Muzeul Olteniei Craiova. *Oltenia. Studii şi comunicări. Ştiinţele Naturii.* Tom. 29, No. 1/2013 ISSN 1454-6914

STRUCTURAL CHARACTERISTICS OF SOIL MITE POPULATIONS (ACARI- MESOSTIGMATA) FROM THE OAK-HORNBEAM FORESTS FROM SOUTHERN ROMANIA

MANU Minodora, ONETE Marilena

Abstract. The paper present the structural modifications of soil mite populations from four forest ecosystems, characterized by the two vegetal associations (*Querco petraeae-Carpinetum* SOÓ et POCS 1957 and *Q. robori-Carpinetum* BORZA 1937), taking into account the distribution of these invertebrates on soil layers (litter-fermentation, humus and soil). In total, 35 species of Mesostigmata were identified, three species being common: *Pachyseius humeralis* (BERLESE 1910)*, Prozercon traegardhi* (HALBERT 1923) and *Veigaia nemorensis* (C. L. KOCH 1836). The analysis of the dominance and constancy indices showed that the eudominant-dominant and euconstant-constant species represented 15.79 %-30 % from the total number of mites. Based on the Jaccard index, the similarities and differences between mite populations from four investigated forest and from all three soil layers were identified.

Keywords: mite, dominance, constancy, similarity, soil.

Rezumat. Caracteristicile structurale ale populaţiilor de acarieni de sol (Acari-Mesostigmata) din stejăreto-cărpinete din sudul României. Lucrarea prezintă modificările structurale ale populaţiilor de acarieni de sol din patru ecosisteme forestiere, caracterizate de două tipuri de asociaţii vegetale (*Querco petraeae-Carpinetum* SOÓ et POCS 1957 şi *Q. robori-Carpinetum* BORZA 1937), ţinând cont de distribuţia acestor nevertebrate pe straturi de sol (litieră-fermentaţie, humus şi sol). În total, 35 mesostigmatide au fost identificate, trei specii fiind comune: *Pachyseius humeralis* (BERLESE 1910)*, Prozercon traegardhi* (HALBERT 1923) şi *Veigaia nemorensis* (C. L. KOCH 1836). Analiza indicilor de dominanţă şi constanţă a arătat că speciile eudominate-dominate şi cele euconstante-constante reprezintă 15,79 % - 30 % din numărul total de acarieni. Bazându-ne pe indicele Jaccard, au fost identificate similarităţile şi diferenţele dintre populaţiile de acarieni din cele patru păduri studiate, dar şi din straturile de sol.

Cuvinte cheie: acarian, dominanţă, constanţă, similaritate, sol.

INTRODUCTION

The edaphic Mesostigmata mites are considered bioindicators for soil quality, especially in forest ecosystems, where they find proper environmental conditions for their development. This characteristic was offered after numerous studies, which demonstrated that any anthropogenic impact determines modifications of the qualitative and quantitative parameters. Being, in their majority predator species, Mesostigmata communities are influenced primarily by the availability of the trophic source and then by the abiotic factors (WALTER & PROCTOR, 2009; SALMANE & BRUMELIS, 2010; BEDANO & RUF, 2010; PEVERIERI et al., 2011). Analysing their ecological requirements it was observed that the mite population structure and dynamics are correlated with biotic and abiotic factors from investigated ecosystems. If we take into consideration one of the biocoenosis components (edaphic invertebrates fauna), the ecological characterization of soil from forest ecosystems can be done with the aid of mites (COJA & BRUCKNER, 2006; GULVIK, 2007; MANOLE et al., 2011).

Studies concerning the soil fauna from deciduous forest ecosystems were also conducted in Romania (Moldova, Romanian Plain, Doftana and Prahova valleys), highlighting the high biodiversity and the characteristic structure of invertebrate populations for each type of investigated areas (CĂLUGĂR & HUŢU, 1999; CIORNET et al., 2003; FALCĂ et al., 2003; HONCIUC & STĂNESCU, 2004; STĂNESCU & HONCIUC, 2004; SANDA et al., 2006a, b; OROMULU-VASILIU et al., 2007-2008; CĂLUGĂR, 2009). However, studies on the structural characteristics of edaphic mite communities from these types of forests (oak and hornbeam) are very few.

If we refer to Europe, ecological studies on the Mesostigmata populations from oak and hornbeam forest have been made in France, Austria, Spain, Slovakia, Poland and Italy (SADAKA & PONGE, 2003; SKORUPSKI, 2003; FENDA & CICEKOVA, 2005; MORANZA, 2006; GWIAZDOWICZ, 2007; NIEPARALA & BLOSZYK, 2009; MADEJ et al., 2011; PEVERIERI et al., 2011).

The aim of the present study is to investigate for the first time the structural characteristics of the Mesostigmata soil populations from four oak-hornbeam forests located in southern Romania, highlighting the similarities and differences between them. The originality of this work is the study of population structures taking into account the distribution of these invertebrates on soil layers (litter-fermentation, humus and soil).

MATERIAL AND METHODS

Study area

The study was made in 2005 in four deciduous forests, characterized by two vegetal associations: *Querco petraeae-Carpinetum* SOÓ et POCS 1957 (QpC), described in ecosystems from Cobia (QpC1), Sărata Monteoru (QpC2) and *Q. robori-Carpinetum* BORZA 1937 (QrC), identified in areas from Călugăreni (QrC1) and Căscioarele (QrC2). All are natural forests from the south part of Romania (Fig. 1).

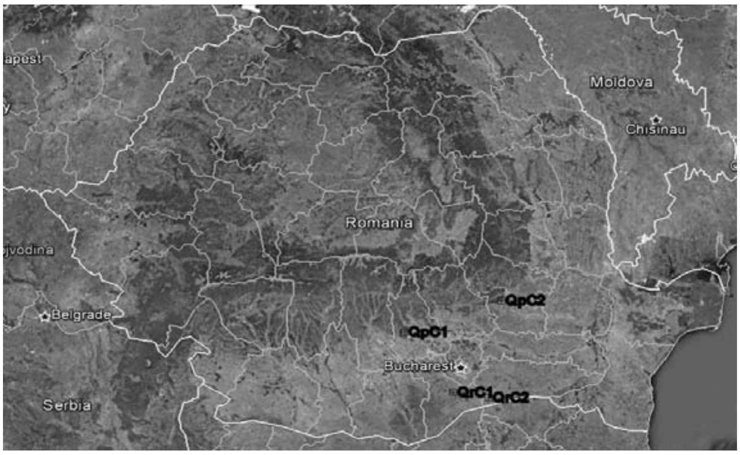

Figure 1. Geographical position of the investigated forest ecosystems {Cobia (QpC1), Sărata Monteoru (QpC2), Călugăreni (QrC1) and Căscioarele (QrC2)} (original).

The geomorphologic characteristics and description of vegetation from the investigated forests are presented below (Table 1) (SANDA et al., 2006a, b).

Table 1. The geomorphological characteristics and description of the vegetation from the investigated forests.

Characteristics	Cobia (QpC1)	Sărata Monteoru (QpC2)	Călugăreni (QrC1)	Căscioarele (QrC2)
Geographical coordinates	N: 44^{0}51’00.15” E: 25^{0}21’17.80”	N: 45^{024}’35.11” E: 25^{0}25’20.07”	N: 45^{0}44’46.84” E: 25^{0}27’22.45”	N: 44^{0}07’41.35” E: 26^{0}27’32.46”
Altitude	447 m	516 m	152 m	127m
Vegetal association	*Querco petraeae-Carpinetum* SOÓ et POCS 1957	*Querco petraeae-Carpinetum* SOÓ et POCS 1957	*Querco robori-Carpinetum* BORZA 1937	*Querco robori-Carpinetum* BORZA 1937
Forest consistency	0.8-0.9	0.8-0.9	0.7-0.8	0.7-0.8
Coverage	75-80%	80-85%	80%	75%
Type of forest	Young forest (35 years) regenerated from offshoots	Mature forest, over 100 years	Mature forest, over 100 years	Mature forest, over 100 years
Dominant tree species	*Quercus petraea, Q. frainetto*	*Quercus petraea, Carpinus betulus, Q. frainetto*	*Quercus robur, Tilia tomentosa, C. betulus*	*Quercus robur, Q. cerris*
Dominant shrub species		*Cornus sanguinea, Carpinus betulus*		*Ligustrum vulgare, Cornus mas*
Dominant herbaceous species	*Carex pilosa, Lathyrus vernus, C. sylvatica*	*Melittis melissophyllum, Tamus communis, Lychnis coronaria*	*Allium ursinum, Lamium galeobdolon, Alliaria petiolata*	*Ranunculus ficaria, Lamium galeobdolon, Alliaria petiolata*
Exposure	S	S	N- NE	N
Slope	15°	30°	10°-15°	10°-15°
Soil	Brown forest soil, medium podzolic	Brown forest soil, medium podzolic	Alluvial soils	Alluvial soils

Soil samples

From each ecosystem 15 samples of soil were collected with MacFadyen corer (5 cm diameter), up to depth of 10 cm. Each soil samples was divided in three subunits, taking into account the soil layers: litter-fermentation (L), humus (S1) and soil (S2). The soil samples were taken three times in one year: in May, July and September. The sampling periods were the same for all ecosystems. The extraction was performed with a modified Berlese-Tullgren extractor, in ethylic alcohol and the mites samples were clarified in lactic acid. The identification of the mites from the Mesostigmata order was made up to the species level, using the latest taxonomic literature. In total, 60 soil samples were analysed, divided in 180 subunits, with 35 species and 136 individuals.

Statistical analysis

After taxonomical identification, the numerical abundance (number of individuals) was the base for the quantification of some structural index as: numerical density (x/sq.m.); dominance (D%); constancy (C%) and Jaccard similarity index (q). The numerical density (x/sq.m.) was calculated using the following formula:

x/sq.m = ($\sum$ no. of individuals/no. of samples) x 1m^2/surface of the soil core

Where: 1 m^2= 10000 cm^2; surface of the soil core = 10 cm^2 (BOTNARIUC & VĂDINEANU, 1982).

The analysis of the results was conducted with the aid of the BioDiversityPro 2.0 program (MCALEECE et al., 1997). Using this program the index Jaccard (q) for mite populations from the four studied forests was calculated:

$q = c / a+b-c$,

In which: a = number of species from ecosystem A; b = number of species from ecosystem B; c = number of common species from ecosystems A and B.

The dominance was calculated using the formula:

$D=100*n/N$

Where: n-number of individuals of one species from one sample; N-total number of individuals of all species from one sample.

The dominance classes for the identified gamasid mites were: eudominant species with dominance over 10% (D5); dominant species with dominance between 5.1 and 10% (D4); subdominant species with dominance between 2.1 and 5% (D3); recedent species with dominance between 1.1 and 2% (D2) and subrecedent species with dominance under 1.1% (D1) (ENGELMANN, 1978).

The constancy was obtained using the formula:

$C=100*pA/P$

Where: pA-number of samples with species A, P-total number of samples.

The mite species were classified in four constancy classes: euconstant species having constancy of 75.1-100% (C4), constant species having constancy of 50.1-75% (C3), accessory species having constancy of 25.1-50% (C2) and accidental species having constancy of 1-25% (C1) (SELVIN & VACCA, 2004).

RESULTS AND DISCUSSIONS

The taxonomical structure of mite communities revealed the presence of 34 species in all investigated forests, with a numerical density of 27.200 ind./sq.m. These species were included in 19 genera and 10 families (Ascidae, Laelapidae, Macrochelidae, Parasitidae, Pachylaelapidae, Rhodacaridae, Trachytidae, Uropodidae, Veigaidae and Zerconidae). The most increased species diversity was recorded in QrC2, followed by the QpC1 and QrC1. The lowest number of species was obtained in QpC2 (Table 2).

Taking account of the soil layers, in litter-fermentation the number of species and the numerical density were the highest, the medium values being recorded in humus and the lowest values in soil layer. The differences between the investigated parameters from the four forests were not so significant, with one exception, the mite communities from QpC2. Due to the more increased slope and to the southern exposure from this area, the litter-fermentation layer, which was thinner and dryer, in comparison with the other forests, does not offer such proper conditions for the development of Mesostigmata, being recorded almost a half from the numerical density obtained in QpC1, QrC1 and QrC2 (Table 2).

Table 2. Some population parameters of Mesostigmata communities from the investigated forests and soil layers.

Population parameters	Cobia (QpC1)	Sărata Monteoru (QpC2)	Călugăreni (QrC1)	Căscioarele (QrC2)	Litter-fermentation (L)	Humus (S1)	Soil (S2)
No. of species	17	13	17	19	26	19	12
No. of ind./sq.m.	7400	3600	6800	9400	15200	8000	4000
No. of eudominant/dominant species	4/3	3/9	2/5	1/3	1/7	2/2	2/1
No. of euconstant/constant species	0/4	0/0	0/4	2/0	3/5	2/1	1/0

These data were similar with those obtained by other specialists from Romania and Europe, where in deciduous forest, characterized by *Quercus* sp. and *Carpinus* sp. there were identified between 15 species and 54 species, the taxonomical spectrum being similar with that from the Romanian forests (CĂLUGĂR & HUŢU, 1999; SADAKA & PONGE, 2003; SKORUPSKI, 2003; FENDA & CICEKOVA, 2005; MORANZA, 2006; MADEJ et al., 2011; PEVERIERI et al., 2011).

Pachyseius humeralis BERLESE 1910 was a common species for all investigated forests and *Prozercon traegardhi* (HALBERT 1923) for all soil layers. *Veigaia nemorensis* (C. L. KOCH 1836) was identified in all studied forests and in all soil layers, as well. These species have a wide ecological plasticity, being predators, in generally. These characteristics allowed them to occur in various microhabitats, being distributed from lowlands (100 m a.s.l) up to mountain areas (1400 m a.s.l) (MASAN & FENDA , 2004; SALMANE INETA & BRUMELIS, 2010; MANU, 2012)

If we take into consideration the dominance, in QpC1 23.53 % from the total number of species are eudominant (*Hypoaspis aculeifer* (G. CANESTRINI 1884)*, Prozercon kochi* SELLNICK 1943*, Prozercon traegardhi* and *Veigaia nemorensis*); 23.53% are dominant and 52.94% are subdominant. *Pergamasus barbarus* (BERLESE 1905) and the eudominant species were classified as euconstant as well, the rest of 76.47% being accidental. In QpC2, only

30.77% are eudominant species (*Leptogamasus tectegynellus* (ATHIAS-HENRIOT 1967), *Pachylaelaps furcifer* OUDEMANS 1902, *Pseudolealaps doderoi* (BERLESE 1910) and *Prozercon fimbriatus* (C. L. KOCH 1839)), 53.85 % are dominant and 15.38% are subdominant. The species *Leptogamasus tectegynellus* and *P. doderoi* accessory, the rest of them being accidental (84.62%) (Table 3).

In QrC1, *Pseudolaelaps doderoi* (BERLESE 1910) and *Trachytes aegrota* (C. L. KOCH 1841) are eudominant, 29.11% from the total number of species being dominant and the rest (58.82% subdominant). If we analyse the constancy, only 17.65% are constant species, 11.76% accessory and 70.69% accidental. In QrC2, *Hypoapsis aculeifer, Pachyseius humeralis* and *Veigaia nemorensis*, represented 15.79% as eudominant species and euconstant as well, 5.26% being dominant and 78.95% subdominant. 26.32% were accessory and 63.16% accidental species (Table 3).

The analysis of the dominance and constancy indices revealed the absence of the recedent-subrecedent species and a high number of accessory and accidental ones. This fact demonstrates the high mobility of these edaphic mites, being capable to looking after food from different microhabitats from forest ecosystems.

Table 3. The dominance (D%) and constancy (C%) of the investigated Mesostigmata populations.

Species	**Cobia (QpC1)**			**Sărata Monteoru (QpC2)**			**Călugăreni (QrC1)**			**Căscioarele (QrC2)**		
	Soil layer	**D%**	**C%**	**Soil layer**	**D%**	**C%**	**Soil layer**	**D%**	**C%**	**Soil layer**	**D%**	**C%**
Family Parasitidae												
Leptogamasus parvulus (BERLESE 1903)	L, S1	5.41	40									
Lysigamasus neoruncatellus SCHWEIZER 1961		2.70	20							L, S1	4.26	20
Lysigamasus sp.	S2	2.70	20									
Leptogamasus tectegynellus (ATHIAS-HENRIOT 1967)				L	11.11	40				L	4.26	40
Leptogamasus parvulus (BERLESE 1903)	L, S1	5.41	40									
Pergamasus barbarus (BERLESE 1905)	L	8.11	60				L	2.94	20			
Pergamasus laetus JUVARA-BALŞ 1970	L	2.70	20				L	8.82	40	L	2.13	20
Pergamasus quisquiliarum (CANESTRINI & CANESTRINI 1882)				S2	5.56	20						
Vulgarogamasus kraepelini BERLESE 1905				L	5.56	20	S1	5.88	20	L	2.13	20
Family Veigaidae												
Veigaia cervus (KRAMER 1876)				L	5.56	20						
Veigaia exigua (BERLESE 1916)	L	2.70	20	L	5.56	20	S1	2.94	20			
Veigaia kochi (TRÄGÅRDH 1901)	L	2.70	20									
Veigaia nemorensis (C. L. KOCH 1836)	L, S1	10.81	60	S2	5.56	20	L, S1	8.82	60	L, S1, S2	21.28	80
Veigaia transisalae (OUDEMANS 1902)										S1	4.26	40
Family Rhodacaridae												
Dendrolaelaps sp.										L	4.26	20
Rhodacarus denticulatus BERLESE 1921							S2	2.94	20			
Family Ascidae												
Asca aphidoides (LINNEAUS 1758)										L	2.13	20
Proctolaelaps pomorum (OUDEMANS 1929)							S1	5.88	20			
Family Macrochelidae												
Macrocheles montanus (C. L. KOCH 1839)							S1	2.94	20	S1	2.13	20
Neopodocinum mrciaki SELLNICK 1968				S2	5.56	20						
Geholaspis longispinosus (KRAMER 1876)	S1	2.70	20				S1	2.94	20			
Family Laelapidae												
Hypoaspis aculeifer (G. CANESTRINI 1884)	L, S1	13.51	60							L, S2	10.64	40
Hypoaspis oblonga (HALBERT 1915)							L	2.94	20			
Pseudolaelaps doderoi (BERLESE 1910)				L, S1	11.11	40	L	11.76	60	L	4.26	40
Family Pachylaelapidae												
Olopachys suecicus SELLNICK 1950				L	5.56	20	L	2.94	20			
Pachylaelaps dubius HIRSCHMANN & KRAUSS 1965	S2	2.70	20									

Pachylaelaps furcifer OUDEMANS 1902				L, S2	11.11	20	L	2.94	20	S1	2.13	20
Pachylaelaps imitans BERLESE 1920							L	2.94	20			
Pachyseius humeralis BERLESE 1910	S1	2.70	20	L	5.56	20	L	8.82	60	L, S1, S2	14.89	80
Family Zerconidae												
Prozercon fimbriatus (C. L. KOCH 1839)	L, S1	8.11	20	L	16.67	20				L, S2	4.26	40
Prozercon kochi SELLNICK 1943	L	10.81	20							S2	2.13	20
Prozercon traegardhi (HALBERT 1923)	L, S1, S2	10.81	60	L	5.56	20						
Zercon fageticola HALASKOVA 1969										L	4.26	20
Zercon peltatus C. L. KOCH 1836	L	2.70	20							S1	2.13	20
Family Trachytidae												
Trachytes aegrota (C. L. KOCH 1841)	L	8.11	40				L, S1	20.59	60	L	6.38	40
Family Uropodidae												
Uropoda sp.							S1	2.94	20	L	2.13	20

Analysing the Jaccard index, we observed the highest similarity for Mesostigmata communities from QrC1, QrC2 and QpC1 ($q_{QrC1\text{-}QrC2}$ = 33.33 %; $q_{QrC2\text{-}QpC1}$ = 33.33 % and $q_{QrC1\text{-}QpC1}$ = 25.92 %). The number of common species between the forest of QpC2 ecosystem and the other three forests was low ($q_{QpC1\text{-}QpC2}$ = 25%; $q_{QpC1\text{-}QpC2}$ = 28%). These results reflected the similarities between environment conditions from QrC1 and QrC2 forests, which are characterized by the same vegetation and abiotic factors (exposure, soil, slope) and by small distance from one to another (about 40 km). On the other hand, some habitat differences from QpC2 forest (high slope by 30^0, south exposure) influence the mite community structures (Fig. 2A).

If we take into consideration the mite distribution on soil layers, for populations from forests characterized by *Querco petraeae-Carpinetum* (QpC) and *Q. robori-Carpinetum* (QrC), there were recorded the highest similarities between litter-fermentation layers ($q_{LQpC\text{-}LQrC}$= 44.44 %) and humus-soil ($q_{S1QpC\text{-}S2QrC}$= 40 %). The lowest values of the Jaccard index were obtained between mite communities from soil layers ($q_{S2QrC\text{-}S2QpC}$= 8.33 %) and litter-fermentation-soil ($q_{LQrC\text{-}S2QpC}$= 8%) (Fig. 2B).

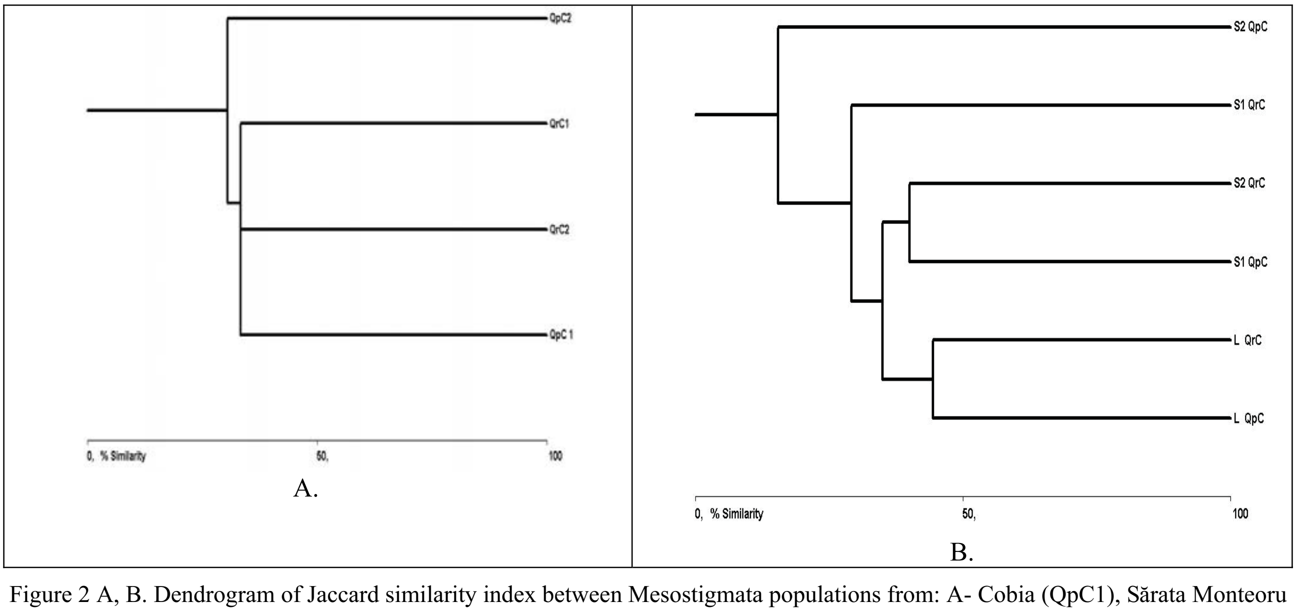

Figure 2 A, B. Dendrogram of Jaccard similarity index between Mesostigmata populations from: A- Cobia (QpC1), Sărata Monteoru (QpC2), Călugăreni (QrC1) and Căscioarele (QrC2) (A) and between Mesostigmata populations from soil layers: B – litter - fermentation (L), humus (S1) and soil (S2).

Many ecological studies revealed that the litter-fermentation layer is the most favourable habitat for Mesostigmata species. Due to the increased humidity and organic matter content, which is the trophic source for other soil invertebrates, the edaphic mites find proper conditions for their development (KOEHLER, 1999; MANU, 2012). This fact was highlighted by the high similarities obtained between mite populations from investigated forest, from the first soil layer.

We assumed that the alluvial soil (which is reach in organic matter) and northern exposure (which determines a high soil humidity) of *Querco robori-Carpinetum* forest created similar habitats for mites on S2 level as those from humus layer S1 (mull or mull-like moder) from *Q. petraeae-Carpinetum,* which have a high level of organic matter especially close to the surface (CHIRIŢĂ, 1974). Some differences in soil mite distribution were recorded between soil layers L, S1 and S2 from each investigated ecosystems. Even the type of vegetation influences the abundance and species diversity of the mite fauna (KOEHLER, 1999; CĂLUGĂR & HUŢU, 1999; FALCĂ et al., 2003; MANOLE et al., 2011; MADEJ et al., 2011).

CONCLUSIONS

Ecological investigations on the structure of Mesostigmata from four oak-hornbeam forest ecosystems from the south part of Romania revealed the presence of 34 species, with a numerical density by 27.200 ind./sq.m. The species number and numerical density had recorded closed values between forests, with one exception: Sărata Monteoru area (QpC2). The increased slope (which determines instability of the soil layers) and southern exposure of the forest (which causes dryness) from this forest, influence the abundance of Mesostigmata mites.

Due to their wide ecological plasticity, some common species were identified: *Pachyseius humeralis* found in all investigated forests and *Prozercon traegardhi* in all soil layers. *Veigaia nemorensis* was identified in all studied forests and in all soil layers, as well. The analysis of the dominance and constancy indices showed on one hand that the eudominant-dominant and euconstant-constant species represented 15.79 % - 30% from the total number of mites. On the other hand, these parameters revealed the absence of the recedent-subrecedent species and the presence of a high number of accessory and accidental ones, which proves the high mobility of these edaphic mites.

Significant similarities between mite communities from Călugăreni (QrC1) and QrC2 (Căscioarele) forests and between mites from soil layers are due to the same vegetation and abiotic factors (especially soil type and exposure). Unfavourable environment conditions (high slope, south exposure) are reflected by the decreased values of Jaccard index obtained between communities from Sărata Monteoru (QpC2), in comparison with the other two forests mentioned above.

ACKNOWLEDGEMENT

This study was funded by project no. RO1567-IBB01/2013 “Researches on the relationship between biodiversity and functions in some ecosystems from the Romanian Carpathians” from the Institute of Biology Bucharest, Romanian Academy. Thanks to anonymous referees for their useful suggestions, constructive comments and publishing advice.

REFERENCES

BEDANO J. & RUF ANDREA. 2010. *Sensitivity of different taxonomic levels of soil Gamasina to land use and anthropogenic disturbances*. Agricultural and Forest Entomology. Royal Entomological Society. Melbourne. **12**: 203-212.

BOTNARIUC N. & VĂDINEANU A. 1982. *Ecologie*. Edit. Didactică şi Pedagogică. Bucureşti. 438 pp.

CĂLUGĂR ADINA & HUŢU MARINA. 1999. *On the gamasid fauna (Acari: Gamasida) from the hardwood forests of Tutova's Hills.* Anuarul Muzeului Naţional al Bucovinei. Suceava. **25**: 47-59.

CĂLUGĂR ADINA, 2009. *A comparative study of the chemical and integrated treatments impact against the defoliating insects on the structure and dynamics of the edaphic mesofauna in two oak forests from North-Eastern Romania*. Annals of Forest Research. Edit. Silvică. Bucureşti. **52**: 19-26.

CHIRIŢĂ C. 1974. *Ecopedologie cu baze de pedologie generală*. Edit. Ceres. Bucureşti. 591 pp.

CIORNEI C., CIUCA L., HANCE T. 2003. *Predator soil fauna with impact on defoliator populations from oak forests of Moldavia*. Analele I.C.A.S. Bucureşti. **46**: 187-196.

ČOJA TAMARA & BRUCKNER A. 2006. *The maturity index applied to soil gamasine mites from five natural forests in Austria*. Applied Soil Ecology. Elsevier. Stuttgard. **34**(1): 1-9.

ENGELMANN H D. 1978. *Zur Dominanzklassifizierung von Bodenarthropoden*. Pedobiologia. Elsevier. Stuttgard. **18** (5/6): 378-380.

FALCĂ M, VASILIU-OROMULU LILIANA, POPESCU A., SANDA V., PAUCĂ-COMĂNESCU MIHAELA, HONCIUC VIORICA, MAICAN SANDA, PURICE DORINA, STĂNESCU MINODORA, ONETE MARILENA, BIŢĂ CLAUDIA, MATEI B. 2003. *The ecosystemic study of some thermophile quercus forests from Romanian Plain.* Proceedings of the Institute of Biology. Bucharest. **5**: 47-60.

FENDA P.& CICEKOVA JANA. 2005. *Soil mites (Acari, Mesostigmata) from oak forests in the Male Karpaty Mts. (W Slovakia).* Ekologia. Elsevier. Stuttgard. **24**(2): 102-112.

GULVIK M. E. 2007. *Mites (Acari) as indicators of soil biodiversity and land use monitoring: a review*. Polish Journal of Ecology. Warszawa. **55**(3): 415-450.

GWIAZDOWICZ D. 2007. *Ascid mites (Acari, Gamasina) from selected forest ecosystems and microhabitats in Poland*. University Augusta Cieszkowskiego. Poznan. 247 pp.

HONCIUC VIORICA & STĂNESCU MINODORA. 2004. *Structure and dynamics of the Acari (Prostigmata, Mesostigmata, Astigmata, Oribatida) in Quercus robur and Querqus pedunculiflora forest from the south of the Romanian field*. Proceedings of the Institute of Biology. Bucharest. **6**: 73-79.

KOEHLER H. H. 1999. *Predatory mites (Gamasina, Mesostigmata).* Agriculture, Ecosystems and Environment. Elsevier. Stuttgard. **74**(1): 395-410.

MADEJ G., BARCZYK GABRIELA, GAWENDA IWONA. 2011. *Importance of microhabitats for preservation of species diversity, on the basis of mesostigmatid mites (Mesostigmata, Arachnida, Acari)*. Polish Journal of Environment Studies. Warszawa. **20**(4): 961-968.

MANOLE T., BANASZAK J., RATYŃSKA HALINA, IONESCU-MĂLĂNCUŞ IRINA, PETRESCU EUGENIA, MĂRGĂRIT GABRIELA. 2011. *The importance of forest islands for invertebrate biodiversity: a case study in Western Poland*. Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa». Bucharest. **54**(1): 263-281.

MANU MINODORA. 2012. *The similarities between predator mite populations (Acari: Gamasina) from some natural forests in Bucegi Massif, Romania*. Biologia, section Zoology. Romanian Academy Publishing House. Bucharest. **67**(2): 390-396.

MASAN P. & FENDA P. 2004. *Zerconid mite's of Slovakia (Acari, Mesostigmata, Zerconidae).* Institute of Zoology. Slovak Academy of Science. Bratislava. 238 pp.

MCALEECE N., LAMBSHEAD P. J .D. & PATERSON G. L. J. 1997. *BioDiversity Pro: Free Statistics Software for Ecology*. The Natural History Museum. London. http://gcmd.nasa.gov/records/NHML Biopro.html (Accessed February 15, 2013).

MORAZA MARIA. 2006. *Efecto de la degradación de un encinar de Quercus rotundifolia en la comunidad de ácaros cryptostigmados y mesostigmados (Acari: Cryptostigmata, Mesostigamata)*. Revista Ibérica de Aracnología. Zaragoza. **13**: 171-182.

NAPIERAŁA AGNIESZKA., BŁOSZYK J., BRUIN J. 2009. *Communities of uropodine mites (Acari: Mesostigmata) in selected oak-hornbeam forests of the Wielkopolska region (Poland).* Experimental and Applied Acarology. Warszawa. **49**(4): 291-303.

PEVERIERI G. S., ROMANO M., PENNACCHIO F., NANNIELLI R., ROVERSI P. F. 2011. *Gamasid soil mites (Arachnida Acari) as indicators of the conservation status of forests*. Redia. London. **94**: 53-58

SADAKA N. & PONGE J. F. 2003. *Soil animal communities in holm oak forests: influence of horizon, altitude and year*. European Journal of Soil Biology. Stuttgard. **39**: 197-207.

SALMANE INETA & BRUMELIS G. 2010. *Species list and habitat preference of mesostigmata mites (Acari, Parasitiformes) in Latvia*. Acarologia. London. **50**(3): 373-394.

SANDA V., VASILIU-OROMULU LILIANA, PAUCĂ-COMĂNESCU MIHAELA, BARABAŞ N., FALCĂ M., HONCIUC VIORICA, MAICAN SANDA, STĂNESCU-MANU MINODORA, ONETE MARILENA, BIŢĂ-NICOLAE CLAUDIA, FIERA CRISTINA, ŞINCU DANIELA, ION MIHAELA. 2006a. *The ecosystemic study of the pedunculate oak (Quercus robur) south part of Romanian plain.* Studii şi comunicări. Complexul Muzeal de Ştiinţe ale Naturii „Ion Borcea" Bacău. **21**: 124-137.

SANDA V., VASILIU-OROMULU LILIANA, PAUCĂ-COMĂNESCU MIHAELA, BARABAŞ N., FALCĂ M., HONCIUC VIORICA, MAICAN SANDA, STĂNESCU-MANU MINODORA, ONETE MARILENA, BIŢĂ-NICOLAE CLAUDIA, FIERA CRISTINA, ŞINCU DANIELA, ION MIHAELA. 2006b. *Structural characteristics of the biocenosis in the sessile oak (Quercus petraea) forest from south Subcarpathians*. Studii şi comunicări. Complexul Muzeal de Ştiinţe ale Naturii „Ion Borcea" Bacău. **21**: 138-151.

SELVIN S. & VACCA A. 2004. *Biostatistics. How it works*. Pearson Education. London. 408 pp.

SKORUPSKI M., RADZIKOWSKI R., CEITEL J. 2003. *Mites (Acari: Mesostigmata) in experimental oak tree stands at the Siemianice forest experimental station*. Acta Silvarum Colendarum Ratio et Industria Lignaria. Poznan University. **2**(2): 91-97.

STĂNESCU MINODORA & HONCIUC VIORICA. 2004. *Structure and dynamics of the edaphic acari (Mesostigmata, Oribatida) in Quercus cerris and Quercus pubescens forest from the south of the Romanian field* . Proceedings of the Institute of Biology. Bucharest. **6**: 149-155.

VASILIU-OROMULU LILIANA, PAUCĂ-COMĂNESCU MIHAELA, ONETE MARILENA, SANDA V., NICOLAE CLAUDIA, ŞTEFĂNUŢ S., ŞINCU DANIELA, HONCIUC V., MANU MINODORA, FALCĂ M., FIERA CRISTINA, PURICE DORINA, MAICAN SANDA, MUNTEANU CRISTINA, ION MIHAELA. 2007-2008. *Ecosystemic differentiation of Quercus petraea and of mixed Quercus petraea and Fagus sylvatica decidous forests from the lower Doftana valley (Prahova county)*. Romanian Journal of Biology - Zoology. Romanian Academy. Bucharest. **52-53**: 79-105.

WALTER D. E. & PROCTOR H. 1999. *Mites-Ecology, Evolution and Behaviour*. UNSW Press. Everbest Printing Hong-Kong. 322 pp.

Manu Minodora, Onete Marilena
Romanian Academy, Institute of Biology, Department of Ecology, Taxonomy and Nature Conservation,
Str. Splaiul Independenţei, No. 296, P.O. Box 56-53, code 0603100 Bucharest, Romania.
E-mail: minodora_stanescu@yahoo.com

Received: March 10, 2013
Accepted: July 7, 2013