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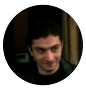

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## Article

# Oribatid mite (Acari: Oribatida) diversity in different forest stands of Borjom-Kharagauli National Park (Georgia)

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## Abstract

We studied oribatid mite diversity in two sites of virgin Pleistocene forests in Borjom-Kharagauli National Park in Georgia. The aim was to explore the effects of microhabitat and tree species on the composition and the relative abundance of oribatid mites. Investigations revealed high species richness (96 species in total) with community composition varying according to the microhabitat type. *Carabodes tenuis* Forsslund, 1953 was registered for the first time for Caucasian fauna. Soil and canopy (twig)-dwelling oribatid communities comprises rather distinctive groups unlike moss and litter. No difference was observed between moss and litter dweller mites. One species, *Camisia horrida* (Hermann, 1804), was found only in canopy samples, but was very rare. *Poroliodes farinosus* (C.L. Koch, 1840), *Carabodes labyrinthicus* (Michael, 1879) and *Phauloppia rauschensis* (Sellnick, 1908) were found frequently in canopy habitats, with *P. rauschensis* abundant on tree twigs and almost absent from forest floor. The presence of beech trees (*Fagus orientalis* Lipsky) was correlated with the number of species per site. The results showed that geographic distance between sites is an important determinant in oribatid community composition and can have stronger effects than a microhabitat type.

**Key words:** Cryptostigmata, biodiversity, Pleistocene forests, microhabitat preference.

## Introduction

The factors driving the community composition of soil faunas remain poorly understood. Oribatid mites are one of the most diverse suborders of Sarcoptiformes (Behan-Pelletier & Newton 1999; Maraun *et al.* 2007; Sylvain & Buddle 2010). Over 10000 species are described worldwide (Subías 2004, electronically updated in 2014) and their densities can reach up to 200000 individuals per square meter in temperate forests (Maraun & Scheu 2000). Investigation of oribatid mite diversity in virgin untouched forests preserved in Georgian (Caucasus) national parks provides an opportunity to observe soil animal community in natural environment free of anthropogenic disturbance.

The Georgian mountains harbor plio-pleistocene refugia where old-grown primary forests are well-survived (Velichko & Kurenkova 1990; van Zeist & Bottema 1991; van

Andel & Tzedakis 1996; Zazanashvili *et al.* 2004). The Borjom-Kharagauli National Park is mostly presented by coniferous and deciduous forests. It was established in 1995 and was officially opened in 2001. The park is located on the northern and southern slopes of the eastern part of Ajara-Imereti Range and is the largest protected landscape in Georgia with a total area of 61235 ha (Agency of Protected Area of Georgia 2014).

Oribatid mite fauna (and soil fauna in general) of the park is poorly studied. Eighty two species were collected in burned and unburned soils of two parts of Borjom-Kharagauli National Park – Bornis Ghele and Likani (Kvavadze *et al.* 2010). In five different locations of Borjom-Bakuriani gorge (that envelops Borjom-Kharagauli National Park area), 68 species were recorded (Darejanashvili 1967), but none of these locations belong to current national park territory. Hence, the information on oribatid mite distribution in the park is significantly understudied. We sampled the oribatid mite fauna in several microhabitats (soil, moss, litter, and tree branches) in two forest sites of the Kvabiskhevi reserve within the Borjom-Kharagauli National Park. Both sites were dominated by spruce (*Picea orientalis* (Lipsky)), interspersed with hornbeam (*Carpinus caucasica* Grossh.), and beech (*Fagus orientalis* Lipsky), respectively. To make oribatid mite inventory of the Kvabiskhevi reserve, we addressed three questions: (1) does the microhabitat type (soil, moss, litter, tree branches) influence oribatid mite faunal composition? Our assumption was that different microhabitats provide different resources for oribatid mites and are reflected in their community composition (Aoki 1967; Anderson 1978a). We suppose that oribatid mite assemblages of different microhabitats should be more different within a site than between remotely located sites; (2) does the presence of different broad leaved tree species (hornbeam in one and beech in the second site) influence overall fauna composition? Different tree species should create contrasting soil and litter environments providing different feeding resources and influencing the small-scale (i.e. habitat patches) pattern of distribution of oribatid mite communities; (3) is the arboreal oribatid mite fauna tree species specific? Since arboreal fauna of oribatid mites is different from surrounding soil-litter fauna (Behan-Pelletier & Walter 2000) little is known about tree species specific differences in oribatid mite composition. We investigated whether different tree species (spruce in one and beech twig branches in the other site), support different species of oribatid mites.

## Material & Methods

### *Sampling*

Sampling was performed in August 2011, in two sites located in the same gorge of River Kvabiskhevi, 6 km apart from each other. Both sites had a canopy composed mainly of two tree species (see below), with no understory vegetation, and moss partially covered the ground. Site and microhabitat descriptions are provided in Table 1.

Each site was represented by 100 $m^2$ including all corresponding microhabitats described in Table 1. Within this area, in each microhabitat three samples of moss and litter were taken haphazardly within the 1 m radius from the tree base. That makes six samples of moss and six samples of litter in each habitat. For litter sampling, litter from 20 x 20 cm area to a depth of 10 cm was grabbed and sieved. 20 x 20 cm moss mats were sampled in 5–7 cm depth. For soil sampling, litter and moss cover was completely removed from the sampling area and six soil samples were taken at each habitat per site using 10 x 10 x 10 cm soil corer. In total, 36 soil samples were taken in site 1 and 24 soil samples were taken in site 2 (Table 1).

**Table 1.** Sampling site description indicating abbreviations used in the manuscript.

| **Site 1** (N 41.79576, E 43.23817; 998 m a.s.l.) - mixed forest of spruce (*Picea orientalis*) (dominant) and hornbeam (*Carpinus caucasica*) | | | | | |
|---|---|---|---|---|---|
| Moss and litter | | Soil | | Canopy (tree branches free from lichens, leaves, moss or suspended soil) | |
| L1.1 | Leaf litter under the hornbeam within 1 m from the base of a tree | S1.5 | Mineral soil under the litter (under hornbeam) | C1.s1.2 | Spruce 1. Height 2 m |
| M1.2 | Moss under the hornbeam within 1 m from the base of a tree | S1.6 | Mineral soil under the moss (under hornbeam) | C1.s1.2 | Spruce 1. Height 2 m |
| L1.3 | Conifer litter under the spruce within 1 m from the base of a tree | S1.7 | Mineral soil under the litter (under spruce) | C1.s1.5 | Spruce 1. Height 5 m |
| M1.4 | Moss under the spruce within 1 m from the base of a tree | S1.8 | Mineral soil under the moss (under spruce) | C1.s2.2 | Spruce 2. Height 2 m |
| | | | | C1.s2.5 | Spruce 2. Height 5 m |
| | | | | C1.s3.2 | Spruce 3. Height 2 m |
| | | | | C1.s3.5 | Spruce 3. Height 5 m |
| **Site 2** (N 41.85401, E 43.23916; 1611 m a.s.l.) spruce forest with scattered beech (*Fagus orientalis*) trees | | | | | |
| Moss and litter | | Soil | | Canopy | |
| L2.1 | Conifer litter under the spruce within 1 m from the base of a tree | S2.5 | Mineral soil under spruce litter | C2.b1.2 | Beech 1. Height 2 m |
| M2.2 | Moss under the spruce within 1 m from the base of a tree | S2.6 | Mineral soil under moss (under spruce) | C2.b1.5 | Beech 1. Height 5 m |
| L2.3 | Leaf litter under the beech within 1 m from the base of a tree | S2.7 | Mineral soil under litter (under beech) | C2.b2.2 | Beech 2. Height 2 m |
| M2.4 | Moss under the beech within 1 m from the base of a tree | | | C2.b2.5 | Beech 2. Height 5 m |

For canopy samples, trees of different bark structure were chosen. Spruce trees with complex bark structure were sampled in Site 1 and beech trees with almost smooth bark structure were sampled in Site 2. Three spruce and two beech trees were selected different from those trees where we took ground samples. At each tree, branches were taken at two heights – 2 and 5 meters, and at each height three branches of 2 m long and 4 to 6 cm diameter were cut.

Samples from each microhabitat for each site were pooled together and placed into plastic bags for later extraction in the laboratory.

### *Mite extraction & identification*

Mites were extracted from soil, litter and moss samples within two days after sampling. Extraction was made using Berlese funnels for 5 days, into a mix of 70% alcohol, distilled water, glacial acetic acid and glycerol. In order to facilitate extraction of mites from canopy, branches were cut into 20 cm long pieces. Mites from branches were extracted using the twig washing technique described in Walter & Krantz (2009). Each sample of branches was placed into a separate bucket of water added with a small amount of detergent, for 24 hours. Branches were then individually shaken into the water and removed from the buckets. The remained water, which contained mites washed off the twigs, was sieved into two sieves of different mesh sizes (1 mm and 75 µm) and rinsed with 70% alcohol into the jars.

For specimen examination, we used temporary cavity slides filled with lactic acid. All adult specimens were identified using the keys of Weigmann (2006) and Ghilarov & Krivolutsky (1975). The identified material was placed in vials of 70% alcohol to which a drop of glycerol was added and stored in the personal collection of M. Murvanidze. Species were classified according to Schatz *et al*. (2011). In sample C2.b2.5, no oribatids were found; hence, this sample was excluded from further treatment.

*Data analyses*

Sampling completeness for each microhabitat was assessed using bias corrected Chao 1 estimator (Gotelli & Colwell 2010). The number of co-dominant species can was estimated by the reciprocal of Simpson's index (1/$\sum$ , where$\varphi p_i^2$ represents the proportion of each species in a community) according to Kikvidze & Oshawa (2002). This measure is also known as the effective number species (ENS) or true diversity sensu Jost (2006) and is suggested as the best proxy in comparing diversity among communities. We used the ENS index for comparing diversity; however the subset of the most abundant species provided by this index is frequently misleading (Murvanidze *et al*. 2013). Instead we used a slightly modified method of Kikvidze & Ohsawa (2002) details of which were described in our previous publication (Murvanidze *et al*. 2013).

We also compared community composition of samples using multivariate ordination (nMDS – non-metric multidimensional scaling). nMDS was performed using transformed abundance (log (abundance+1)) data (standardized per square meter) for the complete species-site matrix as well as for the dominant species-site matrix including only dominant species (defined by the ENS index). Analyzes were performed using PAST software (Hammer *et al*. 2001) and Microsoft Excel.

## Results

In total, 13722 individuals of oribatid mites belonging to 36 families, 71 genera and 96 species were identified (see Appendix 1). Fifty two species were new for the national park. Ninety four species were found in forest floor samples and 12 species in canopy. The species *Carabodes tenuis* Forsslund, 1953 was the new record for Caucasian fauna. *Ceratozetes sellnicki* Rajski, 1958 and *Scheloribates latipes* (CL Koch, 1844) were found in all types of habitats – soil, moss, litter and canopy. *Ceratozetes sellnicki* was the only species that showed a higher abundance in soil than in litter or moss. All other abundant species were found in moss or litter. One of the species, *Camisia horrida* (Hermann, 1804), was found only in the twig samples.

The Chao index revealed sampling completeness (in average) of 91% for moss and litter, 82% for canopy and about 67% for soil microhabitats. In spite of the higher number of singletons and doubletons in moss and litter the inventory in these habitats was more accurate than in the other habitats (Table 2). The estimate for whole pooled samples suggests that 10 rare species remained unsampled ($\text{Chao1}_{\text{total}} = 106$). Hence our inventory provides quite complete data for the sampled microhabitat area.

A similar number of species were found in the two sites: 74 species in Site 2 and 69 species in Site 1. Raw species richness varied from 2 (C2.b1.5) to 55 (L1.1), while the true diversity varied from 1 (C1.s1.2 and S 1.5) to 9 (M1.2). There was a clear pattern of decreasing of average richness from moss-litter microhabitats (ENS= 6) through soil (ENS= 4) to the canopy (ENS= 3) (Table 2).

**Table 2.** Number of species, number of individuals, number of singletons and doubletons, with estimated richness (Chao1) and diversity indices (Simpson'S 1/D) for each sampling site.

| Microhabitat | No. species | No. individuals | Singletons | Doubletons | Chao 1 | Simpson'S D | 1/D (ENS) |
|---|---|---|---|---|---|---|---|
| L 1.1 | 55 | 2017 | 12 | 9 | 62 | 0.13 | **8** |
| M 1.2 | 39 | 1504 | 6 | 4 | 42 | 0.11 | **9** |
| L 1.3 | 31 | 1297 | 6 | 8 | 33 | 0.17 | **6** |
| M 1.4 | 36 | 999 | 7 | 8 | 38 | 0.19 | **5** |
| S 1.5 | 12 | 228 | 3 | 4 | 13 | 0.68 | **1** |
| S 1.6 | 9 | 15 | 7 | 1 | 20 | 0.21 | **5** |
| S 1.7 | 9 | 19 | 5 | 1 | 14 | 0.16 | **6** |
| S 1.8 | 9 | 19 | 6 | 1 | 17 | 0.21 | **5** |
| C1.s1.2 | 3 | 49 | 0 | 0 | 3 | 0.53 | **2** |
| C1.s1.2 | 4 | 33 | 2 | 0 | 5 | 0.73 | **1** |
| C1.s1.5 | 5 | 20 | 2 | 0 | 6 | 0.31 | **3** |
| C 1.s2.2 | 5 | 9 | 3 | 1 | 7 | 0.28 | **4** |
| C1.s2.5 | 4 | 14 | 1 | 1 | 4 | 0.40 | **3** |
| C 1.s3.2 | 4 | 29 | 1 | 0 | 4 | 0.56 | **2** |
| C 1.s3.5 | 6 | 19 | 3 | 0 | 9 | 0.28 | **4** |
| L 2.1 | 42 | 1906 | 8 | 5 | 47 | 0.30 | **3** |
| M 2.2 | 28 | 787 | 5 | 6 | 29 | 0.28 | **4** |
| L 2.3 | 47 | 2872 | 11 | 4 | 58 | 0.21 | **5** |
| M 2.4 | 45 | 1787 | 10 | 9 | 50 | 0.16 | **6** |
| S 2.5 | 9 | 14 | 7 | 1 | 20 | 0.18 | **5** |
| S 2-6 | 6 | 14 | 2 | 1 | 7 | 0.20 | **5** |
| S 2.7 | 11 | 56 | 5 | 1 | 16 | 0.37 | **3** |
| C2.b1.2 | 4 | 7 | 2 | 1 | 5 | 0.31 | **3** |
| C 2.b1.5 | 2 | 2 | 2 | 0 | 3 | 0.50 | **2** |
| C 2.b2.2 | 4 | 6 | 3 | 0 | 7 | 0.33 | **3** |

M= moss, L= litter, S= soil, C= canopy. See Table 1 for site description.

Moss and litter habitats have much more individuals and species than soil and canopy. High total density was usually provided by high relative abundance of dominant species (see Appendix 1).

Ordination analysis (nMDS) indicate that species composition of moss samples was similar to those of litter samples, while it clearly differed from soil and canopy samples. Canopy samples were the most distinct (Fig. 1).

Abundant species of the superfamily Oppioidea (*Dissorhina ornata* (Oudemans, 1900) and *Oppiella similifallax* (Subías & Minguez, 1986)) were almost absent from site S1 (*D. ornata* presented only in two samples with 1 and 2 individuals, *O. similifallax* was frequently found with number of individuals from 3 to 93). The same species were much more abundant in site S2 (number of individuals of *D. ornata* from 1 to 432 and abundance of *O. similifallax* from 2 to 1179). Less abundant species of oppioids also preferred site 2 (Appendix 1). Members of Achipteroidea were abundant in moss and litter microhabitats in both sites (S1 and S2), with a little preference for litter (Fig. 3). Species of Ceratozetoidea differed by their habitat preferences. *Ceratozetes mediocris* Berlese, 1908 was abundant in moss, *C. sellnicki* in soil and *Minunthozetes pseudofusiger* (Schweizer, 1922) showed higher number of individuals in litter. Among the other three dominant species, *Damaeolus ornatissimus* Csiszar, 1962 was abundant only in moss habitat in site S1, *Eupterotegaeus ornatissimus* Berlese, 1908 was abundant in litter of both sites and *Scheloribates latipes* (C.L. Koch, 1841) was abundant in both, moss and litter microhabitats of site S1 (Fig. 3).

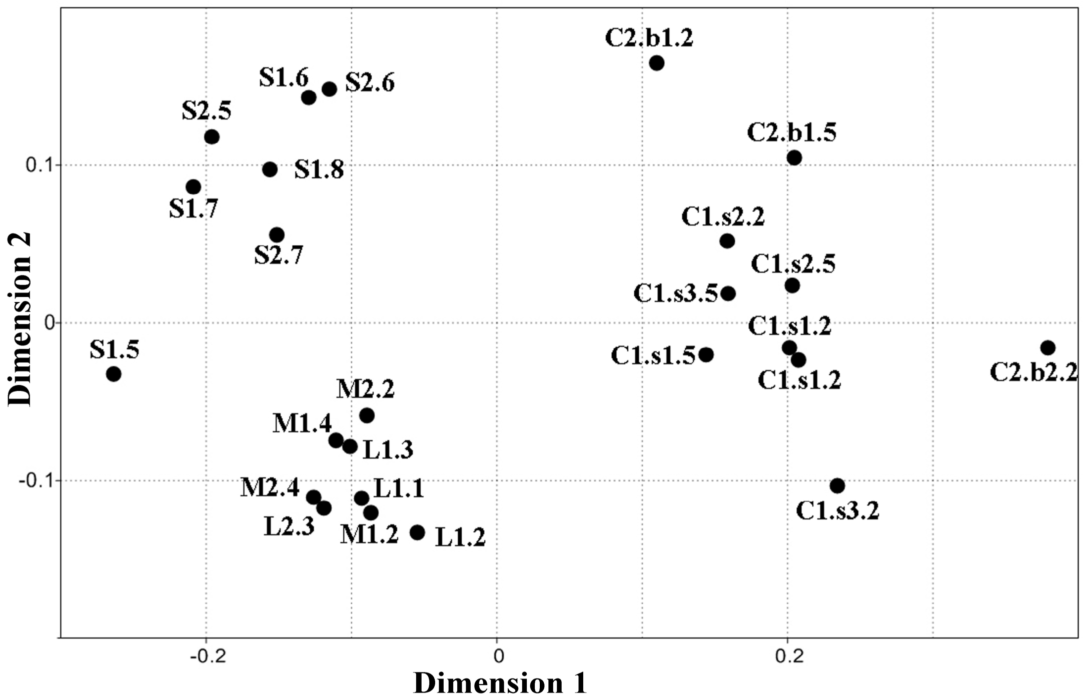

**Figure 1.** nMDS ordination diagram based on all species abundance data between soil (S), moss (M), litter (L) and canopy (C) habitats in Kvabiskhevi reserve (Georgia). See Table 1 for microhabitat abbreviations.

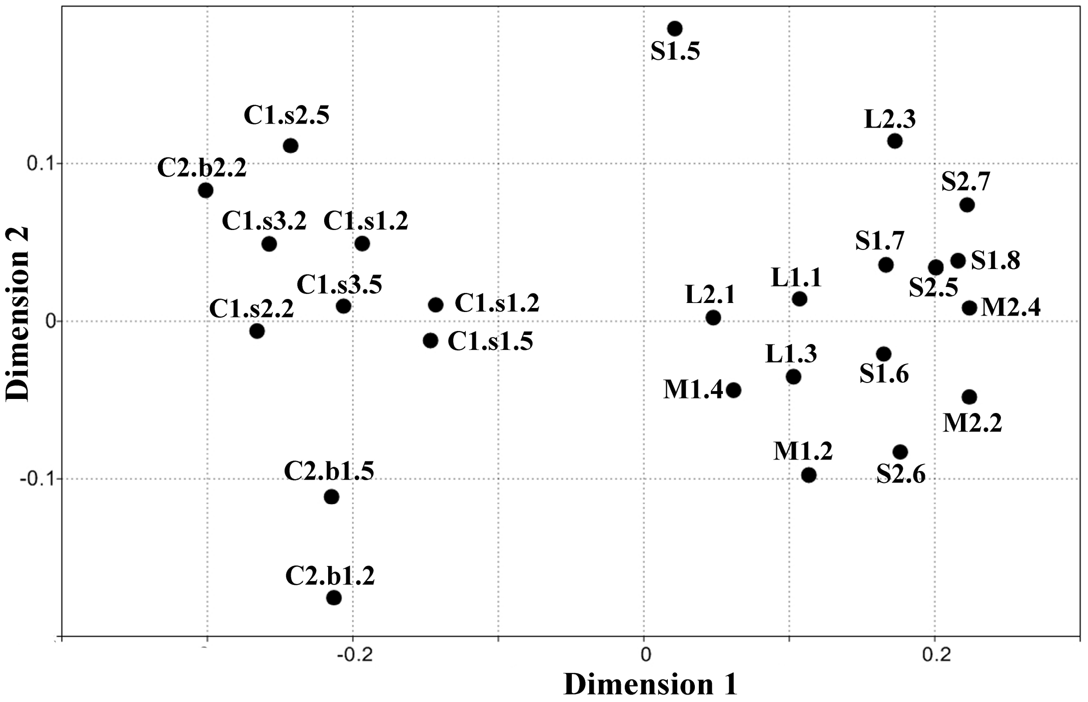

**Figure 2.** nMDS ordination diagram based on co-dominant species abundance data between soil (S), moss (M), litter (L) and canopy (C) habitats in Kvabiskhevi reserve. See Table 1 for microhabitat abbreviations.

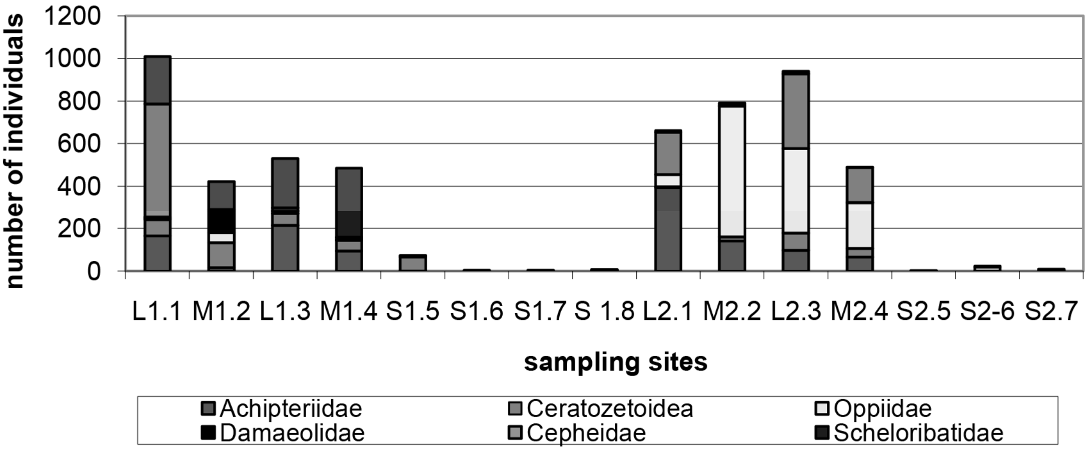

**Figure 3.** Graph showing raw abundance distributions (y-axis) of dominant superfamilies for each sampling localities (x-axis) except canopy. See Table 1 for microhabitat abbreviations.

nMDS based on co-dominant species only, clearly separated the canopy community from other microhabitats (Fig. 2). This is clear since all the dominant species found in terrestrial sites were absent from the canopy. In contrast soil, moss and litter microhabitats (S- and M- and L- points) were dominated by the same species group.

## Discussion

### *Species diversity and richness*

The Chao1 estimator shows that the species number would have been slightly higher if more samples were taken. Clearly, in forests there are more diverse microhabitats than we have investigated; the additional studies must provide a more detailed inventory for the study area. In spite of the high number of sampled individuals, a large proportion of singletons and doubletons was found. Considering high passive dispersal ability of oribatids (Karasawa *et al.* 2005; Lebedeva 2012; Lehmitz *et al.* 2011, 2012) the existence of rare species in any particular microhabitat can be considered as a random process (i.e. moving species between microhabitats temporarily). In that way, unless all the available microhabitats are sampled, the estimator (such as Chao1) may not stabilize. Our investigations revealed 96 species in total of which 52 were reported for the first time for this area, with species composition varying depending on the microhabitat type.

The canopy sampling revealed a community that was significantly different from the one in the forest floor. *Camisia horrida* was the only species found in twigs and absent from other microhabitats. *Camisia* spp. are known as residents of both forest floor and canopy habitats with a preference for canopy (Behan-Pelletier & Walter 2000). The most common species on twigs were *Poroliodes farinosus, Carabodes labyrinthicus* and *Phauloppia rauschensis,* with *P. rauschensis* abundant on the tree twigs and almost absent from forest floor (only two individuals were found in sample M2). This species is well known resident of canopy habitats (Weigmann 2006).

*Carabodes tenuis* was found for the first time for Caucasian fauna. This species is known to prefer acidic soils in mountain coniferous forests (Weigmann 2006); we have found two individuals in moss under the beech tree.

*Microhabitat specificity and spatial composition of mite communities*

In a previous study (Mumladze *et al*. 2013), we recognized the need for more active research to understand why so many species of oribatid mites coexist in the same habitat patch. Isotope studies clearly indicate that mite species have different diets (Schneider *et al*. 2004) which may contribute in species coexistence, however most of oribatid species are known to be a general feeders (Maraun *et al*. 2003). Co-existence of species with similar feeding requirements especially in seemingly resource limited environments (such as soil or canopy) was considered to be in conflict with general ecological theory and named as "the enigma of soil animal diversity" (Anderson 1975). One of the proposed hypothesis states that different species with similar ecological requirements may avoid competition by partitioning habitat space and occupying specific microhabitat patches (Anderson 1978a, b; Schneider & Maraun 2005). A More realistic explanation of the pattern could be a feeding resource partitioning in a competitive way. This means that any habitat type composed of different feeding niches can harbor a large number of mite species and the community composition and abundance distribution will heavily depend on the types of available resources. This hypothesis provides several cues which can be tested thoroughly. Particularly, there must be a clear difference in mite community composition (at least dominant species assemblages) between different microhabitats; while similar microhabitats from distant areas must be more similar in community composition than communities in microhabitats near to each other. Our results showed that the presence of moss with different types of litter (composed by conifer needles, beech and hornbeam leafs) had a negligible effect on Oribatida community composition. There was almost no difference between Oribatida complexes of these microhabitats. Moss and litter dweller mite communities of the same site were more similar than moss or litter inhabiting oribatid mites from different sites (Figs. 1 & 2). The distance between the sites and probably differences in altitude (998 m and 1611 m a.s.l., respectively) played an important role in that particular case (which is in agreement to the findings of Erdmann *et al*. (2012)), whereas soil and canopy harbored more specific species and grouped according to microhabitat specificity. It seems that microhabitat type in terms of physical constraints has a major effect on oribatid community composition (Arroyo *et al*. 2013). Our results are in accordance with the findings of Aoki (1967) who found a poor oribatid fauna on the upper part of the forest floor (freshly fallen wood or leaves, moss on the trees and rocks, etc.) and rich in the deeper layers (lower part of rotten wood, decaying litter, etc.) and described the litter layer as “simple and rich”.

Moss and litter microhabitats had a higher number of individuals and species than soil and canopy, but leaf litter seemed to harbor more species and individuals than moss. Decaying leaf litter is usually richer in terms of fungal species and in that way creates more feeding resources (Maraun *et al*. 2003), while living moss contains less fungi and microbes. Indeed, the primary decomposers of the family Achipteriidae and *Steganacarus spinosus* (Sellnick, 1920) and the fungal feeding families – Oppidae and Galumnidae – were abundant in both, moss and litter microhabitats, with a preference of litter. Secondary decomposer species of the family Cepheidae – *Eupterotegaeus ornatissimus* (Berlese, 1908) – prevailed also in litter indicating organic matter decay processes ongoing here providing rich feeding resources for the decomposing oribatid mite fauna.

Although forests were represented mainly by coniferous trees, the presence of deciduous tree species (hornbeam in S1 and beech in S2) seemed to influence mite community composition. It is known that unlike other soil arthropods (e.g. Collembola) oribatid mites are more depended on vegetation composition than on the geographical location (Al-Assiuty *et al.* 1993). In our study, the overall number of species and abundance of oribatid mites was higher in site S2 with presence of beech trees compared to site S1 where coniferous trees were mixed with hornbeam. Indeed, the presence of beech is known to be beneficial for them (Eisfeller *et al.* 2013). It is presumed that oribatid mites should benefit from feeding on the fine roots of beech trees and associated ectomycorrhizal fungal hyphae (Maraun *et al.* 2003; Schneider *et al.* 2005; Eisfeller *et al.* 2013). This pattern needs additional investigation as conifers can also provide dense ectomycorrhiza (Haug & Pritisch 1992) and the altitude (600 m elevation difference between sites - 998 m a.s.l. for the first and 1611 m a.s.l. for the second site) can be a confounding factor. Beside this, interconnection of biotic and abiotic components can influence the beech litter and soil fauna composition in a more complex way. In particular, Ponge *et al.* (1997) indicate that the availability of soil mineral elements for vegetation in beech forests may be increased or decreased according to the composition of the soil fauna, what in turn may affect the mineral composition of the beech foliage. In addition, the phenolic content of litter may affect directly some animal groups through their food preferences.

Despite the low abundance and species richness, the oribatid mite community inhabiting tree branches is clearly distinct from that of the forest floor. Our research showed higher habitat specificity of arboreal mites compared with those of terrestrial habitats. Height of canopy sampling did not affect the arboreal faunal composition. No clustering of oribatid mites inhabiting spruce or beech twigs was noticed (Fig. 2); however, in spruce tree branches 10 species were registered with 169 individuals, whereas in beech branches seven species were found represented by only 15 individuals. Differences in number of species and number of individuals between spruce and beech branches may be explained by bark surface structure (rough in spruce and smooth in beech) and abiotic conditions in canopy. Surface structure of barks is known to have a strong effect on arboreal micro-arthropod assemblages (Sobek *et al.* 2008). A rough structure of tree branches provides more grooves and furrows and consequently offers more food and shelter for mites (Prinzing 1997; Sobek *et al.* 2008).

## Conclusion

Microhabitat type influences soil oribatid mite fauna only partly. Presence of moss or litter appeared to have only a minor effect on community composition, whereas soils harbor specific Oribatida communities, independent of the presence of moss or litter.

A major influence on community structure was noted for the presence of broad-leaved tree species among the spruce trees. The number of species and the abundance of oribatid mites were higher in sites characterized by the presence of beech. Since the amount of litter was not different between these two sites, one has to test the effect of altitude as a confounding factor.

Tree species specificity provided differences in arboricolar faunal composition as well. In spite of low faunal differences, spruce twigs harbored a more diverse and abundant oribatid fauna compared to beech twigs due to their rough twig bark structure that creates more microhabitats and shelters for oribatid mites.

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# تنوع کنه‌های اریباتید (Acari: Oribatida) در توده‌های جنگلی مختلف پارک ملی بورجوم-خراگاولی (گرجستان)

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## چکیده

تنوع کنه‌های اریباتید در دو محل از جنگل‌های دست نخورده پلیستوسن پارک ملی در بورجوم-خراگاولی در گرجستان مطالعه شد. هدف کشف اثرات خردزیستگاه و گونه‌های درختان بر ترکیب و فراوانی نسبی کنه‌های اریباتید بود. بررسی‌ها نشان از غنای گونه‌ای زیاد داشت که ترکیب جمعیتی آن بر اساس نوع خردزیستگاه متفاوت بود. گونهٔ *Carabodes tenuis* Forsslund, 1953 برای نخستین بار برای فون قفقاز گزارش می‌شود. کنه‌های اریباتید خاکزی و در سایه‌انداز (شاخه) درختان گروهای مشخص‌تری را برخلاف خزه‌ها و خاکبرگ‌ها تشکیل دادند. هیچ تفاوتی بین کنه‌های موجود در خزه‌ها و خاکبرگ‌ها دیده نشد. گونهٔ *Camisia horrida* (Hermann, 1804) تنها در نمونه‌های سایه‌انداز یافت شد اما بسیار کمیاب بود. گونه‌های *Poroliodes farinosus* (C.L. Koch, 1840)، *Carabodes labyrinthicus* (Michael, 1879) و *Phauloppia rauschensis* (Sellnick, 1908) به صورت فراوان در سایه‌انداز و شاخهٔ درختان یافت شد و کم و بیش در کف جنگل حضور نداشت. تعداد گونه در هر محل با وجود درخت راش ارتباط داشت. نتایج نشان داد فاصلهٔ جغرافیایی محل‌ها در تعیین ترکیب جمعیت اریباتیدها مهم است و می‌تواند از نوع خردزیستگاه اثر بیشتری داشته باشد.

**واژگان کلیدی:** نهان استیگمایان، تنوع زیستی، جنگل‌های پلیستوسن، ترجیح خردزیستگاه.

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