childhood, the years of apprenticeship, the years of professional titration, the probation in the profession (with large accumulations), the stage of biological and professional flowering, the old age and the small years, counted at each end of December from the post-retirement stage. There could be still other stages, but these are essential. Their duration varies from one person to another, not only in terms of accumulated years but the intensity of feelings. I wonder what is more important to our colleague existence: that he was a lecturer during 1966-1990, or that in 1994-2002 period when he functioned as a full Professor? Each stage has its biological and spiritual significance.

The psalmist draws our attention to remember that:

“10. Our years were counted as a cobweb of a spider, the days of our years are seventy years;

11. And if they will be in power eighty years old and what is more than these, fatigue and pain;

12. that our life passes and we will go” (Psalm 89).

Our years are passing and we all will be passing, but it does not matter so much how many years are, but the intensity and the joy with which you live them.

In the prayer of Moses, the man of God, was spoken about the years given to man, but Moses did not meet Mr. Varvara; He did not know what means the maintenance moving and neither the significance of natural medicine, if even he roved in the wilderness for 40 years.

Fifty-four years have passed since I discovered Professor Mircea Varvara. He has appeared at the Department of Zoology of our Faculty in 1958. I was a student in the second year of study. I knew the young teaching staff at the Department of Zoology, so the new Head of Laboratory could not pass unobserved. He was quite full, I could say, plump, and particularly well-mannered. The moon was barely rising, but it was well hidden by the hair cleverly placed. A skill that during the time it has reached to the excellence since it managed to cover with 2-3 turns of hair the equator of the head lighted by the moon. In this year, 2012, my series has celebrated 50 years from the graduation of the faculty. On this occasion, I have discovered the assistant Mircea Varvara in a photo of ours, of group made during the field-trip on the Ceahlău Mountain : In the picture he was like us (similar to us), that is without a tie, without a valise with which he realised the ascension to the “Dochia” Chalet.

Fifty-four years have passed in the life of the octogenarian Mircea Varvara, but they have passed well and with accomplishments in profession and personal life.

Mircea saw the light on the 13th of August, 1932, in the Dealul Morii village, Vultureni Commune, Bacău County. I am from the Adjudu-Vechi Village, I will say that he was born over the Siret River, over the hills that guard the sunrise.

His parents, Anica and Dumitru enjoyed themselves much at the birth of their first

child (especially since he was a boy) who has stepped right in life and opened the door widely to his brother Stefan and sisters Speranța, Aneta, Maria. His grandfather Vasile Plugaru, a true Romanian who became nonagenarian, was also overjoyed. At that time, there were hard times, but not vile times like now (2012).

With regard to human longevity, I, as a biologist, emphasize the lifestyle of the person (not to neglect the lifestyle of Professor Varvara), but what it is given by the hereditary endowment comes from God, as a holy gift. The hills from the Valley of Berheci put their mark on Mircea strongly, especially in the stage of his childhood, representing the country space in which he has begun his existence

During the primary school, he learned in the village. In those times, there were teachers of high quality, true educators, who were honest and honoured both by authorities and the local people and the classes were not structured according to the number of pupils, as today. Nowadays, if in a class there are less than 25-30 pupils, then the class cannot work and the pupils have to go to another village, to walk distances of several kilometres in order to learn at a nearer school. Bad weather conditions do not matter. Just in Harghita and Covasna there are classes with 5-7 pupils, not Romanians, but Hungarians; The Romanians can learn in the Hungarian language too.

Mircea attended the primary schools under the competent guidance of two teachers who were teaching at two classes at once, alternatively, and on Saturday all those four classes were put together.

The pupil Mircea had to greatly esteem the two teachers if he chose to go to the Pedagogical High School. The greatest personalities of the village were the teachers, the priest and the policemen, so it was worthwhile to study hard at a Pedagogical High School to become a teacher. This explains the fact that in the period 1945-1952, Mircea attended the courses of the Normal School in Bârlad, which became the Pedagogical High School, in 1948.

I visited a lot in schools of Moldavia and not only, when I worked at C.I.T.P. (Central Institute for Teaching Perfecting). I arrived too to the Pedagogical High School in Bârlad. At that time, it functioned in the building which was constructed for a military school. I watched a little the history of this High School and I was impressed by the big number of great educators and intellectuals who were formed at this High School. Moreover, in Bârlad, there are two schools that have proven to be truly elite in the Romanian education: The “Gh. Rosca Codreanu” High School and the Pedagogical High School. Here, Mircea had the fortunate to spend his years of apprenticeship, being taught by a pleiad of great teachers who skilfully carved the intellectual and human structure of him. He told me about the teacher Velicu Vasile, whom I have also known, as being a great teacher because he taught me Biology at the Boys High School in the town of Tecuci, and about the teacher Maxim Iancu who was not only a model of what a true teacher means, but he also wrote and published a very valuable book with the title *The Ethnogenesis of the Romanian People*.

Since the entry into the High School, Mircea settled down to work, having near him the good and his dear departed colleague and friend, Valeriu Zanoschi. The native intelligence and love of studying, doubled by a great ambition have made from the child from Dealul Morii village a graduate with a Diplomas of Merit.

Hand in hand with his colleague Valeriu, they knocked at the doors of the Faculty of Natural Sciences-Chemistry at the University of Iași, passing into the stage of

professional titration.

I do not know how others are, but I, like the colleague, Varvara Mircea, always had the cult of personalities and of our teachers. How not to be proud saying, that you had among professors : Mihai Constantineanu, Petre Șuster, Olga Necrasov, Petre and Matilda Jitariu, Constantin Papp, Zigman Feider, the brothers, Sergiu and Dumitru Cărbășu etc.

The accumulations in the profession put the student Mircea Varvara on the top of his colleagues, graduating the Faculty with Diplomas of Merit, 1957.

The years spent at the Faculty drew Mircea near to nature and Philosophy. His entire academic career has been based on scientific knowledge and philosophical interpretation of vital phenomena. I discovered this feature of his personality once we have become colleagues at the Department of Zoology.

The graduate Mircea Varvara returned himself, for a short period of time, in the wonderful landscape of childhood, holding a teaching position not far from the native village, at the Podu-Turcului High School. Here, he has discovered his teaching grace but also the call for research in the field of Entomology .Here, the young teacher has fulfilled in the family life too, marrying to his distinguished wife, Mrs. Elena.

At Podu-Turcului, he did not stay more than a year and after that he was called to the Department of Zoology, at the Professor Feider Zigman and then he has been transferred to Professor Mihail Constantineanu, where he held the post of Head of Laboratory.

The new position has changed his life. He moved to Iași and integrated himself to the academic team. Entering the collective of Professor Mihail Constantineanu, a world-class entomologist, the young lecturer has orientated to entomological research. I am convinced that a decisive influence has had his approaching to the Professor Filimon Cârdei, in the entourage of him, he felt well.

In 1964, the assistant Mircea Varvara becomes a PhD candidate of Professor Mihail Constantineanu, having as a thesis subject “The plum harmful insects from the County of Iasi and their natural enemies (entomophagous insects)”.

Being a close person of the Professor Filimon Cârdei, because of the crisis of teaching norms that was in that time at the Department of Zoology, the young assistant Varvara Mircea followed him to the Pedagogical Institute of three years, Faculty of Natural and Agricultural Sciences, the discipline of Invertebrate Zoology.

Thus, during 1960-1966 he was assistant at this discipline.

In 1972, he presented successfully his doctoral thesis, having in the Commission the following members: Professor Dr. Mihai Peiu, Professor Dr. Constantin Bogoescu and Reader Dr. Gheorghe Boguleanu and as president Professor Sergiu Cărbășu, who was the head of the Department of Zoology.

After the defending of the doctoral thesis he has continued the research on the knowledge of the complexes of entomophages that control the populations of harmful insects such as: *Melasoma populi*, *Malacosoma neustria*, *Aporia crataegi*, *Lymantria dispar*, *Neurotoma nemoralis*, *Yponomeuta padellus*, *Euproctis chrysorrhoea* etc. These researches are considered by him as the research of modern Ecology.

Another direction of research conducted by Professor Dr. Mircea Varvara has been oriented to the complex knowledge of the family Carabidae (diversity, distribution, dynamics, Phenology, Ecology, Ethology and so on). Such research has been carried out in some forest associations (Querco-Carpineti, Carpino-Făgete, Abieto-Făgete), in natural

meadows and in apple orchards, in some agricultural crops (potatoes, sugar beet, maize, wheat) and in other types of ecosystems. The papers of Professor Varvara are models of what it means modern entomological research in biodiversity and Ecology.

The scientific work of Professor Mircea Varvara is concretized in over 110 papers published in prestigious scientific journals in the field. Many scientific papers were presented at international Symposia and Congresses in different countries: Hungary (1983, 1989, 1991), England (1994), Czech Republic (1998), Switzerland (1999), Poland (1998), Austria (2003).

A very important direction is the research stipulated by contracts. He worked in over 60 scientific contracts and grants, at some in the capacity of Director.

In the stage of completion of profession, Professor Mircea Varvara has had a scientific work that honours him and which there will endure over time.

The teaching grace has accompanied him the Professor Mircea Varvara throughout his existence. The teaching grace is a genetic dowry (a sign of Divine endowment), but this has been transposed into phenotype through labour, passion and dedication, blooming and manifesting itself strongly in the academic activity that there were done in all those 47 years served at the University.

Professor Mircea Varvara has honoured 14 disciplines from the successive plans of curriculum, among which: Invertebrate Zoology, Entomology and General Ecology. The lectures of Professor were charged with teaching design, clear, well documented, with scientific information to date, logically structured and attractive. The main disciplines were provided with a printed support (textbooks, workbooks, practical work) which greatly facilitated the activity of students. He was actively involved in the biological practice of students and practical applications in the field, both in the country and abroad (Germany and France).

The teaching grace and the valences of good educator have helped him a lot also in the activity of perfecting of the teachers of Biology and in the teaching inspections (Grade II and Grade I).

If I were to concretize through something the academic teaching activity carried on by the colleague Mircea Varvara, then I should emphasize the intrinsic feature of his personality, that capacity to rise from the practical knowledge to the philosophical interpretation of biological structures and processes. I have used the teaching and scientific experience requesting him as scientific reviewer to some of the books I have published.

I have always admired and even envied the passion and kindness showed in his existence by the colleague, He is the biologist who speaks fluently the English language. Only the native intelligence, the immeasurable will and passion have raised him in the period of his perfection to his academic career.

We must not neglect his social behaviour. I have never seen speaking him on the corners or questioning the competence of any colleague. Always, elegant, cheerful, in good temper, close and well-mannered, he is a model of true academic.

I have always felt him in the middle of his family. It is the Holy Family for which he has spared no energy in the whole of his existence. He has been, is and will be to the end a good family man who knows how to enjoy and worthy feed-back of their loved ones. I have often heard him speaking with pathos, with thanks giving, even with enthusiasm about sons, daughters-in-law, grandchildren and great-grandchildren, the fulfilment of the family life and he has with what to be proud .

Try to ask him something about his sons, Viorel and Cătălin, about his daughters – in-law, Roxana and Beatrice, surely he will open his heart thanking to God, to his parents, to his wife and to the sons for the Holy Family that he wanted. In the presentation written by teacher Mihai Bejenaru about him, he confessed to him like this:

“All my life I have liked to work... I am grateful to chance, fortune, destiny, parents, especially to the work and qualities of my wife and sons, to my temperament that have made me a toiler of the long-distance race, tolerant, submitting to the Empire of Hope”.

I was pleasantly impressed by those declared by Mr. Colleague Mircea Varvara, but I wish to comment on some aspects. Not the incident has left its mark on his entire existence for 80 years, but the soul structure, the education received even from the familiar environment, and indeed the fortunate to be contemporary with great people. Somewhere here, and everywhere, you need to find also the place where to put the good Lord.

The octogenarian around us today cannot go on foot home (but who knows!), But certainly, he will continue his program scrupulously as far as to the passing of the border.

We all are biologists, but few of us know how to join in nature so well as Mr. Colleague Mircea Varvara. He makes it not like a skilled man, but as a man who knows how to capitalize the products of nature and he does it with full conviction, with joy, that he can do it, therefore he obtains truly miraculous results.

He will not take along all accumulations of a lifetime, but he will leave them as a model for his family. If he were to write his memoirs would help many in life

If I want to ask something from God now, I will say something out loud:

Lord God, keep me alive to be able to participate in the celebration of Professor Mircea Varvara at the age of 90 years, and why not? 100 years!

Happy Birthday!

Iasi, 21st of July 2012

Professor Mustață Gheorghe

Faculty of Biology, Alexandru Ioan Cuza University of Iași
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Dear Professor Varvara, dear guests,

We bring today, as a present, to Professor Varvara, a bouquet of beautiful and sincere thoughts sprung from the feelings spread out on a distance of over 25 years since, as students, we had the chance to meet Professor Varvara. Our perceptions settled in time, were crystallized and represented the fundament of one of the most harmonious and stable professional relationship; moreover, our relationship was also based on an excellent communication, respect, trust, discretion and on a rarely-met behavioural elegance. And maybe all the things we have mentioned above cannot describe everything we have observed / learned from appreciated at Professor Varvara; it is a special moment, and we would like the audience to understand that he has transmitted us confidence - when we needed it, hope - when the despair overwhelmed us, ideas, solutions - when we were not able to see too deep at the horizon of our becoming. Not only my English is better because of his warm generosity, but also my health is better because I could benefit from his effective and moral support when I sat on a hospital bed, and my mood is better and it got better when he told me, “you start to be you again, as I used to know you, you start to

regain the light that you had”.

Man must be seen in his integrity and complexity, as he is not a professional robot. There are situations when the moral supports of the professional evolution are of a great fineness. But who has still time to look at these Details. In a time when everything runs at an unimaginable speed, when people are not interested in the way and means, but rather in results, measured in numbers, items, quantity, “kilograms of scientific production”. Who else has time to look to his neighbour, when the egoism, individualism reach unimaginable levels? Here is that the Professor Varvara has had time and patience, generosity and calm, honesty and commitment to communicate, to help people in which theoretically he would not have had reasons to invest. It is a dimension of great nobility, which we want to emphasize and share with the others. And what it would have meant all his achievements if he would have lost his soul, his authentic feeling? He is a complete and fulfilled person, with a successful family and that can be seen on his face: He IS HAPPY, he is serene, he is at peace with himself and with the people, he has no wars with other persons, he is a model of life, a model of autodidact, a model of equilibrium, and who can see these it is free to learn from him. HE is not ostentatious, he does not crush with his authority, he does not bear with him the cult of personality, but he shines discreetly, modestly, wisely for all those who have the eyes of the mind to see and to learn. Gentle counsellor, discrete model, generous moral support - you have helped unselfishly anytime when it was a need. As a good Christian you gave, and now please accept this sincere bunch of thoughts, as a measure of the deep respect and unlimited appreciation that we bear to you.

My children whom you know and about whose development and education, we have often talked, Madam Ursula Dreher (a lady Professor of English at the University of Constantz, Germany) present here and who gives, perhaps, the dimension of your opening towards multilingualism, all of us wish you, from the soul, a long and quiet life, full of joy and content as a measure of your kind, warm, generous and honest soul.

We respect you much and in frequent situations, we have assimilated you as a spiritual father.

Please, forgive our excess of sensibility, but we believe that often it is better to shut up, but now I must speak. Today is the day in which we have to reveal these thoughts because the celebration is special, because Professor Varvara is quite special. After all, we do not know to what Horizons every soul will be traveling, but it must be left clean and beautiful, ennobled by a dignified existence as the one of Professor Varvara.

Iasi, 21st of July 2012

Readers Naela & Mihai Costică
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