Acta entomologica serbica, 2010, 15(1): 129-140 UDC 595.42(498)

RANK CORRELATIONS AT THE LEVEL OF SOIL MITES (ACARI: GAMASIDA; ORIBATIDA) FROM CENTRAL PARKS OF BUCHAREST CITY, ROMANIA

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Abstract

The study of soil mites (Acari: Gamasida; Oribatida) was done in three parks in Bucharest city, Cişmigiu, Unirea and Izvor, achieved by transects situated in the lateral sides (near the roads, boulevards or street), or in the middle of these areas. From 72 identified species of mites, 54 were saprophages-detritophages (Oribatida) and 18 predators (Gamasida). In all the parks 22 common species were identified: 14 oribatids and 8 predators. Spearman rank correlations applied between the number of individuals of the species from each park showed an appropriate concordance (rank correlation = *r'*) between them in Cişmigiu and Unirea parks (*r'* = 0.30; *r'* = 0.12), Cişmigiu and Izvor parks (*r'* = 0.68), in Unirea and Izvor (*r'* = 0.19; *r'* = 0.05) and a non concordance between those from Cişmigiu and Izvor parks (*r'* = - 0.21). Taking into account the correlations among the common decomposer species of the transects from the parks, an appropriate concordance in transects of Cişmigiu and Unirea parks (from *r'* = 0.32 for T_1-T_3, to *r'* = 0.58 for T_2-T_3) and a non concordance in all transects from studied parks (from *r'* = - 0.80 for T_1-T_2 to *r'* = - 0.01 for T_1-T_3) have been recorded. The common predators species have recorded an appropriate concordance in Unirea (*r'* = 0.12 for T_1-T_3) and in Izvor (from *r'* = 0.12 for T_1-T_3, to *r'* = 0.51 for T_2-T_3). The frequency of the common species from these studied parks, which realized multiple possibilities of concordance and fewer possibilities of non concordance, led to the assumption that the soil-vegetation complex of the studied parks have similar characteristics and exercise a positive influence on the presence of the populations of these mites.

KEY WORDS: concordance, non concordance, park, transect, habitat.

Introduction

Mites play an important role in terrestrial ecosystems (KRANTZ, 1978). Some of the microarthropods (Oribatida) are consumers of vegetable matter undecomposed or partly decomposed through microbiota action and through abiotic factors (PETERSEN & LUXTON, 1982, EVANS, 1992). Others are predators and parasites or omniphagous mites (Gamasida) (WALTER & PROCTOR, 1999). Gamasida are the main predators among the soil mesofauna (GILAROV & BREGETOVA, 1977; KARG, 1993). In general, the greatest diversity of mites is in the highly structured organic horizons (litter, fermentation and humus layers) of forests areas and is lower in open areas of fields, meadows, and urban areas (WEIGMANN & STRATIL, 1979; WEIGMANN & KRATZ, 1987; NIEDBALA *et al*., 1990; WEIGMANN, 1995; HONCIUC & STĂNESCU, 2006; MINOR & CIANCIOLO, 2007). In all terrestrial ecosystems they are influenced by such abiotic factors as: temperature, humidity of the soil, precipitation and the contents of the organic matter, having preferences for different types of soil (KEHL & WEIGMANN, 1992; PORZNER & WEIGMANN, 1992; WEIGMANN & JUNG, 1992; RUF, 1998; RUF *et al*., 2000; RUF & BECK, 2005).

Materials and Methods

Study areas and sites are in Bucharest, the capital of Romania, situated in the Romanian Plain at 44°25' N and 26°06' E. It has a surface of 238 km^2, with an altitudinal difference of 55.8 m in the north and 91.5 m in the south. It is crossed by the Dâmboviţa River. Of the total surface 15% is represented by green areas. The studies were done in 2006-2007 in three parks in the central area of the city: Cişmigiu (44°25'56.6" N, 26°05'27.5" E), Unirea (44°25.5'56.6" N; 26°08'09.9" E) and Izvor (44°25'56.4" N, 26°05'27.8" E) (Fig. 1).

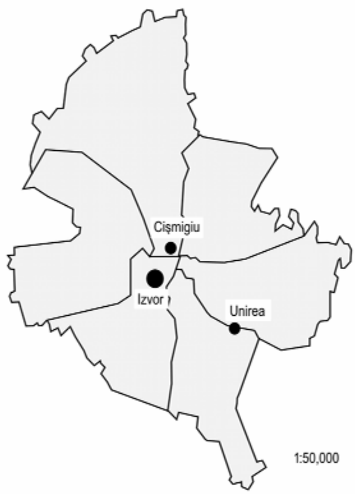

Figure 1. The map of Bucharest city with investigated parks (Cişmigiu, Izvor and Unirea).

During the vegetation period in 2006-2007the oribatid and gamasid soil mites of about 9 transects in urban soils of the chosen parks were studied. The transects were located in each park and included different habitats such as lawns, wooded areas, and herbaceous vegetations. Each park has 3 transects: transects T_1 on the longer side near boulevards, T_2 on the lateral side near roadsides or streets, and T_3 in the middle of the park.

The soil samples were taken with a MacFadyen core to a 10 cm depth on three levels: L - litter, S_1 - humus layer and S_2 - soil layer. The collection of mites from the soil samples was done by the modified Berlese-Tullgren method, in ethylic alcohol, and clarified in lactic acid. The faunistic material was identified on the genus and species level (BALOGH, 1972; GILAROV & BREGETOVA, 1977; BALOGH & MAHUNKA, 1983; KARG, 1993). At the same time as the fauna samples, the relative humidity of the soil was taken. Four samples/month/transect/park were collected. Thus, in each park 48 soil samples were collected per month. After measurements were done an average of the results was taken, representing the values for each studied transect/year (Tab. I).

Table I. The average of the relative humidity (%) of soil in central parks from Bucharest.

Transects	Cişmigiu	Unirea	Izvor
T1	12.62 (SD= ± 1.7)	19.32 (SD= ± 2.7)	6.77 (SD= ± 0.4)
T2	10.78 (SD= ± 0.8)	9.32 (SD= ± 0.7)	8.9 (SD= ± 2.1)
T3	8.83 (SD= ± 1.2)	10.98 (SD= ± 1.5)	10.69 (SD= ± 1.4)

The aim of this paper is to identify the correlations between common species of two mites groups (decomposers and predators) from three parks in Bucharest, taking into account the specific environmental factors (vegetation, the type of soil and relative humidity) of each area.

The parks' vegetation is characterized by the presence of 42 species of trees, 23 species of shrubs, 9 species of lichens and 78 vascular plants. Common species for the transects were identified from all the mentioned vegetation categories (Tab. II).

From 72 identified species of mites, 54 were saprophages-detritophages (Oribatida) and 18 were predators (Gamasida) (HONCIUC & STĂNESCU, 2006). From the total number of mites, common species of oribatids and gamasids from the studied parks were identified. (Tabs. III & IV).

In order to identify the level of connection between the common species, Spearman's rank correlation (r_S), a nonparametric (distribution-free) rank statistics proposed by SPEARMAN in 1904, was used as a measure of the strength of the associations between two variables (LEHMANN & D'ABRERA, 1998). The Spearman rank correlation coefficient can be used to give an *r'* , and is a measure of monotone association that is used when the distribution of the data makes Pearson's correlation coefficient undesirable or misleading:

$$r' = 1 - 6 \sum d^2 / N (N^2 - 1)$$

where *d* is the difference in the statistical rank of corresponding variables, and is an approximation of the exact correlation coefficient computed from the original data. *N* represents the number of ranks.

Table II. Structure of common vegetation in Bucharest parks.

Trees	Lichens	Herbaceous plants	Transects*
Acer pseudoplatanus L.		*Achillea millefolium* L.	CT_2; CT_3; UT_1; UT_3;
Aesculus hippocastanum L.		*Agrostis stolonifera* L.	CT_3; CT_2; IT_3; UT_3
Ailanthus altissima (Miller) Swingle		*Arctium minus*	IT_2; IT_1; UT_3
Catalpa bignonioides Walter	*Hypogymnia physodes*	*Capsella bursa-pastoris* (L.) Medik	UT_1; UT_3
Fraxinus americana L.	*Cladonia concolor*	*Capsella bursa-pastoris* (L.) Medik	UT_1; UT_2; UT_3
Fraxinus excelsior L.	*Parmelia saxatilis*	*Cynodon dactylon* (L.) Pers.	CT_3; UT_1; UT_3
Paulownia tomentosa (Thunb.) Stend.		*Daucus carota* L.	CT_1;
Pinus sylvestris L.		*Erigeron annuus* (L.) Pers.	CT_1; UT_2
Platanus hispanica Miller ex. Muench.	*Hypogymnia physodes*	*Euphorbia cyparissias* L.	CT_3
Quercus rubra L.	*Parmelia saxatilis*	*Geranium pusillum* L.	CT_2; IT_1; IT_2; IT_3; UT_1; UT_2; UT_3
Tilia tomentosa Moench.	*Parmelia saxatilis*	*Malva sylvestris* L.	UT_1; UT_2; UT_3
Ulmus minor Miller		*Plantago lanceolata* L.	CT_2; IT_1; IT_2

* C - Cişmigiu park; U - Unirea park; I - Izvor park; T_1; T_2; T_3 - transects

Table III. Common oribatid species identified in central parks in Bucharest city.

Species	Cişmigiu	Unirea	Izvor
Epilohmannia cylindrica (Berlese, 1904)	+	+	+
Tectocepheus velatus (Michael, 1880)	+	+	+
Tectocepheus sarekensis Trägärdh, 1910	+		+
Suctobelbella acutidens (Forsslund, 1941)	+	+	+
Ramusella insculptum (Paoli, 1908)	+	+	+
Medioppia obsoletum (Paoli, 1908)		+	+
Zygoribatulla excavata Van der Hammen, 1952	+	+	+
Scheloribates laevigatus (C.L.Koch, 1836)	+		+
Protoribates capucinus Berlese, 1908		+	+
Trichoribates novus (Sellnick, 1928)	+		+
Trichoribates trimaculatus (C.L.Koch, 1836)	+	+	+
Punctoribates punctum (C.L.Koch, 1839)	+	+	+
Galumna elimata (C.L.Koch, 1841)	+		+
Galumna obvia (Berlese, 1915)	+		+

Table IV. Gamasid species identified in central parks in Bucharest city.

Species	Cişmigiu	Unirea	Izvor
Parasitus beta Oudemans and Voigts, 1904	+		+
Ameroseius fimetorum Karg, 1971	+	+	+
Amblyseius obtusus C.L.Koch, 1839		+	+
Rhodacarellus silesiacus Willmann, 1936	+	+	
Rhodacarellus perspicuus Halaskova, 1958	+		+
Asca bicornis Caneastrini and Fanzago, 1887		+	+
Pseudolaelaps doderoi Berlese, 1916		+	+
Hypoaspis aculeifer Caneastrini, 1883	+	+	+

Results and Discussion

In all transects from the three studied parks, the relative humidity of the soil was recorded, with low variation in all parks (Tab. I). At the level of the transects the lowest values were registered in Izvor park, and the highest values in Unirea and Cişmigiu parks, all in T_1.

From 54 oribatid mites, 14 species were common to all parks (Tab. III). On the transects level, oribatid had a better representation in Cişmigiu park, with all 14 species being identified in this urban area (Tab. V). In transects from Unirea park 10 common species were identified and in Izvor park, 12 species (Tab. V). Six oribatid species recorded the highest frequency in parks, as well as in transects: *Epilohmannia cylindrica*, *Galumna obvia, Oppiella nova*, *Protoribates monodactylus*, *Punctoribates punctum*, *Ramusella insculptum*, *Scheloribates laevigatus*, *Suctobelbella acutidens*, *Tectocepheus sarekensis*, *Tectocepheus velatus*, *Trichoribates trimaculatus*, *Zygoribatulla terricola*.

Using the Spearman rank correlation (r_s) between the number of individuals (as variables row) of each of the common species belonging to the same order, a concordance was recorded between the oribatid species from the Cişmigiu and Unirea parks (r'=0,30), as well as those from Unirea and Izvor (r'=0,19) and between those from Cişmigiu and Izvor (r'=0,68) (Fig. 2).

Oribatid species had recorded a concordance on the transects level T_1-T_3 (r'=0,32) and T_2-T_3 (r'= 0,58) in Cişmigiu and Unirea park. Non concordance appeared between common species from the transects T_1-T_2, T_1-T_3 and T_2-T_3 (from r'=-0,80 to r'=-0,01 and r'=-0,53) in Unirea park, at the level of transects T_1-T_2 (r'=-0,09) in Cişmigiu park, and on the transects T_1-T_2 (r'=-0,73) in Izvor park (Fig. 3).

From the total of 18 gamasid mites identified in parks, 8 species were common (Table IV). In transects (T_1-T_3) of each area, these common species are distributed as following: 2 gamasids in Cişmigiu park, 4 gamasids in Unirea park and 5 gamasids in Izvor park (Tab. VI). The highest frequency obtained in parks, as well as in transects, belongs to 2 gamasid species: *Ameroseius fimentorum* and *Hypoaspis aculeifer*.

Table V. Common oribatid species identified between transects of each studied park.

Species	Cişmigiu			Unirea			Izvor		
	T1-T2	T1-T3	T2-T3	T1-T2	T1-T3	T2-T3	T1-T2	T1-T3	T2-T3
Epilohmannia cylindrica (Berlese), 1904	+				+		+		
Tectocepheus velatus (Michael), 1880	+	+	+			+		+	
Tectocepheus sarekensis Trägårdh, 1910	+	+	+		+			+	
Oppiella nova (Oudemans, 1902)		+					+	+	+
Ramusella insculptum (Paoly, 1908)	+	+	+				+	+	+
Dissorhina ornata (Oudemans), 1900		+							
Medioppia obsoletum (Paoli), 1908	+							+	
Zygoribatulla excavata Van der Hammen, 1952	+	+	+			+	+	+	+
Scheloribates laevigatus (C.L.Koch, 1836)	+	+	+		+			+	
Protoribates lophotrichus (Berlese, 1904)		+							
Protoribates monodactylus (Haller, 1804)				+	+	+			
Protoribates capucinus Berlese, 1908								+	
Trichoribates trimaculatus (C.L.Koch, 1836)	+	+	+	+	+	+		+	
Ceratozetes minutissimus Willmann, 1951	+			+					
Punctoribates punctum (C.L.Koch, 1839)	+	+	+	+	+	+	+	+	+
Galumna obvia (Berlese, 1915)		+					+	+	+
Anachypteria deficiens Grandjan, 1932					+				

Table VI. Common gamasid species identified between transects of each studied park.

Species		Cişmigiu		Unirea		Izvor
	T_1-T_3	T_2-T_3	T_2-T_3	T_1-T_3	T_1-T_2	T_1-T_3
Ameroseius fimentorum Karg, 1971			+	+	+	+
Amblyseius obtusus C.L.Koch, 1839			+		+	+
Rhodacarellus perspicuus Halaskova, 1958	+					+
Asca bicornis Caneastrini and Fanzago, 1887				+	+	
Hypoaspis aculeifer Caneastrini, 1883		+		+	+	

The rank correlation (r_S) between the number of individuals of each of the common species of predator mites showed a concordance in Cişmigiu and Unirea parks (r'=0,12) and in Unirea and Izvor parks (r'=0.05). On the other hand, a non-concordance was recorded between common gamasids from Cişmigiu and Izvor parks (r'=-0.20) (Fig. 2).

On the transects levels, gamasid species recorded a concordance on T_1-T_3 (*r'*=0.12) in Unirea and Izvor parks, in T_2-T_3 and T_1-T_2 (*r'*= 0.12; *r'*=0.50) in Izvor park (Fig. 4).

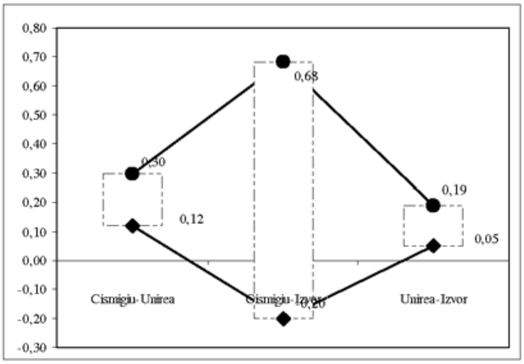

Figure 2. Spearman rank correlations (*r'*) between common mite species from the parks of Bucharest city (♦ - rank correlation between mesostigmatid species, ● – rank correlation between oribatid species).

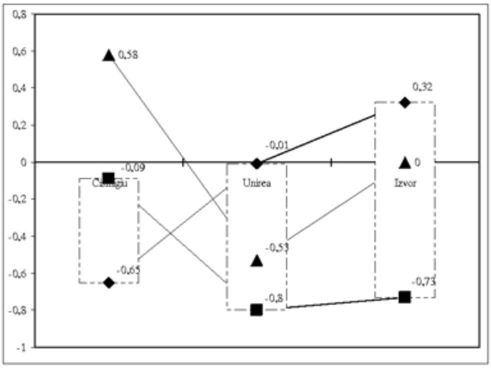

Figure 3. Spearman rank correlations (*r'*) between common oribatid species from the transects from Cişmigiu, Izvor and Unirea parks (■ - T_1-T_2, ▲ - T_1-T_3 , ♦ - T_2-T_3).

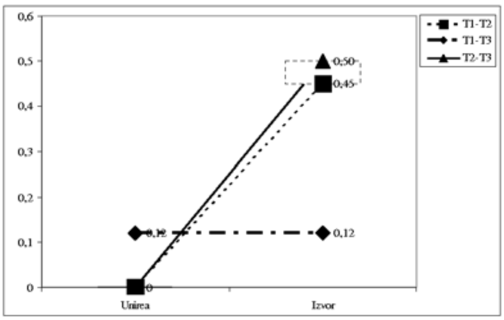

Figure 4. Spearman rank correlations (*r'*) between common mesostigmatid species from the transects from Unirea and Izvor parks (■ - T_1-T_2, ♦ - T_1-T_3 , ▲ - T_2-T_3).

In a terrestrial ecosystem oribatid mites contribute to the decomposition of the vegetal matter, which is partially destroyed and cut into very small pieces, making in this way new attack surfaces for fungi. The microorganisms' activity is easily due to these oribatids, the vegetal rests being partially decomposed and mineralized. The humus formations of the vegetative rests begin in the digestive apparatus of the soil invertebrates, the most important besides lumbricids being oribatid mites (PETERSEN & LUXTON, 1982; EVANS, 1992). Besides the oribatid the gamasids are various predators of other microarthropods, nematodes, enchytraeids, insect larvae, and eggs. Their specific meaning within an ecological framework is their function as top predators in the mesotrophic system. Gamasida do not change soil structure or plant productivity directly. However, as predators, they influence population growth of other organisms and thereby have an indirect effect on overall ecosystem performance. The multiple interactions with their prey are rather diverse, not only with respect to their food, but also with respect to the soil profile and the patchiness of habitat (KOEHLER, 1999). Both groups participate in the three main energy flow pathways in the soil: the primary production, fungal, and bacterial energy channel (RUF & BECK, 2005).

Knowing the importance of these microarthropods in the structure and dynamics of the stable terrestrial ecosystems (natural), our research is trying to highlight the situation on the other types of ecosystems (anthropical), especially in urban areas. In this way, the results of the research concerning the structure and dynamics of these populations in parks and urban areas in Central Europe (WEIGMANN & KRATZ, 1987; NIEDBALA *et al.*, 1990; WEIGMANN, 1995; HONCIUC & STĂNESCU, 2006) is disseminated. In general, in these sites the oribatid mites were represented by a small group of species, like those signaled in different areas in meadows (lawn species) from parks of Warsaw, *Suctobelbella* sp., *Liebstadia similis*, *Scheloribates laevigatus* and *Trichoribates novus* or species such as *Scutovertex sculptus*, *Pilogalumna alifera*, *Pilogalumna tenuiclava* from zones with herbaceous perennial vegetation from parks in Berlin. The dominant gamasid mites identified in urban areas are represented by the species common in terrestrial temperate ecosystems such as: *Veigaia nemorensis, Rhodacarellus silesiacus, Rhodacarellus perspicuus, Asca bicornis, Pachylaelaps furcifer, Hypoaspis aculeifer* (HONCIUC & STĂNESCU, 2006).

In parks in Bucharest the oribatid mites are represented by different species that were mentioned above and are divided into two groups: the first one formed from species signaled in litter from the zones of parks with rich herbaceous vegetation: *Epilohmannia cylindrica*, *Tectocepheus velatus*, *Tectocepheus sarekensis*, *Punctoribates punctum*, *Zygoribatulla terricola*, *Trichoribates trimaculatus*, *Galumna obvia*; and the second one formed from species characteristic of litter of trees: *Ramusella insculptum*, *Oppiella nova*, *Scheloribates laevigatus*, *Protoribates lophotrichus*.

Most of the species common in the parks were included in the formation of these groups; in addition the sandy soil structure, the humidity and vegetation had an important role. The decreased values of the humidities from the studied parks (from 8.9% in Izvor to 19.32% in Unirea) which are in correlation with the soil structure and characterized by aridity and sandy structure determined a feature of xerophity in all studied areas. This character determined the habitat of the greatest number of oribatid species from the first group who tolerated arid sites (meadows, agroecosystems characterisated by soil with less organic matter).

By applying the Spearman correlation index to the common species from the parks the index which indicated the similarity and dependance between vegetation and the acari mites presence was established. On the other hand, the constancy of the decreased humidities recorded in parks was determined by the practice used in their care (working of soil, the irrigation of vegetation, partial introduction of new types of soils), phenomena which determined the appearance of the oribatids from the second group, characteristic of the forests. Correlated with the vegetation, the positive values of the Spearman index recorded on oribatids common to the Cişmigiu-Unirea and Unirea-Izvor parks connected closely to values of the humidities. In these parks the soil humidity is increased more in Unirea and Cişmigiu than Izvor. Besides this abiotic factor, the presence of the same species of trees and herbaceous vegetation determined a connection with the appearance of the same species of oribatids, since these found the same microhabitats for their development. Study of oribatids showed that the positive values recorded on the transects are determined by the presence of the common species. Distribution of the common species (Tab. IV) at the transects level was weaker, a phenomen highlighted by the increased number of negative values of the correlation index. Only on the transects T_2-T_3 in Cişmigiu Park and T_1-T_3 in Izvor Park were positive values recorded, induced by the localization of transects in areas from parks with similar structure and vegetation. On the lateral transects (T_2 -T_3), the minimum values recorded were due to the influence specifically of the stationary factors, being near the streets and boulevards.

Population development of gamasida is very much influenced by the microclimate, which depends on the structure of the herbaceous plants, shrubs or trees and on the litter layer. (KOEHLER, 1999). Due to its small dimensions, the gamasids can easily adapt to the unfavorable conditions (such as the recorded decreased soil humidities from the urban areas, in comparison with those from forestry ecosystems). This adaptation determined the identification of the common species mentioned in all three parks (Table III). These are sylvicolous and praticolous species. The obtained values of Spearman index demonstrated that the vegetation and the soil humidity (most increased in Unirea park due to the irrigations, as well as in Cişmigiu) had a positive influence on common gamasid species from Cişmigiu - Unirea and Unirea - Izvor parks.
From another point of view, the common vegetative structure of all the parks (with similar structure of the herbaceous and litter layers) created conditions for the appearance of other groups of invertebrates (immature oribatids, nematodes, enchytreids, springtails), which represent food to the predatory gamasids (KOEHLER, 1999; WALTER & PROCTOR, 1999). Depending on the vegetation and humidity, the common species at the level of the transects (T_1; T_2; T_3) had a better representation in Izvor and Unirea parks. Although the humidity differences are greater between Izvor and Unirea parks than between Izvor and Cişmigiu parks, the similarity of the vegetation (poorly developed) of the two urban areas mentioned above created conditions for development of common gamasid populations.

The majority of identified mites species are characteristic of praticolous and sylvicolous ecosystems, signaled in many ecosystems from Romania (HONCIUC & STĂNESCU, 2000, 2002, 2004, 2005; STĂNESCU & JUVARA BALŞ, 2005), their presence being correlated with the structure of the soil and vegetation of the studied park.

Conclusions

The concordances obtained between a few common species of gamasid and more oribatid mites species identified in soil from Cişmigiu-Unirea and Unirea-Izvor parks showed that the pedological and vegetal structures are the same and created a favorable habitat for the development of these mites. In all parks, at the levels of the lateral transects, the types of vegetation and soil determined modifications of the specific structure of the mite's populations, showing that on this level they were not a common species. This fact explains the absence of the rank correlations.

Taking into account the frequency of the possibilities of the concordance and the non concordance realised by gamasid and oribatid species, it can be said that the specific structure of the mite's populations was the same and was positively influenced by the complex soil-vegetation-abiotical factors specified for each studied park.

Acknowledgements

This study was possible thanks to the LIFE AIR-AWARE project: AIR Pollution ImpAct Surveillance and WArning System for URban Environment; a project financed by the European Community, 2006-2008, developed at the Institute of Biology of the Romanian Academy; Department of Taxonomy, Ecology and Nature Conservation.

References

BALOGH, J.,1972. The oribatids genera of the world. Akadémiai Kiado, Budapest, 188 pp.

BALOGH, J. & MAHUNKA, S., 1983. The soil mites of the world.1. Primitive oribatids of the palearctic region. Akadémiai Kiado. Budapest, 372 pp.

EVANS, G.O., 1992. Principles of Acarology.C A B International Wallingford Oxon OX10 8DE UK, 576 pp.

GILAROV, M.S. & BREGETOVA, N.G., 1977. Opredelitiel obitayushchikh v pochve kleshchei Mesostigmata. Nauka, Leningrad, 226 pp. [in Russian]

HONCIUC, V. & STĂNESCU, M., 2000. Numerical structure of the mites communities (Arachnida – Acari) in the spoilt areas from Ţarcu – Godeanu Massif . Proceeding of the Institute of Biology, Romanian Academy, 4: 63-76.

HONCIUC, V. & STĂNESCU, M., 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, Romanian Academy, 6: 73-79.

HONCIUC, V. & STĂNESCU, M., 2005. Numerical structure of edaphice mite communities (Arácnida, Acari) from the forests of *Alnus glutinosa* from Romanian field. Proceedings of the Institute of Biology, Romanian Academy, 7: 49-57.

HONCIUC, V. & STĂNESCU MANU, M., 2006. Mites (Acari: Mesostigmata, Oribatida) as bioindicators for pollution in central parks from Bucharest. Environmental Geochemistry and Health (special volume) (in press).

KARG, W., 1993. Acari (Acarina), Milben Parasitiformes (Anactinochaeta) Cohors Gamasina Leach, 59:1-513.

KEHL, C. & WEIGMANN, G., 1992. Die Hornmilbenzonosen (Acari: Oribatida) an Apfelbaumen im Stadtgebiet von Berlin als Bioindikatoren fur die Luftqualitat. Zoologische Beitrage Naturwissenschaftlichen Fakultät, 34(2): 261-273.

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

KRANTZ, G.W., 1978. A Manual of Acarology. Published by OSU Book Stores, Inc. Corvallis, Oregon, 509 pp.

LEHMANN, E.L. & D'ABRERA, H.J.M., 1998. Nonparametrics: Statistical Methods Based on Ranks, rev. ed. Englewood Cliffs, NJ: Prentice-Hall, pp.: 292 – 323.

MINOR, M.A. & CIANCIOLO, J.M., 2007. Diversity of soil mites (Acari: Oribatida, Mesostigmata) along a gradient of use types in New York. Applied Soil Ecology, 35: 140-153.

NIEDBALA, W., BLOSZYK, J., KALISZEWSKI, M., KAZMIERSKI, A. & OLSZANOWSKI, Z., 1990. Structure of soil mite (Acari) communities in urban green of Warsaw. Fragmenta Faunistica, 33: 22-43.

PETERSEN, H. & LUXTON, M.,1982. A comparative analysis of soil fauna populations and their role in decomposition processes. Quantitative ecology of microfungi and animals in soil and litter. Oikos, 39(3): 287-376.

PORZNER, A. & WEIGMANN, G., 1992. Die Hornmilbenfauna (Acari, Oribatida) an Eichen-stänmen in einem Gradienten von Autoabgas-Immissionen. Zoologische Beitrage Naturwissenschaftlichen Fakultät, 34(2): 249-260.

RUF, A., 1998. A maturity index for predatory soil mites (Mesostigmata: Gamasina) as an indicator of environmental impacts of pollution on forest soils. Applied Soil Ecology, 9(1-3): 447-452.

RUF, A. & BECK, L., 2005. The use of predatory soil mites in ecological soil classification and assessment concepts, with perspectives for oribatid mites. Ecotoxicology and Environment Safety, 62(2): 290-299.

RUF, A., BECK, L., ROMBKE, J. & SPELDA, J., 2000. Assessing biological soil quality by a site specific soil fauna community. Ber.nat.-med.Verein Innsbruck, 87: 365-379.

SPEARMAN, C., 1904. The proof and measurement of association between two things. American Journal of Psychology, 15: 72-101.

STĂNESCU, M. & JUVARA BALŞ, I., 2005. Biogeographical distribution of Gamasina mites from Romania (Acari-Mesostigmata). Revue Roum Biol., 50(1-2): 57-74.

WALTER, D.E. & PROCTOR, H.C., 1999. Mites – Ecology, Evolution and Behavior. University of New South Wales Press, printed by Everbest Printing Hong-Kong, pp.: 270-291.

WEIGMANN, G. & STRATIL, H., 1979. Okologisches Gutachten uber die Auswirkungen von Bau und Betrieb der BAB Berlin (West) auf den Großen Tiergarten. Senator fur Bau- und Wohnungswesen, 1: 54-71.

WEIGMANN, G. & JUNG, E., 1992. Die Hornmilben (Acari: Oribatida) an Straßenbaumen in Stadtzonen unterschiedlicher Luftbelastung in Berlin. Zool. Beitr. N. F., 34(2): 273-289.

WEIGMANN, G.,1995. Zur Bedeutung von Hemerobie und Habitatstruktur für Hornmilben (Acari, Oribatida) in Stadtparks und Ruderalflächen. Schr.-R.f.Vegetationskde., Sukopp-Festschrift, 27: 223-230.

WEIGMANN, G. & KRATZ, W., 1987. Oribatid mites in urban zones of West Berlin. Biology and Fertility of Soils, 3: 81-84.

КОРЕЛАЦИЈЕ РАНГА НА НИВОУ ЗЕМЉИШНИХ ГРИЊА (ACARI: GAMASIDA; ORIBATIDA) У ЦЕНТРАЛНИМ ПАРКОВИМА БУКУРЕШТА, РУМУНИЈА

МИНОДОРА МАНУ и ВИОРИКА ХОНЋУК

Извод

Истраживње земљишних гриња (Acari: Gamasida; Oribatida) вршено је у три парка у Букурешту. Од 72 идентификоване врсте гриња, 54 су биле сапрофаги - детритофаги (Oribatida), а 18 предатори (Gamasida). У истраживаним парковима су забележене 22 заједничке врсте: 14 орибатида и 8 предатора. Спирменова израчунавања корелације ранга примењена су на већи број примерака разних врста у сваком парку. Резултати су показали да постоји одговарајућа корелација између примерака у парковима Кишмиђу и Униреа (*r'* = 0,297; *r'* = 0,125) и између примерака у парковима Униреа и Извор (*r'* = 0,188; *r'* = 0,05), али не постоји конкорданција између примерака у парковима Кишмиђу и Извор (*r'* = - 2,159; *r'* = - 0,212). Ако се рачунају корелације честих врста декомпозитора у трансектима паркова, забележена је одговарајућа конкорданција код трансекта у парковима Кишмиђу и Униреа (од *r'* = 0,317 за T_1-T_3, до *r'* = 0,576 за T_2-T_3), док је недостатак конкорданције постојао у свим трансектима у истраживаним парковима (од *r'* = - 0,8 za T_1-T_2 до *r'* = - 0,005 за T_1-T_3). Код честих врста предатора, одговарајућа конкорданција је забелеђена у парковима Униреа (*r'* = 0,125 за T_1-T_3) и Извор (од *r'* = 0,125 za T_1-T_3, до *r'* = 0,511 за T_2-T_3). Учесталост налажења честих врста у истраживаним парковима укључује бројне случајеве конкорданције и мањи број случајева недостатка конкорданције, па је закључено да комбинација земљишта и вегетације има сличне особине у свим истраживаним парковима и да позитивно утиче на појаву популација ових гриња.

Received December 16th, 2009
Accepted May 25th, 2010