Soil mites (Acari, Mesostigmata) of oak-hornbeam forest in NR Katarínka, Southwest Slovakia

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During the years 1999-2002, mesostigmatid mites, an important part of soil mesofauna communities, were studied in two oak-hornbeam forests in the Katarínka Nature Reserve (Malé Karpaty Mts., Slovakia). 84 species from 4 cohors (Antennophorina, Gamasina, Sejina, and Uropodina) were recorded. The mite communities in the young economically exploited oak-hornbeam forest show greater fluctuations in species richness and abundance of mites during the year. At the study site with old xerothermophilous oak forest, evident influence of more stable microclimatic conditions resulted in a more stable mite community.

Keywords: Acari, mites, soil, oak-hornbeam forests, Slovakia.

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Introduction

The Malé Karpaty (Little Carpathians) Mts. form the south-western projection of the Carpathian arch. The eastern and southern slopes of the Malé Karpaty Mts. are influenced by the thermophilous Pannonian District. The area is covered by forests, woody steppes and rocky habitats. Forest stands have been under long-term anthropogenic pressure in the cultivated lands.

The soil mesostigmatid mites of the Malé Karpaty Mts. are partially known only in two papers published by Kalúz (2005) and Fenďa and Ciceková (2005). In addition, all known data from the Malé Karpaty Mts together with the new findings was summarized in monographs of cohors Uropodina (Mašán, 2001) and families Macrochelidae (Mašán, 2003), Zerconidae (Mašán and Fenďa, 2004), Ascidae (Kalúz and Fenďa, 2005), Pachylaelapidae (Mašán, 2007), and Epicriidae (Mašán, 2008).

Study area

Study sites are situated in the zone of oak-hornbeam forests on southeastern slopes of the Malé Karpaty Mts.

The Katarínka Nature Reserve, young forest (48º33' N, 17°32' E, Grid Reference Number of the Databank of the Fauna of Slovakia 7471a, 320 m a.s.l.), 40 to 60 year old oak-hornbeam forest (*Querco–Carpinetum*), economically exploited. Soil distric cambisols, pH = 4.24.

Nature Reserve Katarínka, old forest (48º33' N, 17°32' E, 7471a, 320 m a.s.l.), 80 to 100 year oak forest (*Quercetum*). Soil rendzic leptosols, pH = 6.45.

The more detailed pedological and botanical characteristics of the study sites as well as the climatic conditions in the period of 1999-2002 have been included in the paper by Zlinská et al. (2005).

Methods and material

The study sites were investigated in the period of 1999–2002. The material was collected from April to November by the sifting of leaf litter and the upper part of soil from a 1 m^2 area of land. In addition, the soil samples were taken at irregular intervals. The material was separated using xereclectors of the Moczarski–Winkler's type (Balogh, 1958), and the extracted animals were conserved in 75% ethyl alcohol. The mites were processed to yield microscope slides using chloralhydrate medium Liquid de Swan. The material has been deposited at the Department of Zoology, Faculty of Natural Sciences, Comenius University, Bratislava.

The species dominance (%) was characterized by the scale proposed by Tischler (1949), and the species constancy (%) was expressed by categories in the sense of Schwerdtfeger (1975). The species abundance relationship according to Ludwig and Reynolds (1988) was used to compare the structure of the mite communities [N0 – number of species, N1 – $e^{H'}$ (H' is

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Shannon index), N2 – 1/λ (λ is Simpson index), E1 – Pielou evenness index].

Results and discussion

A total of 13,591 gamasid mites were extracted. Analysis of the material revealed 84 taxa (Table 1). Altogether 58 mite species occurred in the young forest of the Katarínka Nature Reserve (52 taxa and 7126 specimens from 34 sifting samples, and 36 taxa and 431 specimens from 2 additional soil samples). 76 species occurred in the old forest of the Katarínka Nature Reserve (58 taxa and 5569 specimens from 32 sifting samples; 45 taxa and 465 specimens from 3 additional soil samples). On the other hand, higher abundance was recognized in young forest (Table 1).

Smaller weakly sclerotised species are difficult to capture by sifting the forest soil and litter because they are usually killed during the sieving process. In spite of this fact, in forest soil samples we detected 8 species previously not detected by sifting (Table 1, species marked *). In addition, at the old forest site, soil samples with grass rhizosphere were also taken from the forest-steppe zone on the edge of the forest (plateau with ruins of the St. Catherine's monastery). In these samples we found 21 species of mesostigmatid mites. Only in these samples were detected the species *Antennoseius bullitus*, *Asca bicornis*, *Hypoaspis astronomica* and *H. karawaiewi*, *Veigaia planicola*, and *Zercon triangularis* (Table 1, species marked [xe]).

In the material obtained by sifting in the young forest, the eudominant species were *Trichouropoda ovalis* (21.6 %) and *Zercon vacuus* (11.2 %); whereas in the old forest it was *Trichouropoda karawaiewi* (10.7 %) and *Uropoda splendida* (10.3 %). The dominant species were *Pergamasus mediocris* (old: 9.6 %), *Veigaia nemorensis* (old: 9.3 %; young: 9.1 %), *Holoparasitus calcaratus* (old: 8.2 %), *Vulgarogamasus kraepelini* (old: 7.0 %; young: 8.9 %), *Macrocheles montanus* (old: 6.7 %), *Heteroparasitus tirolensis* (young: 8.5 %) and *Pergamasus barbarus* (young: 7.0 %).

The euconstant species were *Holoparasitus calcaratus* (old: 96.9 %; in young forest only 32.3 %), *Pergamasus mediocris* (old: 93.7 %; young: 79.4 %), *Macrocheles montanus* (old: 93.7 %, young: 85.3 %), *Vulgarogamasus kraepelini* (old: 87.5 %; young: 79.4 %), *Heteroparasitus tirolensis* (young: 85.3 %; in old forest only 12.5 %), *Trichouropoda karawaiewi* (old: 84.4 %; in young forest only 2.9 %) and *T. ovalis* (young: 94.1 %; old: 71.8 %), *Zercon vacuus* (old: 84.4 %; young: 64.7 %), *Veigaia nemorensis* (old: 81.2 %; young: 67.6 %), *Uropoda splendida* (old: 78.1 %; young: 79.4 %), *Pergamasus barbarus* (old: 78.1 %; young: 85.3 %), *P. canestrinii* (young: 82.3 %; in old forest only 18.7 %), *Geholaspis longispinosus* (young: 79.4 %; old: 68.7 %), and *Porrhostaspis lunulata* (young: 79.4 %; in old forest only 3.1 %). Almost all these species are widely distributed in Slovakia, except for *Heteroparasitus tirolensis* and *Pergamasus canestrinii* due to insufficient faunistic data. Moreover, *Zercon vacuus* is a typical element of forest litter of western Slovakia, and the Malé Karpaty Mts. are the easternmost border of its occurence in Slovakia (Mašán and Fenďa, 2004; Fenďa and Ciceková, 2005). The species *Sessiluncus hungaricus*, *Trachytes baloghi*, *Trichouropoda elegans*, and *Zercon hungaricus* are typical thermophilic species in Slovakia.

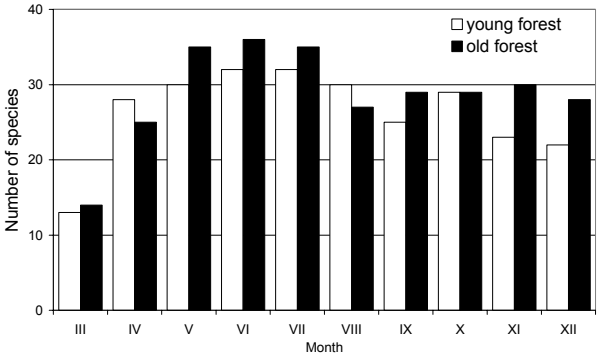

Fig. 1. Species richness of mites in both study sites of the Katarínka Nature Reserve during the years 1999–2002 (material obtained only by sifting).

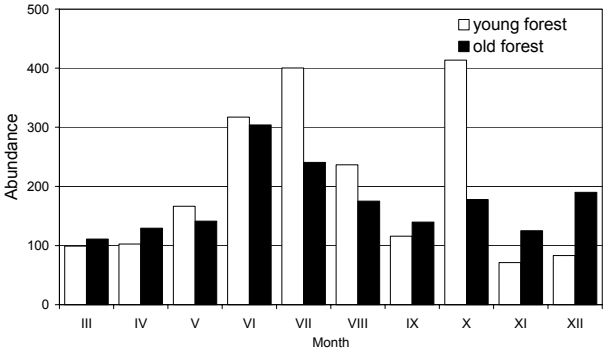

Fig. 2. Abundance of mites in both study sites of the Katarínka Nature Reserve during the years 1999–2002 (material obtained only by sifting).

The species *Eviphis ostrinus*, species of the genus *Hypoaspis*, *Macrocheles carpathicus*, *Geholaspis hortorum*, *Pergamasus theseus*, *Trichouropoda elegans*, species of the genus *Dinychus*, *Uroseius traegardhi* and *Uroobovella obovata* occurred only in the old forest. On the other hand, some members of the family Ascidae occured only in the young forest (Table 1). Other species occurred at both study sites, but they evidently preferred one of them. *Holoparasitus calcaratus* and *Trichouropoda karawaiewi* were more abundant in the old forest; *Heteroparasitus tirolensis*, *Pergamasus canestrinii* and *Porrhostaspis lunulata* were more abundant in litter of the young forest.

A more balanced community occurred at the old forest site (E1 = 0.714, Table 1). That fact was confirmed also by differences in species richness during the years 1999–2002 (Fig. 1) and also by differences in abundance (Fig. 2). The first maximum of abundance was observed in summer (May, June, July) and the second maximum was observed in autumn (October).

Table 1. Survey of mesostigmatid mites in study sites during years 1999-2002. N – number of specimens, PS – number of positive samples, N0 – number of species, N1 – $e^{H'}$ (H' is Shannon index), N2 – 1/λ (λ is Simpson index), E1 – Pielou evenness index. Species marked by * were found only in soil samples; species marked [xe] come from forest-steppe soil samples.

Study sites:	young forest		old forest	
Mites	**N**	**PS**	**N**	**PS**
cohors Antennophorina				
family Celaenopsidae				
Celaenopsis badius (C.L.Koch, 1841)	11	11	15	5
cohors Gamasina				
family Ascidae				
[xe] *Antennoseius bullitus* Karg, 1969	-	-	1	1
Arctoseius brevichelis Karg, 1969	2	2	5	1
Arctoseius eremitus (Berlese, 1918)	2	2	-	-
Arctoseius semiscissus (Berlese, 1892)	2	2	-	-
* *Arctoseius* sp.	1	1	-	-
[xe] *Asca bicornis* (Canestrini et Fanzago, 1887)	-	-	1	1
Lasioseius muricatus (C.L.Koch, 1839)	11	1	9	4
Zerconopsis michaeli Evans et Hyatt, 1960	2	2	-	-
Zerconopsis remiger (Kramer, 1876)	8	5	4	4
family Eviphididae				
Eviphis ostrinus (C.L.Koch, 1836)	-	-	51	11
family Digamasellidae				
Dendrolaelaps sp.	3	1	2	2
family Laelapidae				
Haemogamasus nidi Michael, 1892	2	1	1	1
Hypoaspis aculeifer G. Canestrini, 1884	-	-	61	9
[xe] *Hypoaspis astronomica* (C.L.Koch, 1839)	-	-	4	1
[xe] *Hypoaspis karawaiewi* (Berlese, 1903)	-	-	1	1
Hypoaspis oblonga (Halbert, 1915)	-	-	1	1
Hypoaspis vacua (Michael, 1891)	5	3	10	3
Hypoaspis spp.	7	6	36	12
family Macrochelidae				
Geholaspis hortorum (Berlese, 1904)	-	-	25	12
Geholaspis longispinosus (Kramer, 1876)	126	28	104	23
Macrocheles carpathicus Mašán, 2003	-	-	114	18
Macrocheles glaber (J. Müller, 1859)	3	3	1	1
Macrocheles montanus Willmann, 1951	197	30	376	31
family Pachylaelapidae				
Olopachys suecicus Sellnick, 1950	44	9	48	15
Pachylaelaps magnus (Halbert, 1915)	25	7	26	10
Pachylaelaps spp.	60	14	392	30
Pachyseius humeralis Berlese, 1910	27	4	6	6
Pachyseius wideventris Afifi et Nasr, 1984	-	-	1	1
family Parasitidae				
Amblygamasus sp.	4	2	-	-
Ernogamasus afobeus (Athias-Henriot, 1970)	-	-	5	1
Eugamasus magnus (Kramer, 1876)	-	-	4	4
Heteroparasitus tirolensis (Sellnick, 1968)	604	29	18	4
Holoparasitus calcaratus (C.L.Koch, 1839)	73	13	467	33
* *Leptogamasus suecicus* Trägårdh, 1936	-	-	11	1
Leptogamasus spp.	143	17	163	23
* *Lysigamasus misellus* (Berlese, 1903)	30	1	-	-
Ologamasiphis minimus (Holzmann, 1969)	1	1	87	21
Parasitus loricatus (Wankel, 1861)	-	-	1	1
Pergamasus barbarus Berlese, 1904	433	29	223	25
* *Pergamasus brevicornis* (Berlese, 1903)	-	-	5	1
Pergamasus canestrinii (Berlese, 1884)	347	28	23	6
Pergamasus crassipes (Linnaeus, 1758) sensu Berlese, 1906	131	25	27	5
Pergamasus mediocris (Berlese, 1904)	262	29	523	31
Pergamasus theseus (Berlese, 1903)	-	-	7	4
Poecilochirus necrophori Vitzthum, 1930	-	-	1	1
Porrhostaspis lunulata J. Müller, 1869	172	27	6	1
Vulgarogamasus kraepelini (Berlese, 1904)	682	29	403	29
Vulgarogamasus remberti (Oudemans, 1912)	1	1	-	-
family Phytoseiidae				
Amblyseius spp.	8	6	7	1
family Rhodacaridae				
Cyrtolaelaps mucronatus (G. et R. Canestrini, 1881)	8	3	1	1
* *Rhodacarus* sp.	2	1	1	1
* *Sessiluncus hungaricus* Karg, 1964	-	-	2	1
Stylochirus fimetarius (J. Müller, 1859)	2	2	11	3
Stylochirus sp.	1	1	1	1
family Veigaiaidae				
Veigaia cerva (Kramer, 1876)	115	15	41	14
* *Veigaia exigua* (Berlese, 1917)	1	1	10	2
Veigaia kochi (Trägårdh, 1901)	28	6	2	1
Veigaia nemorensis (C.L.Koch, 1839)	762	25	606	29
[xe] *Veigaia planicola* (Berlese, 1892)	-	-	1	1
family Zerconidae				
Prozercon carpathofimbriatus Mašán et Fenďa, 2004	30	6	11	2
Prozercon tragardhi (Halbert, 1923)	3	2	3	1
Zercon curiosus Trägårdh, 1910	-	-	1	1
Zercon hungaricus Sellnick, 1958	111	14	55	17
Zercon peltatus C.L.Koch, 1836	262	21	47	17
[xe] *Zercon triangularis* C.L.Koch, 1836	-	-	1	1
Zercon vacuus C.L.Koch, 1839	817	23	191	29
cohors Sejina				
family Sejidae				
Sejus togatus C.L.Koch, 1836	42	16	199	24
cohors Uropodina				
family Polyaspidae				
Uroseius traegardhi Hirschmann et Zirngiebl-Nicol, 1969	-	-	2	1
family Trachytidae				
Trachytes aegrota (C.L.Koch, 1841)	63	9	32	5
* *Trachytes baloghi* Hirschmann et Zirngiebl-Nicol, 1969	8	2	3	1
family Trematuridae				
Trichouropoda elegans (Kramer, 1882)	-	-	3	1
Trichouropoda karawaiewi (Berlese, 1904)	1	1	612	28
Trichouropoda obscurasimilis Hirschmann et Zirngiebl-Nicol, 1961	4	3	1	1
Trichouropoda ovalis (C.L.Koch, 1839)	1546	33	251	24
family Urodinychidae				
Dinychus perforatus Kramer, 1886	-	-	1	1
Dinychus woelkei Hirschmann et Zirngiebl-Nicol, 1969	-	-	4	1
Urodiaspis pannonica Willmann, 1951	4	4	1	1
Urodiaspis tecta (Kramer, 1876)	39	12	47	14
Uroobovella obovata (G. Canestrini et Berlese, 1884)	-	-	1	1
family Uropodidae				
Cilliba erlangensis (Hirschmann et Zirngiebl-Nicol, 1969)	1	1	31	10
Discourella modesta (Leonardi, 1899)	3	2	5	2
Uropoda orbicularis (O.F.Müller, 1776)	2	1	-	-
Uropoda splendida Kramer, 1882	272	29	580	27
total individuals / samples	7557	36	6034	35
H'	2.817		3.082	
N0	58		76	
N1	16.73		21.8	
N2	11.07		15.83	
E1	0.693		0.714	

The age of the forest, presence of dead wood and a deep layer of leaf litter, and pedological characteristics like pH or content of humus are important factors for mite assemblages in oak and oak-hornbeam forests in the Malé Karpaty Mts (Fenďa and Ciceková, 2005). The fauna of mesostigmatid mites of oak forests in Slovakia is not markedly rich. Soil humidity is probably one of the most important factors for the species richness and abundance of this group of mites. According to the published data (Fenďa and Ciceková, 2005), the mite communities at the site Lošonec lom quarry, which were regularly impacted by limestone dust from the nearby quarry, were characterised by H' = 2.843, N0 = 64 species, E1 = 0.674, and mite assemblages in the Lošonský háj grove Nature Reserve, where more stable microclimatic conditions were evident, were characterised by H' = 2.922, N0 = 54 species, E1 = 0.717. Our data from the Katarínka Nature Reserve are very similar: young forest H' = 2.817 and E1 = 0.693; old forest H' = 3.082 and E1 = 0.714 (Table 1).

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References

Balogh, J., 1958. Lebensgemeinschaften der Landtiere. Akadémiai Kiadó, Akademie–Verlag, Budapest, Berlin, 560 pp.

Fenďa, P., Ciceková, J., 2005. Soil mites (Acari, Mesostigmata) of oak forests in the Malé Karpaty Mts (W Slovakia). Ekológia (Bratislava), 24 (Suppl.2): 102-112

Kalúz, S., 2005. Pôdne roztoče. In: Majzlan, O. (ed.), Fauna Devínskej Kobyly. APOP edícia, Bratislava, p. 44-55 (in Slovak)

Kalúz, S., Fenďa, P., 2005. Mites (Acari, Mesostigmata) of the family Ascidae of Slovakia. Institute of Zoology, Slovak Academy of Sciences, NOI Press, Bratislava, 168 pp.

Ludwig, J.A., Reynolds, J., 1988. Diversity indices. In: Statistical Ecology. Whiley Interscience Public, New York, p. 85-103

Mašán, P., 2001. Roztoče kohorty Uropodina (Acarina, Mesostigmata) Slovenska. Annotationes Zoologicae et Botanicae (Bratislava), 223, 320 pp. (in Slovak)

Mašán, P., 2003. Macrochelid mites of Slovakia (Acari, Mesostigmata, Macrochelidae). Institute of Zoology, Slovak Academy of Sciences, NOI Press, Bratislava, 149 pp.

Mašán, P., 2007. A review of the family Pachylaelapidae in Slovakia, with systematics and ecology of European species (Acari: Mesostigmata: Eviphidoidea). Institute of Zoology, Slovak Academy of Sciences, NOI Press, Bratislava, 247 pp.

Mašán, P., 2008. The family Epicriidae in Slovakia: annotated faunal synopsis and description of a new species of *Epicrius* (Acari, Mesostigmata, Epicriidae). Zootaxa, 1880: 48-68

Mašán, P., Fenďa, P., 2004. Zerconid mites of Slovakia (Acari, Mesostigmata, Zerconidae). Institute of Zoology, Slovak Academy of Sciences, NOI Press, Bratislava, 238 pp.

Schwerdtfeger, F., 1975. Ökologie der Tiere. Band III – Synökologie. Verlag Paul Parey, Hamburg–Berlin, 451 pp.

Tischler, W., 1949. Grundzüge der terrestrischen Tierökologie. Friedrich Vieweg, Braunschweig, 219 pp.

Zlinská, J., Šomšák, L., Holecová, M., 2005. Ecological characteristics of studied forest communities of an oak-hornbeam tier in SW Slovakia. Ekológia (Bratislava), 24 (Suppl. 2): 3-19