druhú najvyššiu hodnotu abundancie 12,53 jedincov na m^2 na ploche Naháč–Katarínka 2. K ďalším taxónom s vysokými hodnotami priemernej abundancie patrili *Schendyla nemorensis* na ploche Naháč–Katarínka 1 (10,16 ind.m^{-2}), na ploche Horný háj (9,6 ind.m^{-2}) a *Lithobius austriacus* na ploche Naháč–Kukovačník (8,45 ind.m^{-2}). *Schendyla nemorensis* a *Lithobius muticus* môžeme klasifikovať ako eudominantné druhy na všetkých študijných plochách, ich dominancia dosiahla priemernú hodnotu 40%. Na všetkých dendrogramoch zhlukovej analýzy je spoločenstvo na ploche Vinosady oddelené od ostatných na najvyššej hladine nepodobnosti. Príčinou je najnižší počet determinovaných druhov, unikátne zastúpenie *Cryptops anomalans*, absencia *Strigamia acuminata* a najnižší počet nazbieraných exemplárov za 4 roky. Z hľadiska druhovej identity sú na 87% úrovni najpodobnejšie spoločenstvá stonožiek LH – NK 1. Spoločenstvá dvojice FU – HH sú z hľadiska kvalitatívno-kvantitatívneho zloženia najbližšie až s 92% podobnosťou. Väčšina zistených druhov sa vyskytuje počas celého roka. *Strigamia acuminata* a *Lithobius muticus* boli na väčšine lokalít zistené súvisle od marca do novembra. *Schendyla nemorensis*, druh zastúpený na všetkých lokalitách, často absentoval vo vzorkách z letných mesiacov. Charakteristické spoločenstvo stonožiek dubovo-hrabových lesov Malých Karpát je zložené z druhov *Schendyla nemorensis*, *Strigamia acuminata*, *Lithobius agilis*, *L. borealis*, *L. lapidicola*, *L. mutabilis*, *L. muticus*, *L. austriacus*, v južnejších suchších častiach Malých Karpát tiež *Henia illyrica*.

Ekológia (Bratislava) Vol. 24, Supplement 2/2005, p. 143–151

MILLIPEDE COMMUNITIES (Diplopoda) OF OAK-HORNBEAM ECOSYSTEMS (THE MALÉ KARPATY MTS, TRNAVSKÁ PAHORKATINA HILLS, SW SLOVAKIA)

SLAVOMÍR STAŠIOV

Department of Biology and General Ecology, Faculty of Ecology and Environmental Sciences, Technical University, T. G. Masaryka 24, 960 53 Zvolen , The Slovak Republic e-mail: stasiov@vsld.tuzvo.sk

Abstract

Stašiov S.: Millipedes communities (Diplopoda) of oak-hornbeam ecosystems (the Malé Karpaty Mts, Trnavská pahorkatina hills, SW Slovakia). Ekológia (Bratislava), Vol. 24, Supplement 2/2005, p. 143–151.

Millipede communities were studied in ten oak-hornbeam forest localities in the central and northern part of the Malé Karpaty Mts and the Trnavská pahorkatina hills. The research was conducted during the years 1999–2002. Millipedes were sampled using a dry sieve method from the leaf litter within each locality. In total, 3,654 individuals belonging to 18 millipede species were recorded. The records of *Julus curvicornis* are of the highest faunistic importance. It is an endemic species of the West Carpathian region. The westernmost locality of its occurrence was found in the Malé Karpaty Mts. Influence of selected environmental factors on the structure of millipedes communities was discussed.

Key words: Diplopoda, millipedes, Malé Karpaty Mts, Trnavská pahorkatina hills, Slovakia

Introduction

The Malé Karpaty Mts are relatively well-known area of Slovakia concerning the millipede fauna. Data about the millipedes in these mountains were subsequently published by Ortvay (1902), Lang (1933, 1954), Gulička (1955, 1956, 1986), Mišík et al. (1974), Krumpál (1993) and Mock, Janský (2000). Gulička (1986) presented the most comprehensive study with checklist of 30 millipede species from forest communities in the Malé Karpaty Mts Concerning the Trnavská pahorkatina hills, no data about the millipede fauna have been published up to present.

This paper presents the results of the millipede research realized at ten oak-hornbeam forest localities situated in the central and the northern part of the Malé Karpaty Mts and the Trnavská pahorkatina hills.

Material and methods

The research was conducted during four growing seasons (1999–2002) in 10 oak-hornbeam forest localities situated in the central and the northern part of the Malé Karpaty Mts (Cajla, Fúgelka, Lošonský háj grove, Lošonec–lom quarry, Naháč–Katarínka 1, Naháč–Katarínka 2, Naháč–Kukovačník, Vinosady) and in the adjacent Trnavská pahorkatina hills (Horný háj grove, Lindava). This area is situated in western part of Slovakia between the towns Bratislava and Nové Mesto nad Váhom. The altitude varies from 132 m a.s.l. to 768 m a.s.l. These mountains belong to the gently warm climatic zone. From the phytogeographic point of view the mountains belong to the area of West Carpathian flora with dominating forest stands. From the zoogeographic point of view the mountains have been classified into the Subcarpathian district of the deciduous forest province in Eurosiberian subprovince.

The studied localities differed in the age of forest growth, anthropic impact (contamination by calcareous dust), fragmentation (isolated forests localities in the cultural landscape and non-fragmented forest complexes) and also in phytocoenological and pedological parameters. The detailed ecological characteristics of studied localities areas (pedobiology, phytocoenology and climatic conditions) are available in the introduction work of this supplement (Zlinská et al., 2005).

The following list of studied localities involves their acronyms and selected characteristics: geographic coordinates; altitude; exposition; slope; subassociation of potential vegetation; age of forest growth; species composition of forest.

Cajla (CA)
- 48°20' N, 17°16' E; 260–280 m a.s.l.; S; 7°; *Querco-Carpinetum poetosum nemoralis*; 80–100 years; *Carpinus betulus, Quercus dalechampii.*

Vinosady (VI)
- 48°19' N, 17°17' E; 280 m a.s.l.; NW; 5–7°; *Querco-Carpinetum poetosum nemoralis*; 60–80 years; *Acer campestre, Quercus cerris, Q. dalechampii.*

Fúgelka (FU)
- 48°22' N, 17°19' E; 350 m a.s.l.; S; 4°; *Querco-Carpinetum melicetosum uniflorae*; 80–100 years; *Quercus dalechampii.*

Lindava (LI)
- 48°22' N, 17°22' E; 240 m a.s.l.; without exposition; 0°; *Quercetum petrae-cerris*; 80–100 years; *Quercus cerris, Q. dalechampii.*

Horný háj grove (HH)
- 48°29' N, 17°27' E; 240 m a.s.l.; W-SW; 5°; *Querco-Carpinetum melicetosum uniflorae*; 60–80 years; *Carpinus betulus, Fraxinus excelsior, Quercus cerris, Quercus dalechampii.*

Lošonec–lom quarry (LL)
- 48°29' N, 17°23' E; 340 m a.s.l.; SW; 8–10°; *Querco-Carpinetum caricetosum pilosae*; 80–100 years; *Quercus dalechampii.*

Lošonský háj grove (LH)
- 48°28' N, 17°24' E; 260 m a.s.l.; N; 1°; *Querco-Carpinetum caricetosum pilosae*; 80–100 years; *Carpinus betulus, Quercus cerris, Q. dalechampii.*

Naháč–Kukovačník (NA)
- 48°32' N, 17°31' E; 300 m a.s.l.; NE; 2–3°; *Querco petrae-Carpinetum melicetosum uniflorae*; 40–60 years; *Carpinus betulus, Quercus cerris, Q. dalechampii.*

Naháč–Katarínka 1 (NK1)
- 48°33' N, 17°33' E; 340 m a.s.l.; NW; 3–5°; *Querco petrae-Carpinetum melicetosum uniflorae*; 40–60 years; *Carpinus betulus, Quercus dalechampii.*

Naháč–Katarínka 2 (NK2)
- 48°33' N, 17°32' E; 320 m a.s.l.; SE; 45°; *Lithospermo-Quercetum virgilianae*; 80–100 years;, *Acer campestre, Quercus cerris, Q. virgiliana, Tilia cordata.*

Material of millipedes was sampled using a dry sieve method (Wallwork, 1970) from leaf litter. At each locality the sample of leaf litter was taken as 16 random quadrates, each of size 25x25 cm. Thus, in total 1 m^2 of leaf litter was sampled monthly from each study plot. Millipedes were extracted in laboratory from the sieved leaf litter material using a dry extraction in Tullgren xereclectors. The obtained animals were fixed in 70 % ethanol. The material of millipedes is deposed in the collection of author.

The similarity of localities and species was evaluated by hierarchical clustering analyses and by Principal Components Analysis (PCA) based on the mean abundance calculated for all years of investigation. Logarithm transformation (log n+1, n = number of captured individuals) was used before data analysis. Dendrograms of cluster analysis were produced using the software STATISTICA for Windows 5.1. (StatSoft, Inc., 1999) with Complete Linkage and Percent Disagreement clustering algorithm. PCA was carried out on log-transformed millipedes abundance of the different study localities using the software Canoco (ter Braak, Šmilauer, 1998). Scaling was focussed on inter-species correlations. Species scores were divided by the standard deviation, and the data were centred by species. The index of species diversity (H') and the index of species equitability (E) were calculated according to Odum (1971) using ln logarithm.

Results

In total 3,654 individuals of millipedes were obtained during the whole research. Among them 3,038 individuals were determined on the species level, the remaining 616 undetermined individuals involved juveniles and females. In total 18 species from 8 families and 5 orders were recorded from the studied localities (Table 1). The highest species number (14) was found in the localities Horný háj grove (HH) and Naháč–Kukovačník 2 (NK2) (Table 1). The locality Fúgelka (FU) with 8 recorded species and the localities Cajla (CA), Lindava (LI), Lošonec–lom quarry (LL), Vinosady (VI), all with 9 species only were the poorest in species richness. The millipedes *Glomeris hexasticha*, *Cylindroiulus boleti* and *Ommatoiulus sabulosus* were the most frequent species occurring at all studied localities. The species *Trachysphaera costata* (recorded only in one locality), *Glomeris connexa* and *Polyzonium germanicum* (both recorded in 2 localities) were the rarest representatives of these invertebrates in the studied area. In total, the most abundant species were *Cylindroiulus boleti*, *Strongylosoma stigmatosum* and *Ommatoiulus sabulosus* with 690, 456 and 424 sampled individuals, respectively. The lowest numbers of individuals were recorded for *Trachysphaera costata* (1 specimen), *Polyzonium germanicum* (5 specimens) and *Megaphyllum unilineatum* (27 individuals). The highest values of species diversity (H) were recorded at the localities Horný háj grove (HH), Cajla (CA) and Lošonec–lom quarry (LL) (Table 1). The lowest value of this index was recorded at the locality Fúgelka (FU). The highest values of equitability index (E) were recorded at the localities Lošonec–lom quarry (LL), Vinosady (VI) and Lindava (LI). The lowest species equitability was recorded at the locality Fúgelka (FU) (Table 1).

Table 1. Composition of the millipede communities at the studied localities, the summarizing data from 1999–2002: Species spectrum, total number of individual (Σ), Shannon´s index of species diversity (*H'*), index of species equitability (*E*).

Taxon	Locality										Σ
	CA	FU	HH	LI	LH	LL	NK1	NK2	NA	VI	
Glomerida											
Glomeris connexa C. L. Koch, 1847	-	-	2	-	-	-	-	-	-	6	8
Glomeris hexasticha Brandt, 1833	4	2	3	35	5	11	12	7	14	2	95
Trachysphaera costata (Waga, 1857)	-	-	-	-	-	-	1	-	-	-	1
Polyzoniida											
Polyzonium germanicum Brandt, 1837 Julida	-	-	-	-	-	-	1	4	-	-	5
Cylindroiulus boleti (C. L. Koch, 1847)	62	3	98	63	81	42	34	116	124	67	690
Enantiulus nanus (Latzel, 1884)	-	-	65	-	2	-	-	2	-	-	69
Julus curvicornis Verhoeff, 1899	-	-	-	-	-	-	49	151	150	-	350
Kryphioiulus occultus (C. L. Koch, 1847)	-	-	23	6	-	1	-	20	-	-	50
Leptoiulus proximus (Nemec, 1896)	26	71	155	40	56	26	-	11	-	10	395
Megaphyllum projectum (Verhoeff, 1894)	6	-	12	-	1	5	-	0	-	3	27
Megaphyllum unilineatum (C. L. Koch, 1838)	1	-	7	-	-	-	-	5	-	-	13
Ommatoiulus sabulosus (Linnaeus, 1758)	59	1	117	82	26	65	3	1	3	67	424
Unciger foetidus (C. L. Koch, 1838)	27	9	10	2	2	-	13	28	4	-	95
Unciger transsilvanicus (Verhoeff, 1899)	89	-	18	1	1	6	-	-	4	38	157
Chordeumatida											
Haploporatia eremita (Verhoeff, 1909)	-	3	8	2	47	14	6	11	13	-	104
Craspedosoma rawlinsii Leach, 1815	19	-	-	-	5	8	-	3	1	29	65
Polydesmida											
Strongylosoma stigmatosum (Eichwald, 1830)	-	-	3	-	-	-	2	421	30	-	456
Polydesmus complanatus (Linnaeus, 1761)	-	3	1	9	1	-	5	8	3	4	34
Indet. spp.	6	49	33	90	42	43	72	127	140	14	616
Σ Individuals	299	141	555	330	269	221	198	915	486	240	3654
Σ Species	9	8	14	9	11	9	11	14	10	9	18
H'	1.78	0.89	1.9	1.62	1.33	1.74	1.68	1.45	1.4	1.69	-
E	0.46	0.43	0.72	0.74	0.55	0.79	0.7	0.55	0.61	0.77	-

The abbreviations of the localities: CA – Cajla, FU – Fúgelka, HH – Horný háj grove, LI – Lindava, LH – Lošonecký háj grove, LL – Lošonec–lom quarry (LL), NK1 – Naháč–Katarínka 1, NK2 – Naháč–Katarínka 2, NA – Naháč–Kukovačník, VI – Vinosady

Cluster analysis divided localities into two main clusters (Fig. 1). The first of them included the localities Naháč–Katarínka 2 (NK2), Naháč–Kukovačník (NA) and Naháč–Katarínka 1 (NK1). The second comprised the localities Horný háj grove (HH), Lošonský háj grove (LH), Lindava (LI), Fúgelka (FU), Vinosady (VI), Lošonec–lom quarry(LL) and Cajla (CA). Localities from the first cluster were characteristic by relatively low mean height of trees (reaching maximally up to 25 m), whereas within the localities from the second cluster the mean height of trees varied from 25 to 35 m. The most similar localities were Lindava and Fúgelka. In these two localities the lowest values of pH of the leaf litter and the highest values of sorption complex of leaf litter were recorded (Zlinská et al., 2005).

PCA divided localities into four quadrates (Fig. 2). Two quadrates included only one locality, Horný háj grove (HH) and Naháč–Katarínka 2 (NK2), respectively. The third quadrate included two localities Naháč–Katarínka 1 (NK1) and Naháč–Kukovačník (NA). The other localities were situated in the fourth quadrate. The locality Horný háj grove (HH) differed from the others by the lowest value of maximum sorption capacity of leaf litter and the highest value of species diversity (Table 1). Typical species for this locality was *Enantiulus nanus*. The number of individuals of this species collected within this locality represented 94.2% of total catches. The locality Naháč–Katarínka 2 (NK2) was characterized by highest content of nitrogen in leaf litter, the highest values of sorption complex of leaf litter, maximum sorption capacity and maximum degree of sorption complex saturation of soil layers (mineral layer and leaf litter layer), the highest gradient of slope and the highest abundance of individuals. The dominant millipede species from this locality were *Strongylosoma stigmatosum* and *Polyzonium germanicum*. Two localities placed in the third quadrate were typical by the lowest content of carbon and humus in leaf litter and by the lowest mean age of the forest growth, lowest average height of trees and lowest diameter of stems measured in the breast height. Dominant millipede species were *Trachysphaera costata* and *Polydesmus complanatus*.

Discussion

Relatively rich species composition was found out within the set of the studied plots. The number of recorded millipede species represents approximately a quarter of the Slovak millipede fauna. The species spectrum confirms well preserved natural conditions of the studied localities and corresponds with their location at the external border of the West Carpathians. The factors determining relatively rich and unique millipede communities in this area are relatively low elevation (not exceeding 1000 m), presence of large native forest complexes and deep valleys and narrow defiles with inverse microclimate. South-eastern (*Unciger transsilvanicus*, *Strongylosoma stigmatosum*), alpine (*Haploporatia eremita*, *Haasea flavescens* (Latzel, 1884)), Carpathian (*Julus curvicornis*) and also some common millipedes from the C. Europe occur here (Gulička, 1986).

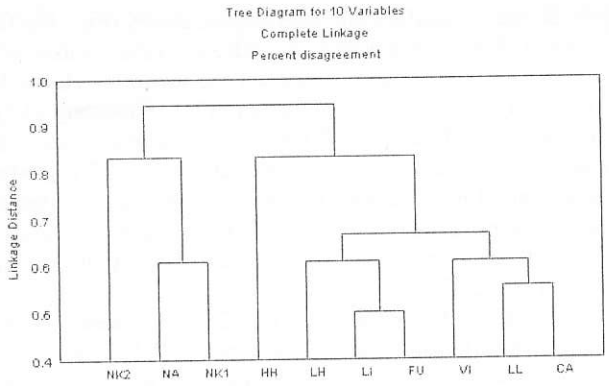

Fig. 1. Cluster analysis of the similarity of localities.

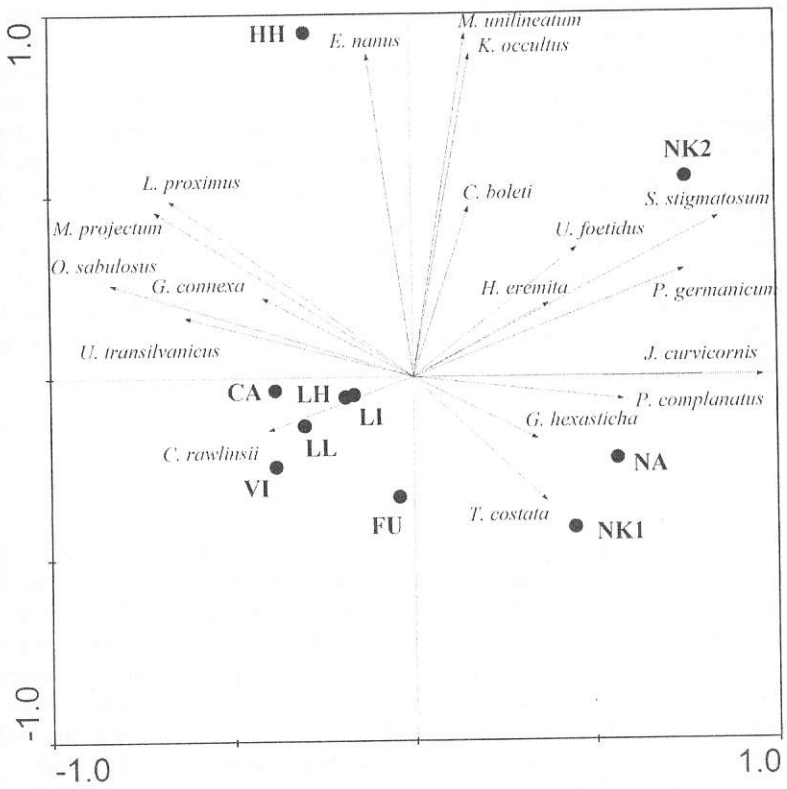

Fig. 2. PCA ordination of millipede species and studied localities. The abbreviations of localities see Table 1. The first two PCA axes $\lambda_1 = 0.458$, $\lambda_2 = 0.192$) explained for 65.1% of the variance of the species data.

The records of the Carpathian endemic species *J. curvicornis* are of the highest faunistic importance. It has been found in this region for the first time. The former westernmost locality of its occurrence was known from the Veľká Fatra Mts (Stašiov, 2002a). These new findings markedly shifted the known western border of its distribution and may indicate its possible occurrence even in the border mountain range between the Czech Republic and Slovakia.

All other recorded species have been already known from the Malé Karpaty Mts, by several authors. The most complex list of the millipede fauna was summarized by Gulička (1986). Author accounted the occurrence of 30 species in this area. Mock, Janský (2000) enriched this list by *Glomeris pustulata* L a t r e i l l e, 1804. Therefore including *Julus curvicornis*, in total 32 millipede species are known from the Malé Karpaty Mts. The occurrence of 14 millipede species was recorded from the Trnavská pahorkatina hills (localities Lindava and Horný háj grove). The ascertained species list is therefore the first information about the millipede fauna of this area.

Dominant occurrence of *Strongylosoma stigomatosum*, *Polyzonium germanicum*, *Unciger foetidus* and *Haploporatia eremita* in the locality Naháč–Katarínka 2 may indicate their preference of habitats with higher humus content. Mentioned locality was also featured by highest slope gradient and the occurrence of lime within the stand, which was not recorded from the other localities. Also these factors could have played deciding role in the shaping of millipede community structure of this locality.

In contradiction, the species *Trachysphaera costata*, *Polydesmus complanatus*, and *Glomeris hexasticha* seem to be more tolerant to lower humus content in the soil, as indicate their dominant occurrence in the localities Naháč–Katarínka 1 and Naháč–Kukovačník. These species could be considered as more tolerant to humidity. The humidity is one of the main factors influencing the humification of detritus and the soil humus contents.

The results of cluster analysis of the similarity of localities showed possible influence of the height of forest growth and also values of pH and sorption complex in leaf litter on the structure of the millipede communities. The tree height could have an indirect effect in the terms of higher litter production (bigger amount of suitable food source for saprophages) by taller trees. Several authors adverted on possible influence of litter properties on the structure of millipede communities. Branquart et al. (1995) studied the influence of environment on terrestrial isopod and millipede communities in oak forest ecosystems in southern Belgium. Authors found out close relationship between investigated communities and type and structure of leaf litter, respectively. Kime (1997) mentioned the potential of millipedes in the biomonitoring of environment properties. He furthermore adverted on the sensitive response of millipedes to the type of soil, form of leaf litter and various climate characteristics. Meyer, Singer (1997) studied millipedes on 6 forest sites in western Austria. They recorded highest epigeic activity of millipedes in mixed forests with mull humus form, in contrast to conifer forests with moder humus form, where the lowest epigeic activity was recorded. Schaefer, Schauermann (1990) investigated the influence of leaf litter on structure and dynamics of soil fauna, including millipedes. They conducted their research in 2 beech forests near Göttingen, Germany. The authors recorded markedly higher biomass of the genus *Glomeris* within the sites with mull humus from. Stašiov (2002b) studied the influence of the leaf litter pH on

millipedes. He conducted his research in 4 beech forest stands in the Kremnické vrchy Mts. He recorded a negative correlation between pH and the epigeic activity of *Polyzonium germanicum*, *Julus curvicornis* and *Mastigona vihorlatica* (A t t e m s, 1899). This correlation may testify the preference of acid detritus by mentioned species. The author has already adverted to positive correlation between values of soil pH and epigeic activity of *Polydesmus complanatus*.

The results from PCA analysis (the allocation of localities and high-affinity species) may indicate possible influence of other investigated factors. Among them the values of sorption complex, maximum sorption capacity of leaf litter, carbon, nitrogen and humus content in the leaf litter, stand composition, age and height of trees and slope inclination, respectively may have important influence on the cenological parameters of millipede communities. The extent of the research did not enable proper evaluation of the effect of mentioned factors on the structure of the millipede communities.

The mentioned factors probably have specific effect on different millipede species. It is still unclear whether the preference of particular biotopes by certain species is influenced strictly only by environment conditions evaluated during this research. Assumed effect of these factors should be topical for future research.

Translated by the author

Acknowledgement

Author thanks A. Mock for help, comments and advices regarding the millipede research in investigated region and M. Svitok for help during the analytical data processing. The research was funded by VEGA grant project No. 1/0119/03.

References

Branquart, É., Kime, R.,D., Dufrêne, M., Tavernier, J., 1995: Macroarthropod-habitat relationships in oak forest in South Belgium. 1. Environments and communities. Pedobiologia, *39*, p. 243–263.

Gulička, J., 1955: Two new species of Diplopoda for Czechoslovakia (in Slovak). Biológia, Bratislava, *10*, p. 367–370.

Gulička, J., 1956: Two Alpines species of Diplopoda in Slovakia (in Slovak). Acta Fac. Rerum. Nat. Univ. Comenianae, Zool., *1*, p. 79–88.

Gulička, J., 1986: Diplopoda of forest communities of the Little Carpathians. In Nosek, J. (ed.): The soil fauna of the Little Carpathians. Results of Research program MAB, Ústav experimentálnej biológie a ekológie SAV, Bratislava, p. 217–224.

Kime, R.D., 1997: Biodiversity and land use with regard to diplopods on some west-European sites. Proccedings of the 10th Int. EIS-Coll., 1995, Saarbrücken, p. 75–82.

Krumpál, M., 1993: Invertebrates (in Slovak). In Bertová, L. (ed.): Karlova Ves. Vlastivedná monografia. Alfa, Bratislava, p. 57–61.

Lang, J., 1933: Contribution to the knowledge of of Czechoslovakian Diplopoda (in Czech). Věst. Král. Spol. Nauk, *2*, p. 1–32.

Lang, J., 1954: Millipedes – Diplopoda (in Czech). Fauna ČSR 2. Nakladatelství ČSAV, Praha, 187 pp.

Meyer, E., Singer, A., 1997: Verteilung, Aktivität und Besiedlungsdichte von Diplopoden in Wäldern Vorarlbergs (Österreich). Ber. Nat.-Med. Verein Innsbruck, *84*,: p. 287–306.

Mišík, M., Gulička, J., Urvichiarová, E., 1974: Devínska Kobyla. Geological conditions, flora and fauna (in Slovak). Obzor, Bratislava, 107 pp.

Mock A., Janský V., 2000: Millipedes (Diplopoda) from Slovakia in the collections of the Slovak National Museum in Bratislava (in Slovak). Acta Rer. Natur. Mus. Nat. Slov., *46*, p. 3–10.

Odum, E.P. 1971. Fundamentals of Ecology, 3rd ed. W. B. Saunders, Philadelphia, 574 pp.

Ortvay, T., 1902: Fauna of Bratislava region and of Bratislava, Trnava, Pezinok, Modra, Svätý Jur cities situated in this region (in Hungarian). Kiadja Pozsonyváros anyagi hozzájárulásával Pozsonyvármegye közönsége. Pozsony (= Bratislava), XVI + 648 pp.

Schaefer, M., Schauermann, J., 1990: The soil fauna of beech forests: comparison between a mull and moder soil. Pedobiologia, *34*, p. 299–314.

Stašiov, S., 2002a: Millipedes (Diplopoda) of Blatnická dolina valley (Veľká Fatra NP, Slovakia) (in Slovak). Matthias Belivs Univ Proc, Banská Bystrica, 2, p. 123–133.

Stašiov, S., 2002b: Selected groups of epigeic macrofauna (Opilionida, Diplopoda and Chilopoda) as indicators of the status of the top soil layer in submontane beech forest (in Slovak). Scientific Studies. Technická univerzita vo Zvolene, Zvolen, 88 pp.

StatSoft, Inc., 1999: Statistica for Windows (Computer program manual). Tulsa.

ter Braak, C.J.F., Šmilauer, P., 1998: CANOCO Reference Manual and User's Guide to Canoco for Windows. Software for Canonical Community Ordination (version 4). Centre of Biometry, Wageningen.

Wallwork, J.A., 1970: Ecology of soil animals. McGraw-Hill Publishing Company Ltd., London, 284 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, p. 3–19.

Received 30. 7. 2005

Stašiov S.: **Mnohonôžky** (Diplopoda) **v dubovo-hrabových ekosystémoch (Malé Karpaty, Trnavská pahorkatina, JZ Slovensko).**

Práca prináša výsledky výskumu zameraného na posúdenie vplyvu viacerých sledovaných faktorov a podmienok prostredia na štruktúru taxocenóz mnohonôžok vo vybraných dubovo-hrabových ekosystémoch situovaných v strednej a severnej časti Malých Karpát a v Trnavskej pahorkatine. Výskum sme bol realizovaný v rokoch 1999 až 2002 kvadrátovou metódou, preosievaním listového opadu a následnou extrakciou živočíchov v Tullgrenových xeroeklektoroch. Celkovo sme na skúmanom území získali 3654 ex. mnohonôžok z 18 druhov z 5 radov. K najvýznamnejším patrí nález západokarpatského endemita *Julus curvicornis* V e r h o e f f, 1899, u ktorého predstavujú Malé Karpaty územie s doposiaľ najzápadnejším zaznamenaným výskytom v rámci jeho areálu. Výsledky výskumu poukázali na možný vplyv viacerých faktorov (priemerný vek a výška porastu, priemerná hrúbka stromov, drevinová skladba porastu, subasociácia potenciálnej vegetácie, sklon svahu, pH, hodnota sorpčného komplexu, maximálna sorpčná kapacita, obsah uhlíka, humusu a dusíka v pokrývkovom humuse, stupňa nasýtenia sorpčného komplexu a obsah humusu v pokrývkovom humuse i v minerálnej pôdnej vrstve) na kvalitatívno-kvantitatívnu štruktúru taxocenóz mnohonôžok v podmienkach dubovo-hrabových lesov.