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Comparison of Myriapoda in beech and spruce forests

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ABSTRACT: Pitfall traps were used to capture 3,550 individuals and 34 species of Myriapoda in five pairs of Norway spruce and beech stands in the Moravskoslezské Beskydy Mts. (Czech Republic). Differences in the occurrence of Chilopoda, Diplopoda and Isopoda on sites with spruce and beech were determined by *F*-test. Diplopoda and Isopoda preferred beech stands and Chilopoda spruce stands. The species *Protracheoniscus politus* (Koch) (Isopoda) indicated a positive relation to beech stands. Among Diplopoda, a strong linkage to beech was seen in *Glomeris hexasticha* (Brandt), while *Julus scandinavius* (Latzel), *Hassea flavescens* (Latzel) and *Brachyiulus bagnalli* (Curtis) tended to prefer the spruce forest environment. The highest variability was found in Chilopoda, of which the species dominating in beech stands are *Cryptops parisi* (Brölemann), *Strigamia acuminata* (Leach) and *Strigamia transsilvanica* (Verhoeff), while *Geophilus flavus* (DeGeer) and *Geophilus insculptus* (Attems) prevail in spruce stands. A wide spectrum of captured species of the order Lithobiomorpha differentiate in their relation to spruce [*Lithobius forficatus* (L.), *L. cyrtopus* Latzel, *L. erythrocephalus* C.L. Koch, *L. tenebrosus* Meinert, *L. austriacus* (Verhoeff), *L. biunguiculatus* (Loksa)] and beech [*Lithobius microps* (Meinert), *L. mutabilis* L. Koch, *L. burzenlandicus* Verhoeff, *L. micropodus* (Matic) and *L. nodulipes* Latzel]. Based on the findings, we can confirm increased incidence in beech forests, although the result is not unambiguous. Therefore, it is necessary to admit that the factor of the main tree species within a stand cannot be used as the single criterion and needs to be supplemented with additional conditions of the natural environment.

Keywords: Chilopoda; Diplopoda; Isopoda; Norway spruce; Beskydy Mts.

Study of natural patterns is an ongoing process that becomes even more significant due to globalization and climate changes. Disturbance of tree layer or species composition of a forest stand affects microclimate, soil conditions as well as fauna (Grgic, Kos 2003; Scheu et. al. 2003; Bardgett, Wardle 2010). Forest management is linked to reactions of forest ecosystems, when changing tree species composition and spatial heterogeneity of stands elicit spatio-temporal development of species diversity and abundance of free-living animals (Wigley, Roberts 1994). In connection with development of new zoocoenoses, migration plays an important role (Hanski 1998). Individual species react differently to direct site changes, depending mainly on the occurring abiotic and biotic factors (Wigley, Roberts 1994). Some authors presented the possibility to use Myriapoda as bioindicators of forest environment and its changes over a relatively short monitoring period (Craston, Trueman 1997; Grgic, Kos 2003; Tuf, Tufova 2008). Grgic and Kos (2003) found marked differences in the abundance of Myriapoda in beech stands (Slovenia), with the highest abundance being observed in young beech stands. At the same time, active migration between sites based on suitability of conditions throughout the year was confirmed. Scheu et al. (2003) reported the increased presence of Chilopoda in a 120-year-old beech stand in northern Germany and also determined a positive relation to thickness and quality of organic matter from litter, which provides better feeding opportunities for decomposers as well as their associated predators.

Representatives of the families Carabidae and Cantharidae and family Chilopoda correlate with

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the occurrence of Lumbricidae and larvae of Diptera (Mycetophilidae and Cecidomyiidae).

Chilopoda are predatory organisms, indirectly influenced by vegetation as it affects the structure, quality and other properties of litter, humus and also undergrowth, where their potential food sources develop (Albert 1982; Fründ 1983; Poser 1990; Schäfer 1990; Schäfer, Schauermann 1990; Schatzmann 1990). Their abundance is reported in the range from 7 indd·m^{-2} (beech mull) to 273 indd·m^{-2} (beech humus) (Auerbach 1951), but also between 1.8 and 648 indd·m^{-2} in beech stands.

Diplopoda and Oniscoidea primarily feed on dead plant material and decomposing organic matter mixed with bacteria, moulds and fungal hyphae (Frankenberger 1959; Hopkin, Read 1992). Their diversity is directly linked to quality and quantity of litter, structure of top soil horizons, parent rock, soil chemistry and moisture (Funke 1971; Scheu, Sprengel 1989; Schaefer 1990; Scheu 1992; Scheu, Poser 1996; Blackburn 2002). The aim of this contribution is to determine the differences in the structure of Myriapoda population living in litter and top humus layers in Norway spruce and beech stands in the mountain area of the Beskydy Mts. (Czech Republic).

MATERIALS AND METHODS

Methodology of research site selection. Localities of the monitoring grid (38 sites) were selected within the altitudinal range of 540–1,220 m a.s.l. on the Smrk and Kněhyně Massif in the Moravskoslezské Beskydy Mts. The idea was to cover as wide spectrum of mezzo-climatic conditions as possible, with trophic conditions ranging from oligobasic soils (Entic Podzols and Podzols) up to eu-mesobasic soils (Cambisols, Leptosols), with a hydric range from soils without hydromorphic characteristics up to soils permanently affected by water (Organosols), with two microecologically markedly different stand types (beech – 11 stands and spruce – 27 stands aged 49–160 years and 60 to 259 years, respectively).

From the monitoring grid of permanent research plots, five pairs of spruce × beech stands located very close to each other were chosen, every pair with comparable altitude, similar exposition and site conditions (Table 1). Selection of these localities was aimed at a comparison of the diversity of Myriapoda coenoses in beech and spruce forest ecosystems.

Natural characteristics. Soil characteristics and soil type were determined from soil pits of 70–120 cm depth excavated on each locality. Content of available nutrients (P, Ca, Mg and K) was assessed by Mehlich III method of soil biochemical analysis and pH/KCl in an accredited laboratory (Laboratoře Morava s.r.o.). The phosphatase activity was determined according to the adapted methodology of Rejšek (1991). The *p*-nitrophenylphosphate (PNP) was used as a substrate; resulting *p*-nitrophenol was determined after incubation by the means of a spectrophotometer. The phosphatase activity was expressed in following units: μg mol PNP·kg^{-1} DM·h^{-1}.

Microclimatic data (T1 – air temperature at 2 m above the soil surface in a forest stand, T2 – soil temperature in A horizon, T3 – soil temperature in B horizon, soil moisture of A and B horizons) were obtained by direct field measurements with Meteo-UNI meteorological stations with VIRRIB sensors (data recording interval: 60 min) between 2008 and 2009 (Table 1).

A phytocoenological survey provided data on stand canopy, degree of herb layer coverage and dominant plant species (Table 1).

Animal sampling. To collect the epigeic fauna, five four-litre pitfall traps filled with 4% formaldehyde were used in each of the stands. The traps were set in lines with 10 m spacing, covered with roofs and checked in six-week intervals in the period from 1st April to 30th October in the years 2007 to 2012. During each collection, a mixed sample was prepared from all five pitfall traps at the locality and preserved in 75% ethanol. Species were determined by Dr. I. H. Tuf and Dr. J. Tufová (Palacký University, Olomouc) and Ing. M. Lazorík (Mendel University in Brno).

Statistical processing. The significance level of the equality of means in two independent samples was tested by a two-sample *T*-test for independent samples, where two basic testing criteria exist for equal and unequal variances. Results of the *F*-test were either rejection or acceptance of the hypothesis on the equality of variance. In the *T*-test, a hypothesis H_0 was set out that if the mean values of the analysed samples are equal, it can be presumed that the mean numbers of the individuals occurring in spruce stands are equal to the numbers of individuals occurring in beech stands. Subsequently, the *T*-test was performed separately for Diplopoda, Chilopoda and Isopoda.

To assess environmental variables that do not differ between structures, but are related to the myriapod turnover, we performed a Canonical Correspondence Analysis (CCA) in CANOCO 4.5

Table 1. Environmental characteristics of pair localities

Locality	Coordinates	Geographic location	Tree		Herbst cover	Dominant species	Age	SoFT	Altitude (m)	Slope (°)	Soil type	Skeleton (%)	Layer (cm)			pH/KCl		T (°C)			Soil moisture (%)		Distance (m)
			species	canopy									L	F	H	A	B	T1	T2	T3	A	B	
3	49°29'02.5"N 18°21'08.7"E	SW	B	98	25	*Calamagrostis arundinacea, Athyrium filix-femina*	66	FA	880	10	CA	1	0_3	3_5	5_9	3.47	3.04	8.12	7.80	7.60	29.43	31.26	289
4	49°29'01.9"N 18°21'23.0"E	E	S	65	45	*Calamagrostis arundinacea*	94	FA	890	5	HP	0	0_2	2_6	6_11	3.02	3.12	8.07	7.70	7.45	27.48	29.09	
12	49°30'57.1"N 18°22'54.4"E	N	B	65	80	*Athyrium filix-femina*	124	FA	835	35	CA	1	0_4	4_5	5_9	x	3.31	8.88	8.21	8.12	32.02	32.98	653
13	49°30'55.0"N 18°22'22.1"E	N	S	96	5	*Dryopteris expansa*	51	FA	850	30	RA	10_15	0_3	3_5	5_12	x	2.78	8.12	7.88	7.52	29.86	35.47	
21	49°28'44.6"N 18°22'43.3"E	SW	B	96	1	*Polytrichum formosum*	110	AF n. st.	730	26	CA	10	0_3	3_5	5_8	3.95	3.05	8.65	8.41	8.35	30.57	30.77	338
22	49°28'36.2"N 18°22'54.0"E	S	S	65	2	*Avenella flexuosa, Vaccinium myrtillus*	65	AF n. st.	695	6_10	CA	0	0_6		6_9	2.97	2.51	–	–	–	–	–	
25	49°29'29.3"N 18°21'00.6"E	W	B	70	30	*Calamagrostis arundinacea*	49	Fac n. st.	870	30	CA	5_10	0_2	2_7	7_14	4.11	x	8.32	8.23	8.00	24.75	25.78	150
26	49°29'27.8"N 18°20'58.1"E	W	S	85	45	*Dryopteris dilatata*	88	Fac n. st.	825	35	RA	30	0_8		8_20	3.00	2.99	8.20	7.94	7.83	24.59	29.52	
35	49°31'09.6'N' 18°19'13.2"E	NE	B	95	95	many species*	42	Ft, Fp	635	10	CA	0	0_2	0	2_7	4.04	x	9.64	8.79	8.61	25.99	29.03	
30	49°31'17.1"N 18°18'57.4"E	N	S	65	65	*Rubus hirtus*	90	Ft, Fp	630	10	CA	0	0_3	3_5	5_12	2.98	2.85	–	–	–	–	–	393

B – beech, S – Norway spruce, FA – Fresh fir beech, AF n. st. – Rich beech fir, Fac n. st. – Maple beech, Ft, Fp – fresh beech, CA – Cambisols, HP – haplic Podzols, RA – Ranker; **Luzula luzuloides, Calamagrostis arundinacea, Carex sylvatica, Poa annua, Rubus hirtus, Prenanthes purpurea, Athyrium filix-femina, Oxalis acetosella, Dentaria bulbifera, Senecio ovatus, Dryopteris expansa, Galeobdolon montanum, Galeopsis pernhofferi*; x – pH was not measured, the soil layer has not been created (ter Braak, Šmilauer 2002). Densities were $\log_{(x+1)}$ transformed and rare species were downweighted. We entered all environmental descriptors, used interspecies distances and Hill's scaling, and extracted the best-fitting seven environmental variables using the forward selection procedure with 999 Monte-Carlo permutations for significance testing.

The data that were shown by the great strength test were subjected to redundancy analysis (RDA). RDA method is a canonical form of the principal component analysis that uses linear regression to determine the maximum response of the dependent data set (samples) to the set of independent data (environmental factors). It results in determination of the maximum linear trends in the analysed data.

RESULTS

Natural environment

All of the localities within this study lie in the flysch zone (sandstones or clay slates), of which the cambic pedogenetic process and podzolization are typical. Oligotrophic localities prevail. Soils are very strongly to extremely acidic (in the surface soil, topsoil horizon A 2.79–5.01 ± 0.52, subsoil horizon B 2.48–3.37 ± 0.27 and in the parent rock horizon C 2.52–4.19 ± 0.41). Sorption complex saturation ranges from very low to low in most of the localities, not exceeding 30%. Phosphatase activity reached 23.5 to 200.6 $\mu g \cdot mol\ PNP \cdot kg^{-1}\ dm \cdot h^{-1}$, overall mean 96.95 ± 35.89 $\mu g \cdot mol\ PNP \cdot kg^{-1}\ dm \cdot h^{-1}$. Cation exchange capacity is on the level of 4.38–28.03 $cmol^{+} \cdot kg^{-1}$; overall mean 14.73 ± 6.21 $cmol^{+} \cdot kg^{-1}$ and the content of exchangeable bases is 0.36–22.51 $cmol^{+} \cdot kg^{-1}$; overall mean 4.35 ± 6.22 $cmol^{+} \cdot kg^{-1}$. Average content of base saturations is 3.6–88.7%.

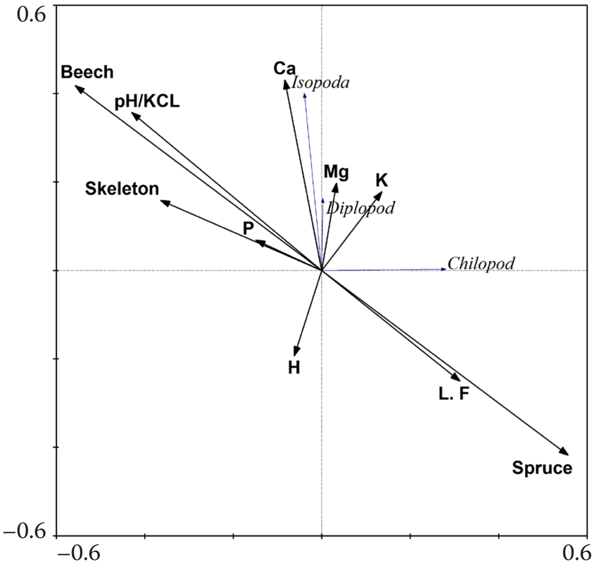

Fig. 1. Comparison of the main environmental variables in the environment of RDA ($F = 2.159$; $P = 0.015$)

L.F – organic soil horizon, layer 0–8 cm; H – secondary organic soil horizon, layer 4–15 cm; P, Ca, Mg, K – major nutrients in the top soil; pH/KCl – pH factor in the soil; Skeleton – average content of soil skeleton in the soil layer

A linear ordination method RDA was used for a comparison of environmental factors and their mutual relationship with spruce- and beech-dominated sites. The first axis of the RDA analysis explained 85.1% and the second axis accumulated 98.4% of the total variance. Results of global permutation tests for the estimation of significance of relationships between species and their environment with RDA, where the trace of all canonical axes is 0.078, which leads to the *F*-ratio of 2.159, and the resulting *P*-value 0.01 indicate that the relationship between the species and their environment is very significant. The factor of organic humus thickness in the top soil layer (Fig. 1) positively proved a correlation with spruce stands, of which the humus accumulation is typical. Besides, pH/KCl indicates higher values (more alkaline) in beech stands. Essential nutrients (P, Ca, Mg and K) in the top soil layer also indicate their higher content in beech stands, only K is slightly increased in spruce stands. By this analysis, we have confirmed the generally accepted processes in spruce and beech stands.

Species diversity

The pitfall traps installed on the monitored localities (2007–2012) captured 3,550 individuals (Diplopoda 405 indd./11 species, Chilopoda 2844/17, Isopoda 301/6). The eudominant Diplopoda were represented by *Glomeris connexa* C.L. Koch (37%), *Leptoiulus trilobatus trilobatus* (Verhoeff) (17.3%), *Polydesmus complanatus* (L.) (15.1%) and *Tachypodoiulus niger* (Leach) (11.6%). *Glomeris verhoeffi fagivora* (Verhoeff) is considered rare. From the viewpoint of occurrence frequency, no significant difference was proved in the presence of individual species between spruce and beech stands (Table 2).

Chilopoda are the most abundant group of Myriapoda with the eudominant representatives being *Lithobius forficatus* (L.) (36.7%), *Lithobius mutabilis* L. Koch) (33.4%) and *Lithobius erythrocephalus* C.L. Koch (17.1%). Despite the species diversity, the subrecedent species (9 species) occupied only an insignificant position (Table 2). The species *Geo-*

Table 2. Myriapoda in beech and spruce forests (pitfall traps, 2007–2012) in pair localities and structure diversity index

Species/Statistics	Abbrev	Locality* (tree species)										Total sum
		3(B)	4(S)	12(B)	13(S)	21(B)	22(S)	25(B)	26(S)	35(B)	3(S)	
Diplopoda												
Brachyiulus bagnalli	Br_bag						7.69					0.25
Cylindroiulus nitidus	Cy_nit			2.38								0.49
Glomeris connexa	Gl_con	7.41		34.52	31.58	57.89	38.46	84.62	23.81	22.22	16.67	37.04
Glomeris hexasticha	Gl_hex			34.52							3.70	7.65
Glomeris verhoeffi fagivora	Gl_verfa									3.70		0.25
Haasea flavescens	Ha_fla										20.37	2.72
Julus scandinavius	Ju_scan	3.70		1.19	15.79				4.76	3.70	25.93	5.19
Leptoiulus trilobatus	Le_tri	25.93	22.73	16.67	36.84	7.89	7.69	8.97	61.90	14.81	7.41	17.28
Ophyiulus pilosus	Oph_pil		4.55			2.63					12.96	2.47
Polydesmus complanatus	P_com	29.63	59.09	1.19	5.26	21.05	30.77			25.93	11.11	15.06
Tachypodoiulus niger	Ta_nig	33.33	13.64	9.52	10.53	10.53	15.38	6.41	9.52	29.63	1.85	11.60
Total		27	44	84	19	38	13	78	21	27	54	405
Chilopoda												
Cryptops parisi	C_par		1.20	1.12	0.36	0.74	0.62	0.36		1.44	0.21	0.60
Geophilus flavus	G_fla				0.36		0.31	0.36	0.47			0.14
Geophilus insculptus	G_inst		0.24									0.04
Lithobius austriacus	L_aus		0.24				7.69					0.91
Lithobius burzenlandicus	L_bur							0.36				0.04
Lithobius biunguiculatus	L_biu		0.24									0.04
Lithobius cyrtopus	L_cyr	11.27	3.61	2.81	5.69	0.74	7.08	8.36	5.61	7.66	7.07	5.91
Lithobius erythrocephalus	L_eryt	9.31	21.15	2.25	26.33	18.45	23.69	12.73	24.77	4.78	16.27	17.09
Lithobius forficatus	L_for	48.53	46.15	35.96	33.81	36.53	16.00	27.64	23.36	34.93	52.46	36.74
Lithobius micropodus	L_mpod									0.48		0.04
Lithobius microps	L-mic	1.96	0.48	2.25	1.42	1.48	1.54		1.87	2.39	1.71	1.41
Lithobius mutabilis	L_mut	26.47	22.84	48.31	28.83	39.48	41.54	44.00	32.24	47.85	21.84	33.40
Lithobius nodulipes	L_nod	1.47	0.48	3.93	1.78	1.11		2.55	2.80			1.16
Lithobius pelidnus	L_pel								1.40		0.43	0.18
Lithobius tenebrosus	L_ten		2.40	0.56					0.93	1.44		0.56
Strigamia acuminata	S_acu	0.98	0.72	2.25	1.42	1.48	1.54	3.64	6.54	0.48	0.21	1.69
Strigamia transsilvanica	S_trans		0.24	0.56								
Total		204	416	178	281	271	325	275	214	209	467	2,844
Isopoda		0	1	66	1	79	0	60	26	10	62	301
Hyloniscus riparius	H_rip			9.09				5.00				2.99
Ligidium germanicum	Li_ger							1.67				0.33
Ligidium hypnorum	L_hyp										1.61	0.33
Porcellio scaber	Pe_scab			1.52								0.33
Protracheoniscus politus	Pr_poli		100.00	83.33		100.00		91.67	100.00	80.00	96.77	94.35
Tracheoniscus ratzeburgi	T_ratb			6.06	100.00			1.67		20.00	1.61	1.66
Statistics												
H'		1.74	1.84	2.22	1.85	1.88	1.87	2.04	2.20	1.82	1.93	
D		0.26	0.24	0.15	0.22	0.19	0.22	0.17	0.14	0.26	0.23	
Evenness		0.67	0.62	0.71	0.66	0.69	0.67	0.71	0.79	0.62	0.63	
Total species		13	19	22	16	15	16	17	16	18	21	
Total sum		231	461	328	301	388	338	413	261	246	583	3,550

Abbrev – abbreviation see Fig. 5, Locality* – see Table 1, B – beech, S – Norway spruce, *H'* – Shannon's index, *D* – Simpson's index

phylus flavus (De Geer), *Lithobius austriacus* (Verhoeff) and *Lithobius pelidnus* Haase were trapped more often in spruce stands (Table 2).

In the limited spectrum of species, Isopoda are represented by *Protracheoniscus politus* (Koch) (94.3%), with a higher number of individuals being trapped in beech than in spruce stands (211:90) (Table 2). The highest species diversity was found on the locality with beech stand aged 124 years (Shannon-Weaver index H' = 2.22 bit, 328 ex., 22 species) (Table 2).

Myriapoda and Isopoda fauna in Norway spruce and beech stands

As the *T*-test failed to confirm the null hypothesis on the equality of means of the variance H_0 ($F = 1.682$, $P = 2.85205$ E-06 $< 0.05\ \alpha$), a *T*-test for unequal variances ($F = -2.242$, $P = 0.01332 < 0.05\ \alpha$) was performed, revealing that the mean values of numbers of individuals in the group of localities with spruce occurrence show a statistically significant difference compared to the mean values of numbers of individuals in the group of localities with beech occurrence. In view of the differences in the groups of Myriapoda estimated by the CCA method, differences were also tested in individual groups of Diplopoda, Chilopoda and Isopoda. A significant difference in the variance of mean values between the sites with beech and spruce stands favouring occurrence in beech stands was found only in Diplopoda (Fig. 2). Variances of mean values found in Chilopoda and Isopoda (Fig. 2) did not confirm the hypothesis that the species trapped in beech and spruce stands come from different initial communities. These results are partially biased due to the irregular distribution of individual species as there were higher numbers of *Protracheoniscus politus* (Koch) individuals found in beech stands. In spruce stands, however, there was higher diversity with the low abundance of individual species.

With the use of canonical correspondence analysis, the first and the second ordination axis explained 86.8% of the total variance (first axis 32.1%, second axis 54.7%). The results of global permutation tests for the estimation of significance of relationships between species and their environment via CCA, where the trace of all canonical axes is 0.635, leading to *F*-ratio 3.485 and the resulting *P*-value 0.001 indicate that the relationship between the species and their environment is very significant ($P < 0.01$). The axes are evenly distributed due to the equal numbers of the monitored stands. The analysis revealed that the Isopoda group (black points), with the dominant species *Protracheoniscus politus* (Koch), is found only in the area closer to the axis of beech, which shows a positive relationship to this tree species in the Beskydy Mts. territory. Of the Diplopoda group (white circles), the most marked is the order Glomerida, where the closest link to beech was found in *Glomeris hexasticha* Brandt. On the other hand, *Julus scandinavius* Latzel, *Hassea flavescens* (Latzel) and *Brachyiulus bagnalli* (Brölemann) incline towards the spruce forest environment. The highest variability was found in the Chilopoda group (triangles), which is also represented by a higher

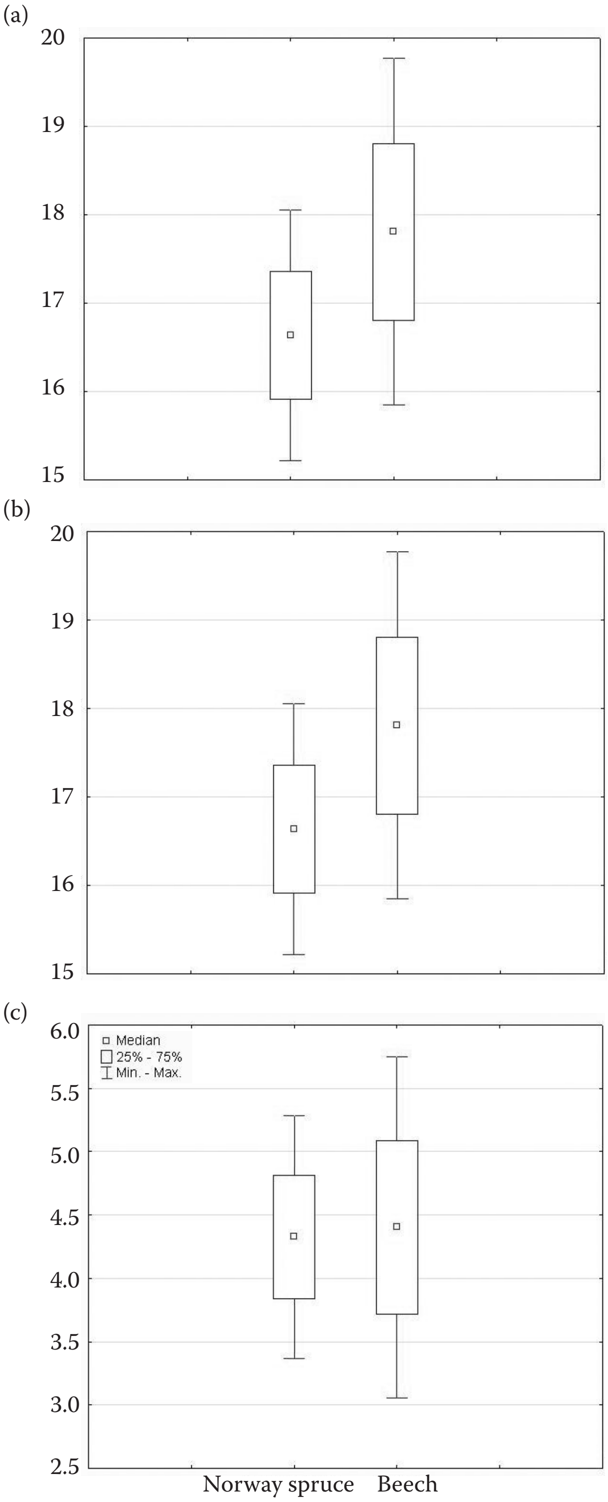

Fig. 2. Abundance of Diplopoda ($F = 5.651$; $P = 0.000$) (a), Chilopoda ($F = 1.068$; $P = 0.275$) (b), Isopoda ($F = 0.088$; $P = 0.928$) and (c) in beech and spruce stands

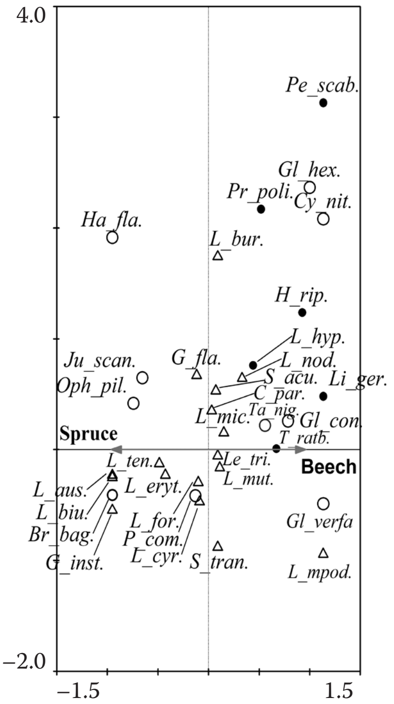

Fig. 5. Results of the CCA and the Myriapoda assemblage with the environmental variables (abbreviations see Table 2)

number of species with different environmental requirements. The only representative of the order Scolopendromorpha, *Cryptops parisi* (Brölemann), is found slightly above the axis of beech. Of the order Geophilomorpha, the species *Geophilus flavus* (DeGeer) and *Geophilus insculptus* (Attems) are linked to spruce stands, while *Strigamia acuminata* (Leach) and *Strigamia transsilvanica* (Verhoeff) to beech stands. In the wide spectrum of the trapped species from the order Lithobiomorpha, preference of spruce was observed in species *Lithobius forficatus* (L.), *L. cyrtopus* Latzel, *L. erythrocephalus* C.L. Koch, *L. tenebrosus* Meinert, *L. austriacus* (Verhoeff) and *L. biunguiculatus* (Loksa) and preference of beech stands in species *Lithobius microps* (Meinert), *L. mutabilis* L. Koch, *L. burzenlandicus* Verhoeff, *L. micropodus* (Matic) and *L. nodulipes* Latzel (Fig. 3).

DISCUSSION

A hypothesis that forest stands affect the epigeic fauna, including Myriapoda as its significant component, via dominant tree species, was tested in selected spruce and beech production stands in the mountain part of the Moravskoslezské Beskydy Mts. Quality and quantity of litter in spruce stands is linked to organic matter accumulation that increases with stand age (Nihlgård 1971; Ulrich 1987, 1994; Kazda, Pichler 1998). This accumulation is due to the high phenol content in coniferous litter, which strongly disadvantages detritivores in habitat colonization (Ulrich, Sumner 1991; Ulrich 1994; Gallet, Lebreton 1995; Lorenz et al. 2000). Beech litter is characterized by a higher content of nutrients; it is especially carbon that contributes to rapid decomposition and positively affects utilization of this environment by fungi, moulds, bacteria up to the predators such as Chilopoda (Maraun, Scheu 1995; Blagodatskaya, Anderson 1998; Schue et al. 2003). Also the overall diversity *H'* of Myriapoda in beech stands was higher than in spruce stands (beech = 3.542 bit, spruce = 3.478 bit). Of the total number of 34 species, six were captured only in spruce stands and nine in beech stands. Significance of these species is lessened by the fact that they were mostly sole catches. On the other hand, some of the eudominant species inhabit both studied ecosystems. Of the Diplopoda class it was *Glomeris connexa* C.L. Koch, *Leptoiulus trilobatus* (Verhoeff), *Polydesmus complanatus* (L.) and *Tachypodoiulus niger* (Leach), representing 81% of the total number of captured individuals. Particularly *Glomeris connexa* C.L. Koch is associated with beech stands (83.3%). In *Leptoiulus trilobatus* (Verhoeff) the numbers were equal (50.0%) and in *Polydesmus complanatus* (L.) it represented only 39.3%, in *Tachypodoiulus niger* (Leach) 72.3% of the overall number of trapped individuals. These results support the previous findings that Diplopoda prefer sites with a sufficient amount of decomposing humus, bacteria, fungi and moulds (Lang 1954; Blower 1985; Hopkin, Read 1992). The observed positive correlation between beech stands with mesotrophic litter and representatives of the families Julidae, Glomeridae and Craspedosomatidae is in agreement with the findings of other authors (Schaefer, Schauermann 1990; David et al. 1993). The prevailing species of the class Chilopoda were *Lithobius cyrtopus* Latzel, *Lithobius erythrocephalus* C.L. Koch, *Lithobius forficatus* (L.) and *Lithobius mutabilis* L. Koch, representing 93.1% of the total number of Chilopoda in the pitfall traps. In contrast to Diplopoda, Chilopoda occurred more often in spruce stands (*Lithobius cyrtopus* 58.9%, *Lithobius erythrocephalus* 75.7%, *Lithobius forficatus* 60.7% and *Lithobius mutabilis* 50.7%). Schue et al. (2003) reported the highest catch of Chilopoda from a beech stand aged 120 years, contrary to our finding in stands of spruce aged 51–94 years (Table 1). This discrepancy may have been caused by a collection method as Schue et al. (2003) applied the method of extraction from soil while we used collection with pitfall traps during the whole vegetation season. Chilopoda are predators with very good mobility and increased resistance to low and high temperatures –7 to +30°C, reacting to a decrease of humidity less sensitively than Diplopoda and Isopoda. Blower (1955) pointed out the importance of integument permeability linked to the limited colonization of waterlogged sites as a result of the worse management of water uptake through endodermis. Due to this, during wet periods of the year, some Chilopoda hide under the bark of fallen trees or in some other well-drained places (Barber 2004). The class Isopoda was represented by the species *Protracheoniscus politus* (Koch) (95.3%), of which 69.4% were found in beech stands, which corresponds to the results of Schue et al. (2003). Isopoda prefer decomposing material with a low content of the phenol component in their diet (Neuhauser, Hartenstein 1978); this corresponds to our results showing its low occurrence in spruce stands. By confrontation of the Myriapoda fauna in spruce and beech ecosystems we were able to confirm that Diplopoda and Isopoda are strongly linked to an environment providing a sufficient amount of decomposing organic matter and a good moisture situation. On the other hand, we found out that Lithobiomorpha do not depend so closely on the site moisture and quality of decomposing organic matter, but are limited by food supply, reacting rapidly to its changes and migrating to other sites.

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