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PREDATORY MITES (ACARI: MESOSTIGMATA-GAMASINA) FROM SOIL OF SOME SPOILT AREAS FROM RETEZAT AND TARCU-PETREANU MOUNTAINS

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ABSTRACT. The paper presents the taxonomical and numerical structure of the gamasid populations from four spoilt areas from Retezat and Tarcu-Petreanu mountains. Eighteen species were identified, belonging to 14 genera and 9 families. Species *Cheroseius borealis* and *Hypospis aculeifer* were dominant and present in all studied surfaces. The mite populations had structural and dynamical differences, caused by the various environmental conditions (like vegetation, soil humidity and pH). To evidence these modifications were analysed the following statistical parameters: number of species, numerical density, relative abundance, dominance, constancy. Comparative with predator mite populations from the natural ecosystems, the values of these parameters obtained for gamasids from the spolit areas were very low. It shows that in anthropized ecosystems the influence of the specifically biotic and abiotic factors on the mite populations was significant.

Keywords: spoilt area, mite, population, dominance, constancy

INTRODUCTION

Due to the social-economical development, the anthropical impact on the different type of ecosystems is bigger and bigger. The human interventions on the environment appeared on different levels of the hierarchy of biological systems. Sometimes the negative effects on the species and populations levels (as soil fauna) are less visible.

The importance of a rich soil mesofauna for ecosystem functions has been documented in many publications on faunal-microfloral interactions and nutrient cycling. Not only food web and nutrient cycling, but also the structural aspects of soil are positively influenced by these small animals. The abundance and the diversity of the soil mesofauna is influenced by the above-ground structure of the vegetation. The effects are indirect by providing a favorable microclimate for the development of soil fauna, by influencing their food, e.g. microflora, and by increasing vertical and horizontal patchiness and habitat diversity (Koehler, 1997; Dunger et al., 2001).

One of the most important soil invertebrates in the structure and functions of the terrestrial ecosystems are mites. Among the mites, predatory Gamasina are a group which has an important controlling function and which may be used for indication of soil quality and anthropogenic impact. Gamasina do not change soil structure or plant productivity directly. However, as predators, they influence population growth of other organisms and through this have an indirect effect on overall ecosystem performance (Koehler, 1997).

MATERIALS AND METHODS

The research was made in 2005-2006, in three waste spoilt areas in Retezat Mountains (Birlii, Riusor, Nucsoara) and in one in Tarcu-Petreanu Mountains (Ciurila). These areas, which resulted from digging the water adduction galleries to the dam lake on Raul Mare, are situated at an altitude of 1000 m to 1400 m. The materials composing the spoils consist of crystalline rock fragments of variable dimensions (diameter ranging from 2 cm to 50 cm). The finer elements (sand and dust) are extremely few and no soil was artificially added to these spoilt areas. Therefore, the substrate has a rough and over-rough texture, which can be assimilated to the naturally stabilized mountain detritus (Pauca-Comanescu and Negrean, 2003).

Birlii spoilt area is one of the most active and is situated on a surface with an inclination of 15°-20°, with a thin layer of soil. Vegetation is represented by the: woody species (*Betula pendula*, *Picea abies*, *Rubus idaeus*-22%), hemicryptophytic species (50%), ruderals and grassy species (28%). Characteristic for this spoilt area are ombrophilous species: *Myosotis sylvatica*, *Chrysosplenium alternifollum*, *Impatiens noli-tangere*, *Laserpitium archangelica*. The vegetation had a constant evolution, except for woody species which growths in every year.

Riusor is an active spoilt area, situated on a surface with an inclination of 15°-20°, partially covered with soil. Vegetation is represented by the: woody species (*Betula pendula*, *Picea abies*, *Rubus idaeus*-20%), herbaceous species (characteristic for the forest cuttings, the wet weeds and for the meadows). The evolution of the vegetation is characteristic for he first stage of ecological succesion, with a slow process of reconstruction.

Ciurila spoilt area is a stable surface, without any anthropical activity, formed by a stable soil stratum. Vegetation is represented by: woody species (*Abies alba*, *Fagus sylvatica*, *Picea abies*, *Bettula pendula*, *Corylus avellana*, *Populus tremula*, *Rubus idaeus*,

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Salix caprea, Pinus sylvestris (40%); hemycriptophytic species (12%); phanerophytic species (9%). There are present species with high biomass: *Deschampsia caespitosa, Dryopteris filix-mas, Petasites albus, Tussilago farfara* (25%). Species from the meadows are in proportion of 15%. This spoilt area is in a process of ecological rehabilitation.

Nucşoara is an active spoilt area, situated on a big slope by 30°-35°, which limits the stabilization of the vegetation on the mineral substratum. Vegetation is characterized by the: woody species (*Betula pendula, Picea abies, Rubus idaeus, Populus tremula* -15%), perennial herbaceous species, which appeared in this area as a vegetable and stable cover (75%). On this spoilt were identified species from carpathic or dacic area (10%), which usually appear in woods or on river's edge: *Campanula patula abietina, Pulmonaria rubra, Petasites kablikianus, Salix silesiaca*. The evolution of the vegetation is very slow toward a stable stage, if the excavations do not affect this area (Honciuc and Stanescu, 2002; Pauca-Comanescu and Negrean, 2003).

In all studied spoilt areas 40% of the plant species are ruderal, with a wider distribution on strongly anthropized lands. The degree of coverage of the spoilt materials considered to be grassed is usually low, ranging from 10 to 60%, while the vegetation spots are distributed randomly (Pauca-Comanescu and Negrean, 2003).

The soil samples were collected randomly. 10 samples of mites from these areas were collected with macfadyen soil core (5 cm diameter), up to 10 cm deep. The extraction was performed with a modified Berlese-Tullgren extractor, in ethylic alcohol and the mite samples were clarified in lactic acid. The identification of the mites was made up to the species level (Gilarov and Bregetova, 1977; Hyatt, 1980; Karg, 1993; Masan, 2003; Masan and Fenda, 2004; Gwiazdowicz, 2007).

To measure the relative humidity and ph of the soil, four samples/month/spoilt areas were collected. The results were averaged and the standard deviation was used to represent the humidity and ph values for each area. The ph was measured with a C532 Jasco Consort-ablæe ph-meter (Table 1).

The statistical analysis (numerical density – number of indiviuals/m^2; standard deviation – SD; relative abundance – A%; dominance – D, constancy – C) was performed with Excel 2007.

Table 1

The average of the soil humidity and ph in studied spoilt areas

Spoilt area	Soil humidity	pH
Birlii	7,05 ± 0,94	6,45 ± 0,63
Riusor	15,32 ± 3,29	7 ± 0,28
Ciurila	15,71 ±1,11	5,95 ± 0,07
Nucsoara	46,05 ±12,8	7,15 ± 0,77

RESULTS AND DISCUSSIONS

The taxonomical structure revealed the presence of 18 species of predator mites (Acari: Mesostigmata - Gamasina), belonging to the following families: Parasitidae, Veigaidae, Rhodacaridae, Ameroseiidae, Macrochelidae, Ascidae, Laelapidae, Pachylaelapidae and Zerconidae. The highest specific diversity was recorded at Riuşor (9 species), then at Ciurila (8 species), Birlii (7 species) and the smaller at Nucşoara (6 species). The common species identified for the four spoilt areas were *Cheroseius borealis* and *Hypospis aculeifer* (Tab. 2).

Due to the most increased soil humidity at Nucşoara (46.05%), the gamasid populations developed in good environmental conditions, being recorded the most increased numerical density (5600 ind./sqm) (Table no. 1). The decreased values of the humidity (7.05% and 15.71%) determined a reduction of the gamasid populations size at Birlii and Nucşoara (2,200 ind./sqm and 2,000 ind./sqm). At Riusor were recorded 4,200 ind./sqm (Figure 1). Comparing with natural ecosystems, where species number varied from 15 in undisturbed open grassland sites or shrubs areas, to 25 in ruderal sites and 30-45 in forests, and where numerical densities had the same evolution (from 2,000 ind./sqm in shrubs ecosystems; 10,000 ind./sqm in undisturbed meadows, to 100,000 ind./sqm in forestry ecosystems), the values obtained in the spoilt areas are very low (Pauca et al., 2005; Salmane, 2000; Skorupski, 2001; Stanescu and Honciuc, 2006).

The gamasids are predator mites and their populations are directly influenced by the presence and by the availability of the food (enchytreids, nematodes, immature of oribatids, springtails) and indirectly by the abiotic factors (Koehler, 2000). In spoilt areas the environmental conditions are not proper for development of the predator mites, which request increased soil humidity by 60% and an acid soil (Salmane, 2000).

The lacking of the organic matter (a proper habitat for the soil invertebrates) affected trophical preferences of the soil gamasids. Other researchers observed that the gamasids from the mine areas were found only occasionally within the investigation period and that in generally, colonization density was quite low (Wanner and Dunger, 2002).

At Birlii, from all identified species the eudominat ones were: *Parasitus loricatus* (400 ind./sqm) and *Hypospis aculeifer* (800 ind./sqm). The rest of them were dominant and accessory or accidently species

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(Figure 2). Only *Hypoaspis aculeifer* is constant, due to its wide ecological plasticity. In other ecological researches, this species was identified in diverse habitats (as grassland, sand dunes, seashore, nests, moss, coal shale, arable fields, decaying vegetation, stored cereal products, farm animal waste) (Skorupski and Luxton, 1998; Salmane, 2001).

Species identified only in this area are: *Vulgarogamasus kraepelini*, *Parasitus loricatus* and *Prozercon kochi*. These mites were found in special in soil of forest ecosystems, at Birlii being only accidently (Skorupski and Luxton, 1998; Salmane, 2000; Stanescu and Honciuc, 2006).

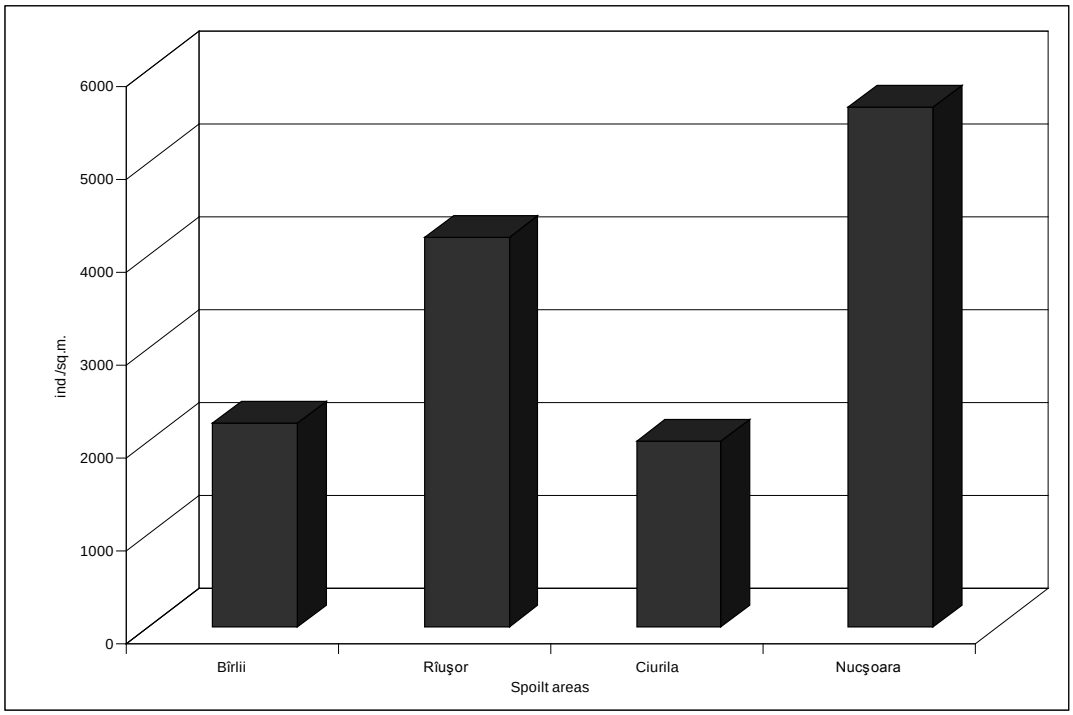

Fig. 1 Numerical densities of the gamasids from the studied spoilt areas

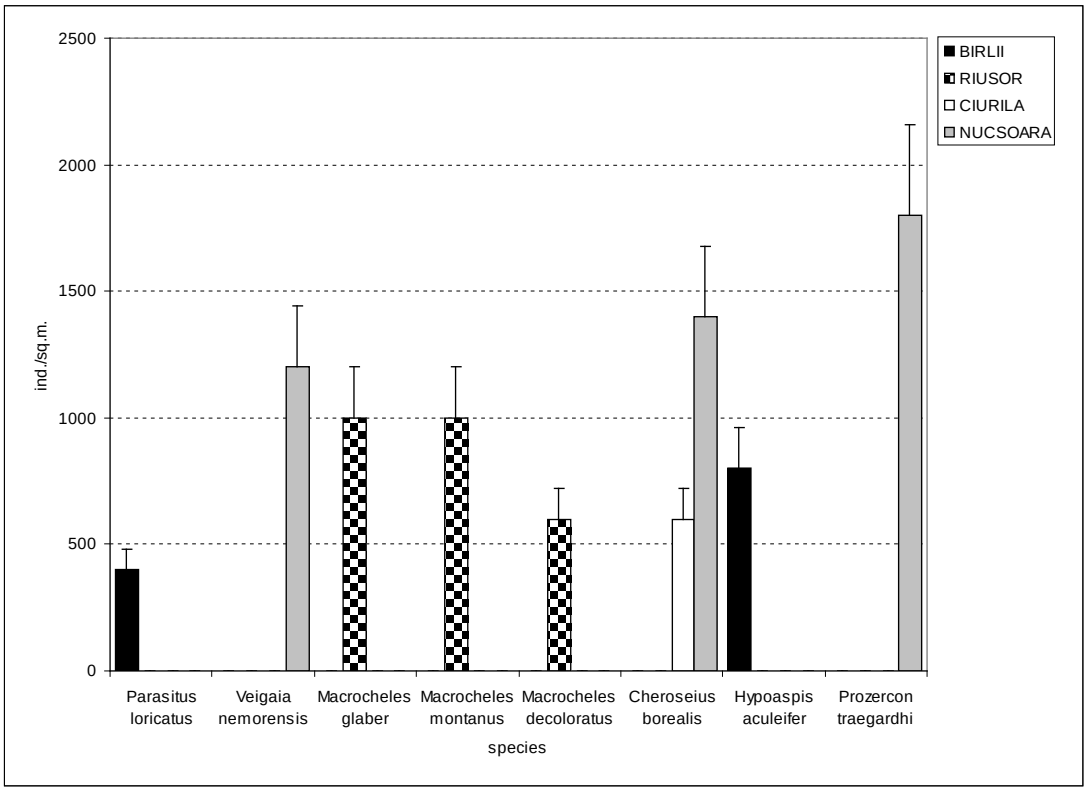

Fig. 2 Numerical densities of the dominat gamasids from the studied spoilt areas

At Riuşor, the eudominant species were: *Macrocheles decoloratus* (600 ind./sqm), *Macrocheles glaber* (1000 ind./sqm) – which was a constant species – and *Macrocheles montanus* (1000 ind./sqm). *Macrocheles decoloratus* is a nidicolous detriticole species. *Macrocheles glaber* have a wide ecological plasticity, living in strongly decomposing organic substrates, mainly in excrements of large herbivores, manure and compost heap. *Macrocheles montanus* is an euryoecious species with a wide ecological plasticity, being a very common species in deciduous forests dominated by beech. (Masan, 2003). Species *Veigaia nemorensis* and *Cheroseius borealis* were dominant (400 ind./sqm) (Figure 2). All identified species were accessory or accidentally. Species *Pergamasus barbarus* and *Macrocheles glaber* were found only here (Tab. No.2). The presence of these mites, which are predators, shows that this area is richer in organic matter, the preferred habitat for soil invertebrates, which are the food of the gamasids.

At Ciurila, all identified gamasids were dominant and accidentally species, with exception of eudominant mite *Cheroseius borealis* (600 ind./sqm) (Table 2), (Figure 2). This species is most frequently found in the litter of various stands of tree, moist meadows and nests of birds and rodents. It shows considerable resistance to pollution and it was found in derelict industrial and mining areas, being identified in all studied spoilt areas from Retezat Mountains (Gwiazdowicz, 2007).

Dominant mites *Rhodacarellus silesiacus*, a slender species of the deeper soil and *Arctoseius cetratus* - phoretic species, were found in generally, in early succession of the disturbed sites, with ruderal vegetation and low humus content. Due to their small dimensions, these euedaphic species with rather high reproductive capacity are able to adapt to these unfavorable environmental conditions, by migrationg in the deeper soil (till 20 cm) (Koehler, 1999; 2000). Species *Rhodacarellus silesiacus, Ameroseius plumigerus* and *Alloparasitus oblongus* are identified in only in this area. These species are found by other specialists in decaying vegetation, in moss, grassland, bogland or arable fields (Skorupski and Luxton, 1998). Although Ciurila is a stable surface, it's in an early ecological succession, here being identified pioneer species (as *Rhodacarellus silesiacus*), which can resist to the specific environmental conditions (Christian, 1995, 2002)

At Nucşoara, all found species were eudominant, with exception of *Hypospis aculeifer* and *Macrocheles montanus.* The preference of the *Cheroseius borealis* for mining area gave it the character of euconstant species. *Veigaia nemorensis* is a very common species, being identified in hygro-mesophytic, xerophytic and driftline habitats (Koehler 1999; Salmane 1999). *Prozercon traegardhi* is a eurytopic detriticole species with wide ecological plasticity. It is abundant in heterogeneous non-woodland and woodland habitats such as littoral reed growth, alluvial stands, meadows, orchards, glades and forests (dry deciduous as well as humid coniferous) (Masan and Fenda, 2004). *Pergamasus crassipes* was found only in this spoilt area.

The presence of an increased number of accessory and accidental species in studied areas showed that these spoilt materials are temporally habitats for the predatory mites, which are very mobile and permanently looking for the food.

Table 2

The dominance and constancy of the gamasid species from the studied spoilt areas.

Species	Birlii	Riuşor	Ciurila	Nucsoara
Vulgarogamasus kraepelini Berlese, 1905	D/ACC			
Parasitus loricatus Wankel, 1861	E/ACS			
Pergamasus barbarus Berlese, 1904		SD/ACC		
Pergamasus crassipes Linne, 1758				E/ACS
Veigaia nemorensis C.L.Koch, 1839		D/ACS		E/ACS
Rhodacarellus silesiacus Willmann, 1936			D/ACC	
Ameroseius plumigerus Oudemans, 1930			D/ACC	
Macrocheles decoloratus C.L.Koch, 1839	D/ACC	E/ACS		
Macrocheles glaber Muller, 1960		E/CT		
Macrocheles montanus Willmann, 1951		E/ACS		SD/ACC
Cheroseius borealis Berlese, 1904	D/ACC	D/ACS	E/ACS	E/EUCT
Arctoseius cetratus Sellnick, 1940		SD/ACC	D/ACC	
Leioseius magnanalis Evans, 1958		SD/ACC	D/ACC	
Alloparasitus oblongus Halbert, 1915			D/ACC	

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Hypoaspis aculeifer Caneastrini, 1883	E/CT	SD/ACC	D/ACC	D/ACS
Pachyseius humeralis Berlese, 1910	D/ACC		D/ACC	
Prozercon kochi Sellnick, 1943	D/ACC			
Prozercon traegardhi Halbert, 1923				E/ACC

E. = eudominant, d. = dominant, sd. = subdominant; euct. = euconstant, ct. = constant, acs. = accessory, acc. = accidentally

CONCLUSIONS

The taxonomical structure of the gamasid populations showed the presence of 9 families, with 14 genera and 18 species. The identified species are characteristic for the terrestrial temperate ecosystems. The common species identified for the four spoilt areas were Cheroseius borealis and Hypospis aculeifer, which are constant on these surfaces. The most of identified gamasids have small dimensions (Rhodacarellus silesiacus, Ameroseius plumigerus, Cheroseius borealis, Arctoseius cetratus, Leioseius magnanalis, Prozercon kochi), being able to adapt to the rough environmental conditions (decreased soil humidity and the poor vegetation and organic matter) from these spoilt areas. 83,34% from described species are accidently or accesories. This means that their presence on the spoilt areas are temporaly, invading from the closed forest ecosytems (beech forests). Due to the differences (vegetation composition, of the degree of coverage, of the soil humidity and of the ph) each area had characteristical eudominant or dominant species.

The specific environmental conditions had an important influenced on the specific and numerical structure, in comparison with others natural ecosystems. Making a comparative analyse of the specific composition, Riuşor dominated with 9 species, then Ciurila with 8 species, Birlii with 7 species and the last was Nucşoara with 6 species. The poor vegetation, the low soil humidity and the lack of the organic matter (the proper habitat for other invertebrates, which are the food source for these predator mites) influenced the numerical densities of the gamasids (Nucşoara with 5600 ind./sqm; Riuşor with 4200 ind./sqm; Birlii with 2200 ind./sqm and Ciurila with 2000 ind./sq.m).

Modifications of the structural parameters of the gamasid populations under the influence of the different environmental factors allow their usage as a bioindicators for the soil conditions. Ecological restoration by recultivation measures prevent erosion, leaching of nutrients and initiate soil development, and stimulate biodiversity with all its consequences for sustainability of ecosystem functions and nature protection.

REFERENCES

Christian A, Succesion of Gamasina in coal mined areas in Eastern Germany. Acta Zoologica Fennica 196: 380-381, 1995.

Christian A, Colonization of primary sterile soils by epedaphic gamasina mites. In Acarid Phylogeny and Evolution. Adaptations in mites and ticks, by F. Bernini, R. Nannel;li, G. Nuzzaci, E. de Lillo, Kluwer Academic Publisher,169-173, 2002.

Dunger W, Wanner M, Hauser H, Hohberg K, Schulz H, Schwalbe T, Seifert B, Vogel J, Voigtländer K, Zimdars B and Zulka1 KP, Development of soil fauna at mine sites during 46 years after afforestation*. Pedobiologia 45, 243–271, 2001.

Gilarov MS, Bregetova NG, Opredeliteli Obitaiuscih v Pocive Clescei, Mesostigmata. Isdatelistvo "Nauka", Leningratkoe, Otdelenie, Leningrad, 1977.

Gwiazdowicz DJ, Ascid mites (Acari, Mesostigmata) from selected forest ecosystems and microhabitats in Poland. Wydawnictwo Akademii Rolniczej Im. Augusta Cieszkowskiego w Poznan, 2007.

Honciuc V, Stanescu M, Numerical structure of the mites communities (Arachnida – Acari) in the spoilt areas from Ţarcu – Godeanu Massif . Proceeding of the Institute of Biology, IV: 63-76, Bucureşti, Romanian Academy, 2002.

Hyatt K H, Mites of the subfamily Parasitinae (Mesostigmata:Parasitidae) in the British Isles. Bulletin of the British Museum, Zoology series, 38 (5): 237-378, 1980.

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

Koehler HH, Natural regeneration and succession - results from a 13 years study with reference to mesofauna and vegetation, and implications for management. Landscape and Urban Planning 51, 123-130, 2000.

Koehler HH, Predatory mites (Gamasina, Mesostigmata). Agriculture, Ecosystems and Environment, 74: 395-410, 1997.

Masan P, Macrochelid mite's of Slovakia (Acari, Mesostigmata, Macrochelidae). Institute of Zoology, Bratislava, Slovak Academy of Science, pp.1-149, 2003.

Masan P, Fenda P, Zerconid mites of Slovakia (Acari, Mesostigmata, Zerconidae). Institute of Zoology, Bratislava, Slovak Academy of Science, 2004.

Pauca Comanescu M, Negrean G., Natural restoration, during a decade, of the vegetation growing on the spoil materials from the basin of Riul Mare (Retezat Massif). Proceedings of the Institute of Biology, 5: 147-180, 2003.

Pauca Comanescu M, Ştefanuţ S, Şincu D, Vasiliu Oromulu L, Falca M, Honciuc V, Stanescu M, Purice D, Fiera C, Biodiversity of alluvial shrubs characteristic to the Calnişţea River. Proceedings of the Institute of Biology, Bucureşti, Romanian Academy, 7: 87-111, 2005.

Salmane I, Soil free-living predatory Gamasina mites (Acari, Mesostigmata) from the coastal meadows of Riga Gulf, Latvia. Latvijas Entomologs, 37: 104 -114, 1999.

Salmane I, A check list of Latvian Gamasina mites (Acari, Mesostigmata) with short notes to their ecology. Latvijas Entomologs, 38: 21-26, 2001.

Salmane I, Investigation of the seasonal dynamics of soil Gamasina mite's (Acari: Mesostigmata) in Pinaceum myrtilosum. Latvia Ekologia, 19 (3): 245-252, 2000.

Skorupski M, Luxton M, Mesostigmatid mites (Acari: Parasitiformes) associated with yew (Taxus baccata) in England and Wales. Journal of Natural History, 32: 419-439, 1998.

Skorupski M, Mite's (Acari) from the order gamasida in the Wielkopolski National Park. Fragmenta Faunistica, 44, pp.129-167, 2001.

Stanescu M, Honciuc V, The taxonomical structure of the Epicriina and Gamasina mite's (Mesostigmata: Epicriina, Gamasina) from forestry ecosystems from Bucegi Massif. Roumanian Journal of Zoology, 52: 33-41, 2006.

Wanner M, Dunger W, Primary immigration and succession of soil organisms on reclaimed opencast coal mining areas in eastern Germany. European Journal of Soil Biology 38, 137-143, 2002.