

Contribution to the knowledge of the millipede fauna (Diplopoda) of the Bohemian Forest, Czech Republic

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Abstract

The first data about the millipede (Diplopoda) fauna on the territory of the Bohemian Forest (= the Šumava Mts.) come from the end of the 19th century. Although these soil invertebrates were studied in the Bohemian and Bavarian Forests by several zoologists, there is no paper summarizing data about these animals from this whole mountain area. Concerning the Bohemian Forest, historical literary data about the occurrence of 21 species of millipedes are available. Field research realized in the 1980s and 1990s brought further faunistic records. Cenological studies aimed at the spruce forest growths of the upper parts of the mountains showed specific composition of millipede fauna characterized by low densities as well as low numbers of species. The presence of the millipedes *Haasea germanica*, *Haasea flavescens*, *Mycogona germanica* and *Polydesmus denticulatus* showed to be characteristic for the most of the studied spruce forest sites. In total 26 species of millipedes are known from the Bohemian Forest at the present time.

Key words: millipedes, history of research, faunistic, ecological notes, specific species composition

INTRODUCTION

The territory of the Bohemian Forest (= the Šumava Mountains) and the Bavarian Forest was repeatedly visited by the millipede specialists since the end of the 19th century. Majority of the literary data is connected with the activities of the German zoologist VERHOEFF (1901, 1927, 1934). He studied millipedes above all in the Bavarian Forest, the German part of this mountain complex, but partly also in the Bohemian Forest. Unfortunately systematic research on millipedes in the Bohemian Forest was not realized up to the present time and no paper summarizing data about the millipede fauna is available. Further informations about the occurrence of millipede species in several parts of this region were collected subsequently in the 1980s and 1990s in the frame of several faunistic and ecological projects. More complex cenological data were obtained in the last years in the frame of the research projects undertaken by the Institute of Soil Biology AS CR. All available data about the millipede fauna from the territory of the Bohemian Forest, both historical literary data as well as new faunistic records are summarized in this contribution.

HISTORY OF THE FAUNISTIC RESEARCH

The first records of the millipedes from the Bohemian Forest were published by ROSICKÝ (1876). He mentioned the occurrence of six species. Nevertheless, only three of them (*Glomeris hexasticha*, *Glomeris connexa* and *Polydesmus complanatus*) can be considered as valid records. The others represent dubious data or misidentifications. K.W. Verhoeff started to

study the millipede fauna at the beginning of the 20th century both in the Bavarian and Bohemian Forests. In the first paper (VERHOEFF 1901) he described the new species *Haasea pinivaga* based on the samples from the neighbouring of the Čertovo Lake (Teufelssee). In the 1920s he continued in the sampling also in the Bohemian Forest, above all at the Pajrek ruin (Beiereck) near Nýrsko and at Železná Ruda (Eisenstein) (VERHOEFF 1927). Lately he mentioned several further faunistic records without precise localization (VERHOEFF 1934). In total, he noted 13 species for the whole Bohemian Forest and 34 species for the Bavarian Forest including the foothills down to the Danube River. Already at that time, he referred to the specificity of the millipede fauna of these mountains and its dissimilarity to other Central European mountains. Verhoeff characterized the fauna as poor in species as well as in their population

Table 1. Millipedes (Diplopoda) recorded at the territory of the Bohemian Forest. Literary data and data from the recent research. 1 – ROSICKÝ (1876), 2 – VERHOEFF (1901), 3 – VERHOEFF (1927), 4 – LANG (1933), 5 – VERHOEFF (1934), 6 – SCHUBART (1934), 7 – ATTEMS (1949), 8 – LANG (1954), 9 – LANG (1959), 10 – GULICKÁ (1985), 11 – RŮŽICKÁ (1988), 12 – TAJOVSKÝ (1992).

Taxon:	Literary data														Recent data
	1	2	3	4	5	6	7	8	9	10	11	12	Total		
<i>Polyxenus lagurus</i>	-	-	-	-	-	-	-	+	-	-	-	-	+	-	
<i>Glomeris connexa</i>	+	-	-	-	-	-	-	-	-	-	-	-	+	-	
<i>Glomeris hexasticha</i>	+	-	+	+	-	-	+	+	-	-	-	-	+	+	
<i>Glomeris undulata</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	-	
<i>Glomeris verhoeffi fagivora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
<i>Haploporatia eremita</i>	-	-	-	-	+	-	-	-	-	-	-	-	+	-	
<i>Mastigona mutabilis</i>	-	-	-	-	-	-	-	-	-	+	-	-	+	-	
<i>Mastigophorophyllon saxonicum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
<i>Haasea flavescens</i>	-	-	+	-	-	+	+	+	-	-	-	-	+	+	
<i>Haasea germanica</i>	-	-	-	-	+	+	-	-	-	-	-	-	+	+	
<i>Haasea pinivaga</i>	-	+	-	-	+	+	+	-	+	+	-	-	+	-	
<i>Listrocheiritium septentrionale</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
<i>Mycogona germanica</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	+	
<i>Nemasoma varicorne</i>	-	-	-	-	-	+	-	-	-	-	-	-	+	+	
<i>Choneiulus palmatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
<i>Enantiulus nanus</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	+	
<i>Julus scandinavus</i>	-	-	-	+	-	-	-	-	-	-	-	-	+	-	
<i>Leptoiulus marcomannus</i>	-	-	+	-	+	+	-	+	-	-	-	-	+	+	
<i>Leptoiulus montivagus</i>	-	-	-	-	-	-	-	-	-	-	+	+	+	+	
<i>Megaphyllum projectum</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	+	
<i>Megaphyllum unilineatum</i>	-	-	-	-	-	-	+	-	-	-	-	-	+	-	
<i>Pachypodoiulus eurypus</i>	-	-	-	-	-	-	-	-	-	+	-	-	+	+	
<i>Unciger foetidus</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	-	
<i>Strongylosoma stigmatosum</i>	-	-	+	-	-	-	-	-	-	-	-	-	+	-	
<i>Polydesmus complanatus</i>	+	-	+	+	-	-	-	+	-	-	-	-	+	+	
<i>Polydesmus denticulatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	
Total number of species (26):	3	1	10	3	4	5	4	5	1	3	1	1	21	16	

densities. SCHUBART (1934) and ATTEMS (1949) repeated some Verhoeff's faunistic data and completed the list by two other species (*Nemasona varicornis* and *Megaphyllum unilineatum*). LANG (1933, 1954, 1959) recapitulated only the old records published by ROSICKÝ (1876) and SCHUBART (1934). He did not know evidently the contributions published by VERHOEFF (1901, 1927). GULIČKA (1985) added to the list two other species (*Mastigona mutabilis* and *Pachypodoiulus euryptus*) from the Boubínský Prales National Nature Reserve (Kubany Wald). RŮŽIČKA (1988) and TAJOVSKÝ (1992) recorded *Leptoilulus montivagus* from these mountains. In total the literary sources involve data about 21 species known from the Bohemian Forest (Table 1).

RECENT RESEARCH

Faunistic research realized in the 1980s and 1990s brought further information on the millipede fauna in some sites of these mountains. Besides individual sampling, pitfall trapping was used for completion of the knowledge about the distribution of millipedes in natural forest sites and in some specific habitats like rock and stony debris. Faunistic research was concentrated above all at the localities Plešné Lake (faunistic square code 7249), the Luč Mt. (7351), the Vydra (6947) and Křemelná (6846) Rivers valleys, the Boubín Mt. (7048), the Smrčina Mt. (7249) and the neighbouring of Březník (Studená Hora Mt., Roklanský Potok stream, Ptačí Nádrž reservoir – all 7046, and Malá Mokrůvka Mt. – 7047). Pitfall traps with different sampling periods were subsequently exposed at several localities of the debris character (Buzošná – 6847, Křemelná – 6846, Luč at Loučovice – 7351, Plešné Lake – 7249, Vydra River – 6947). At the locality Luč (7351), a detail monitoring of soil invertebrates has been realized during the years 1995–1997. In the frame of the cenological research on soil fauna undertaken by the Institute of Soil Biology AS CR, millipedes were sampled in spruce forests by pitfall trapping and soil sampling in the localities Boubín (7048) in 1992–1993 and repeatedly in 2000–2001, Smrčina Mt. (7249) in 1997–2001, Plechý Mt. (7249) in 2000–2001 and in the surrounding of Březník during the years 1999–2001. Further data were recorded by individual sampling in above mentioned localities and at Antýgl (6947), Jasánky (7350), Křemelná (6846), Ramajzl (6847) and Zátoň (7048).

LIST OF THE SPECIES

Both, literary data and new records are listed here. In total 2338 individuals were sampled and determined, their numbers for individual species are given in brackets. Further 270 juvenile individuals (mostly representatives of the genera *Haasea* and *Leptoilulus*) were not determined to the species level and therefore they are not included into this list. Explanation of the used abbreviations: m – males, jm – juvenile males, f – females, jf – juvenile females, j – juveniles.

Order Polyxenida

Family Polyxenidae

Polyxenus lagurus (Linnaeus, 1758)

Literary data: LANG (1954): Prášíly, Modrava.

Order Glomerida

Family Glomeridae

Glomeris connexa C. L. Koch, 1847

Literary data: ROSICKÝ (1876) (syn. *Glomeris tetrasticha*): Kašperské Hory.

Glomeris hexasticha Brandt, 1833

Literary data: ROSICKÝ (1876): Eisenstein – Železná Ruda; VERHOEFF (1927): Böhmisches Eisenstein – Železná Ruda, Beiereck b. Neuren – Pajrek nr. Nýrsko; LANG (1933): Eisenstein; ATTEMS (1949): Böhmerwald; LANG (1954): Železná Ruda.

New records: Jasánky – wet forest (1m, 1f); Křemelná River valey (1f); Zátoň – military bunker in the margin of spruce plantation (1m).

Glomeris undulata C.L. Koch, 1844

Literary data: VERHOEFF (1927) (syn. *Glomeris conspersa*): Beiereck b. Neuren – Pajrek nr. Nýrsko.

Glomeris verhoeffi fagivora (Verhoeff, 1906)

New records: Buzošná, pitfall trapping in stony debris (1m); Ramajzl, military bunker in the grey alder woodland (1m).

Order Chorodeumatida

Family Mastigophorophyllidae

Haploporatia eremita (Verhoeff, 1909)

Literary data: VERHOEFF (1934): Bayrisch–Böhmischer Wald – without precise localization.

Mastigona mutabilis (Latzel, 1884)

Literary data: GULIČKA (1985): Boubínský Prales. This species is also known from the Šumavské Podhůří highland (TAJOVSKÝ 1993), therefore its occurrence in the Bohemian Forest foothills is highly presumable.

Mastigophorophyllon saxonicum Verhoeff, 1910

New records: Buzošná, pitfall trapping in stony debris (1m).

Family Haaseidae

Haasea flavescens (Latzel, 1884)

Literary data: VERHOEFF (1927): Beiereck b. Neuren – Pajrek nr. Nýrsko; SCHUBART (1934): Böhmerwald, Laka–Berg – Plesná Mt.; ATTEMS (1949): Böhmerwald; LANG (1954): Šumava – without precise localization.

New records: Boubín Mt., spruce forests on W–SW slope (7m), pitfall trapping (5m, 3f); Březník, spruce forests, pitfall trapping (97m, 8jm, 86f, 27jf), soil sampling (3m, 17jm, 10f, 9jf); Plechý Mt., soil sampling in spruce forest (1m, 1f, 12jf); Smrčina Mt., pitfall trapping in spruce forest (8m, 1f).

Haasea germanica (Verhoeff, 1901)

Literary data: VERHOEFF (1934): Bayrisch–Böhmischer Wald – without precise localization. New records: Boubín Mt., spruce forests on W–SW slope (5m), pitfall trapping (11m, 13f), soil sampling (1m, 2f); Březník, spruce forests, pitfall trapping (76m, 14jm, 41f, 6jf), soil sampling (6m, 13jm, 8f); Luč, pitfall trapping in stony debris (1f), pitfall trapping in coniferous ravine forest (1m, 1f); Plechý Mt., soil sampling in spruce forest (4m); Smrčina Mt., pitfall trapping in spruce forest (6m, 2f), pitfall trapping in beech forest (1f).

Haasea pinivaga (Verhoeff, 1901)

Literary data: VERHOEFF (1901): Teufelssee – Čertovo Lake – locus typicus. All other papers repeated only this first record: VERHOEFF (1934): Bayrisch–Böhmischer Wald – without precise localization; SCHUBART (1934): Böhmer Wald, Teufelssee; ATTEMS (1949): Teufelssee in Bayrisch–Böhmischer Wald; LANG (1959): Šumava – without precise localization; GULIČKA (1985): Teufelssee.

Family Craspedosomatidae

Listrocheiritium septentrionale Gulička, 1965

New records: Luč, pitfall trapping in stony debris (1m), pitfall trapping in coniferous ravine forest (6m, 7f, 5jf).

Family Chordeumatidae

Mycogona germanica (Verhoeff, 1892)

Literary data: VERHOEFF (1927): Eisenstein, Beiereck b. Neuren – Pajrek nr. Nýrsko; SCHUBART (1934): Böhmer Wald – without precise localization.

New records: Antýgl (3m, 1f, 4jf); Boubín Mt., spruce forests on W–SW slope (3m, 2f), pitfall trapping (59m, 3jm, 34f, 9jf, 6j), soil sampling (1m, 1jm, 5jf, 3j); Březník, spruce forests, pitfall trapping (332m, 7jm, 166f, 38jf, 22j), soil sampling (13m, 5jm, 11f, 6jf, 8j); Buzošná, pitfall trapping in stony debris (2f); Křemelná River valey (1f); Luč, pitfall trapping in coniferous ravine forest (2m, 2f, 2jf); Plechý Mt., soil sampling in spruce forest (1m, 1f, 2jf, 2j); Smrčina Mt., pitfall trapping in spruce forest (37m, 2jm, 25f, 3jf), pitfall trapping in beech forest (43m, 11f, 1jf).

Order Julida

Family Nemasomatidae

Nemasoma varicorne (C.L. Koch, 1847)

Literary data: SCHUBART (1934): Böhmer Wald – without precise localization.

New records: Boubín Mt., spruce forests on W–SW slope (1f); Smrčina Mt., pitfall trapping in beech forest (1f, 1j).

Family Blaniulidae

Choneiulus palmatus (Němec, 1895)

New records: Plešné Lake (4f, 8j).

Family Julidae

Enantiulus nanus (Latzel, 1884)

Literary data: VERHOEFF (1927): Beiereck b. Neuren – Pajrek nr. Nýrsko.

New records: Antýgl (4m, 2jm, 22f, 5jf).

Julus scandinavius Latzel, 1884

Literary data: LANG (1933): Eisenstein – questionable record.

Leptoiulus marcomannius Verhoeff, 1913

Literary data: VERHOEFF (1927): Beiereck b. Neuren – Pajrek nr. Nýrsko; VERHOEFF (1934): Bayrisch–Böhmischer Wald – without precise localization; SCHUBART (1934): Böhmer Wald, Beiereck, Laka Berg – Plesná Mt.; LANG (1954): Šumava – without precise localization.

New records: Antýgl (1m); Křemelná River valey (1m, 1f); Luč, pitfall trapping in stony debris (2m, 1f), pitfall trapping in coniferous ravine forest (16m, 3jm, 19f, 7jf).

Leptoiulus montivagus Latzel, 1884

Literary data: RUŽIČKA (1988): Vydra River valey, stony debris; TAJOVSKÝ (1992): Vydra River valey, stony debris.

New records: Buzošná – pitfall trapping in stony debris (2m, 2f, 1jf).

Megaphyllum projectum (Verhoeff, 1894)

Literary data: VERHOEFF (1927): Beiereck b. Neuren – Pajrek nr. Nýrsko.

New records: Luč, coniferous ravine forest (1jm).

Megaphyllum unilineatum (C.L. Koch, 1838)

Literary data: ATTEMS (1949): Böhmischer Wald.

Pachypodoiulus eurypus (Attems, 1895)

Literary data: GULIČKA (1985); Boubínský Prales.

New records: Buzošná, pitfall trapping in stony debris (1m, 1jm, 1f, 1jf).

Unciger foetidus (C.L. Koch, 1838)

Literary data: VERHOEFF (1927); Beiereck b. Neuren – Pajrek nr. Nýrsko.

Order Polydesmida

Family Paradoxosomatidae

Strongylosoma stigmatosum (Eichwald, 1830)

Literary data: VERHOEFF (1927); Beiereck b. Neuren – Pajrek nr. Nýrsko.

Family Polydesmidae

Polydesmus complanatus (Linnaeus, 1761)

Literary data: ROSICKÝ (1876): Šumava – without precise localization; VERHOEFF (1927); Beiereck b. Neuren – Pajrek nr. Nýrsko; LANG (1933, 1954): Šumava – without precise localization.

New records: Březník, spruce forests, pitfall trapping (2jm); Buzošná, pitfall trapping in stony debris (1f); Luč, coniferous ravine forest (1f), pitfall trapping (4m, 2f, 2jf).

Polydesmus denticulatus C.L. Koch, 1847

New records: Antýgl (1jm, 2f); Březník, spruce forests, pitfall trapping (175m, 70jm, 172f, 61jf, 1j), soil sampling (17m, 77jm, 34f, 115jf, 71j); Buzošná, pitfall trapping in stony debris (1m); Luč, pitfall trapping in stony debris (2m), coniferous ravine forest (1f), pitfall trapping (2m, 1jm, 1f, 2jf); Smrčina Mt., pitfall trapping in spruce forest (1f).

DISCUSSION

The recently elaborated material from individual sampling, pitfall trapping and soil sampling involved in total 16 species of millipedes. Together with literary data, 26 species are known from the Bohemian Forest. The records of *Glomeris verhoefi fagivora*, *Mastigophorophyllon saxonicum*, *Listrocheiritium septentrionale*, *Choneiulus palmatus* and *Polydesmus denticulatus* are new for the fauna of these mountains. *Listrocheiritium septentrionale* represents an endemic species characteristic for uplands and foothills of the Hercynian part of Central Europe. *Polydesmus denticulatus* was found at Smrčina and Luč and frequently at many forest sites near Březník. It is known from a wide spectrum of habitats and is characteristic for the natural spruce climax forests in this region.

The species *Haasea pinivaga*, *Haasea germanica*, *Leptoilulus marcomannius* and *Leptoilulus montivagus* were listed by VERHOEFF (1927) as endemic for the Bavarian and Bohemian Forests, but according to the recent knowledge of their distribution they are not. *Haasea germanica* is widely distributed in South Bohemia (TAJOVSKÝ 1993) and in the Ore Mts. (LANG 1967) and adjacent territories. The validity of the species *Haasea pinivaga* was questioned already in the 1930s by SCHUBART (1934). While *Haasea flavescens* was frequently monitored at many studied localities, no specimen of *Haasea pinivaga* has been sampled since the time of its description.

Cenological studies at the climax spruce forests of the upper parts of the Bohemian Forest (Boubín, Smrčina, Březník) showed specific composition of millipede fauna characterized by low densities as well as low number of species. *Haasea germanica*, *Haasea flavescens*, *Mycogona germanica* and *Polydesmus denticulatus* represent characteristic species composition of the most of the studied ecosystems. This community structure is not known from any other

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