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Diplopoda and Chilopoda from a special protection area in the Huy mountain range in Saxony-Anhalt, Germany

Karin VOIGTLÄNDER and Peter DECKER

Senckenberg Museum of Natural History Görlitz, P.O. Box 300154, 02806 Görlitz, Germany; e-mail: karin.voigtlaender@senckenberg.de, peter.decker@senckenberg.de

Abstract: In the Natura 2000 Habitats Directive site "Huy nördlich Halberstadt" in Saxony-Anhalt, Germany, 11 sites with typical regional plant associations (2 rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi, 2 semi-natural dry grasslands and scrubland facies on calcareous substrates, 3 Asperulo-Fagetum beech forests, 1 Medio-European limestone beech forest of the Cephalanthero-Fagion and 3 Galio-Carpinetum oak-hornbeam forests) were sampled for millipedes and centipedes using pitfall traps over a period of one and a half years. In addition 11 further sites and different microhabitats were investigated using hand sampling, soil cores and sieving. With a total of 30 diplopod and 17 chilopod species, the Huy can be classified as markedly species rich. The community structures and species compositions were of special importance and characteristic for all sites. Ecologically notable species were *Ophiodesmus albonanus* (Latzel, 1895), *Megaphyllum unilineatum* (C.L. Koch 1838), *Brachyiulus pusillus* (Leach, 1814), *Mycogona germanica* (Verhoeff, 1892), *Polyxenus lagurus* Linne, 1758, *Geophilus electricus* (Linné, 1758), *Lithobius nodulipes* Latzel, 1880 and *Lithobius pelidnus* Haase, 1880.

Key words: millipedes, centipedes, ecology, grassland, beech forest, Natura 2000 site

INTRODUCTION

The Natura 2000 site (Habitats Directive, Fauna Flora Habitat – FFH) "Huy nördlich Halberstadt" is a mountain range located 12 km northwest of Halberstadt within the protected landscape area "Huy" (Fig. 1). It has an east-west length of 12 km and a north-south width of about 3 km with a total area of 2,005 ha. The altitude of this largely closed and insular woodland area ranges from 190 to 310 m above sea level.

The Huy consists primarily of limestone layers, bunter and siltstone. The predominant soil types are Lessivés and Pararendzina. Woodruff-beech woods and oak-hornbeam coppices are typical. Shrub and coppice forests are preserved particularly on exposed hilltops and slopes, They clearly represent the transition to warmer and more open areas. Hillsides are often covered by dry and mesoxeric meadows.

Because of its high nature protection value, very intensive investigations of many animal taxa ranging from higher vertebrates to insects and many other invertebrates have been carried out by the State Office for Environmental Protection Saxony-Anhalt over several years (Landesamt für Umweltschutz Sachsen-Anhalt 2014 – LAU, in press). In the context of this initiative, the dipolopod and chilopod faunas were also studied. Since the 1990s both groups have been part of the standard investigation program initiated by the LAU.

INVESTIGATION SITES

In the Huy area, 11 different sites for investigation with plant associations typical of this mountain range were selected for pitfall trapping (Fig. 1). A detailed description of these sites can be found in LAU (in press).

Summary of the characteristics of the sites studied (coordinates as WGS84 decimal degrees):

- Huy 1: Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi, 51.954834° N 11.059753° E; 215 m a.s.l.
- Huy 2: Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi, 51.957301° N 11.053472° E; 220 m a.s.l.
- Huy 3: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), 51.949935° N 10.974578° E; 220 m a.s.l.

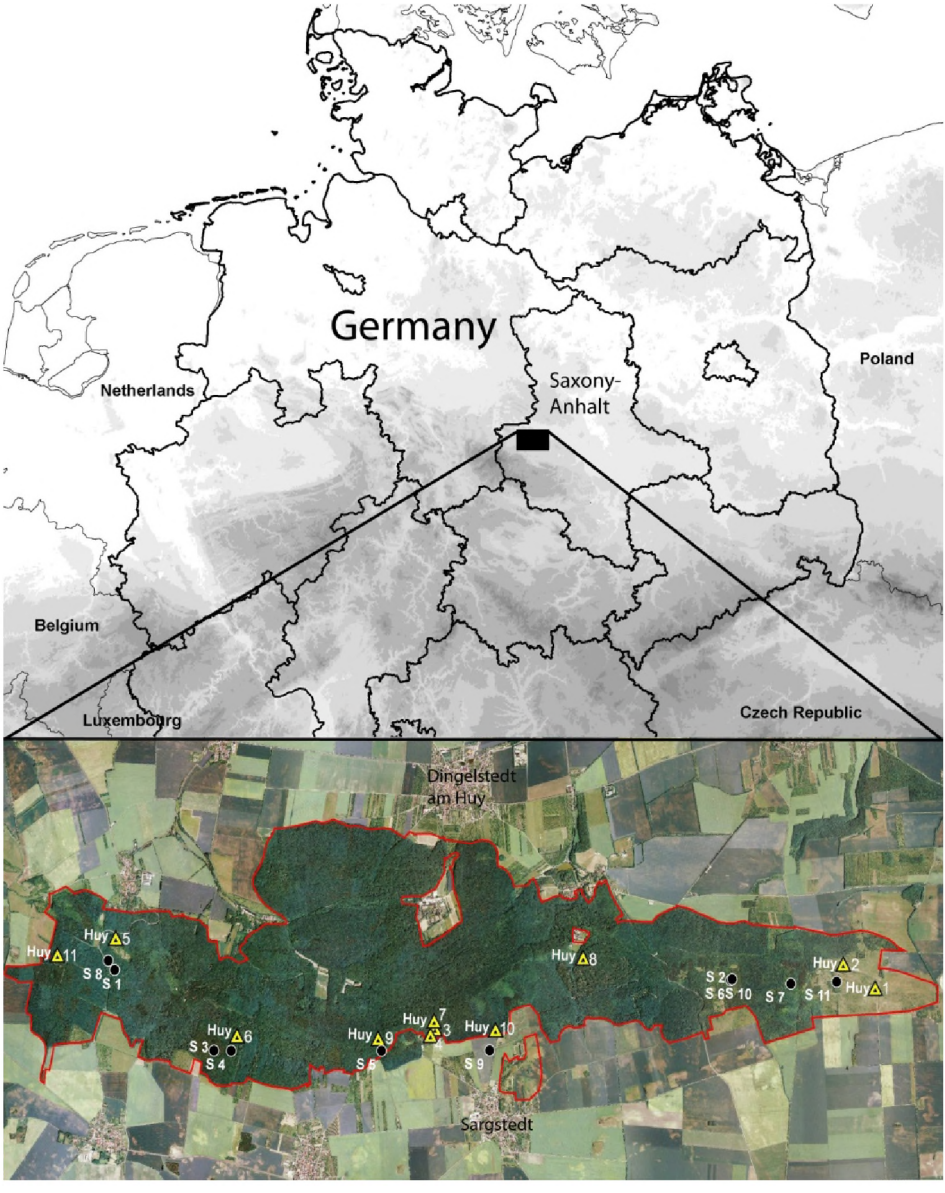

Fig. 1: Location of the study area Huy in Germany and the study sites. Modified after Meyer (2011).
▲ – Huy 1–11 (sites of pitfall traps) and ● S 1–11 (additional sampling sites).

- Huy 4: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia), 51.949280° N 10.973677° E; 270 m a.s.l.
- Huy 5: Asperulo-Fagetum beech forests, 51.959013° N 10.912527° E; 260 m a.s.l.
- Huy 6: Asperulo-Fagetum beech forests, 51.948957° N 10.936261° E; 280 m a.s.l.
- Huy 7: Medio-European limestone beech forests of the Cephalanthero-Fagion, 51.950742° N 10.974356° E; 280 m a.s.l.
- Huy 8: Asperulo-Fagetum beech forests, 51.957586° N 11.003091° E; 300 m a.s.l.
- Huy 9: Galio-Carpinetum oak-hornbeam forests, 51.948841° N 10.963607° E; 290 m a.s.l.
- Huy 10: Galio-Carpinetum oak-hornbeam forests, 51.949884° N 10.986303° E; 240 m a.s.l.
- Huy 11: Galio-Carpinetum oak-hornbeam forests, 51.957120° N 10.901299° E; 270 m a.s.l.

In addition to the pitfall trapping sites, 11 further locations were investigated by means of hand sampling, soil cores and sieving:

- S 1: Giant's kettle, an open area of a quarry, 51.955847° N 10.912270° E; 260 m a.s.l.
- S 2: Giant's kettle, edge of a quarry, under shrubs, 51.955849° N 11.031697° E; 270 m a.s.l.
- S 3: Beech wood, 51.947515° N 10.931712° E; 220 m a.s.l.
- S 4: „Kellerloch", moist location at the bottom of a slope in a lightly cut area of beech, 51.947515° N 10.935045° E, 290 m a.s.l.
- S 5: Mature beechwood, 51.947793° N 10.964207° E, 300 m a.s.l.
- S 6: FND „Steppenrasen" (Protected area „steppe meadow"), 51.955849° N 11.031697° E; 264 m a.s.l.
- S 7: Pine mixed forest, 51.955571° N 11.043362° E; 256 m a.s.l.
- S 8: Small, open boulder slope within a beechwood, 51.956817° N 10.910990° E, 270 m a.s.l.
- S 9: Ruderal area at the edge of a beechwood, 51.948016° N 10.985185° E, 220 m a.s.l.
- S 10: Beechwood, waste wood, 51.955952° N 11.031963° E, 270 m a.s.l.
- S 11: Sloe-wild rose shrub (*Rosa canina*, *Prunus spinosa*) at the edge of the dry meadow Huy 2. 51.955849° N 11.052249° E, 220 m a.s.l.

Material and methods

In the study sites of Huy 1–11, six pitfall traps, filled with 4 % formalin, were installed at a distance of 8 to 10 m to each other. The trapping took place from March to December 2009 and from March until the end of June 2010 and the traps were emptied monthly. Due to closed snow cover it was not possible to empty the traps on the dates 02.01.2010, 01.02.2010 and 01.03.2010. Ignoring destroyed traps, a total of 840 sets of trap contents were available for analysis.

To complete the record of the species spectrum, as well as the pitfall trap sites (Huy 1-11) 11 additional sites (S 1–11) were sampled on one occasion on August 16th, 2011:

- 12 woodland sites: trees were "beaten" by hand and two sievings (each 20 min) of the leaf litter were carried out in each site with material subsequently sorted in the laboratory.
- 10 open sites (without deciduous layer): two soil cores (ca. 25 cm^2 up to approx. 3 cm depth) were taken in each site and subsequently sorted by hand in the laboratory. Additional hand samples (appr. 20 min.) were also taken in each site.

For the evaluation of dominance ratios (after Engelmann 1978) and activity abundances only pitfall trap data was used.

The diplopod and chilopod material is deposited in the collections of Senckenberg Museum of Natural History, Görlitz.

Table 1: Species spectrum, number of individuals and dominances of the Diplopoda caught by pitfall traps at the investigation sites in the FFH area Huy. Preference type according to Voigtländer (2011); ***** = eudominant (32–100 %); **** = dominant (10.0–31.9 %); *** = subdominant (3.2–10.0 %); ** = recedent (1.0–3.1 %); * = subrecedent (< 1 %). Dominance classes after Engelmann (1978).

No	Species	Calcareous grasslands				Beech forests				Bedstraw-oak-hornbeam forests			Preference type
		Alysso-Sedion albi		Festuco-Brometalia		Asperulo-Fagetum			Cephalanthero-Fagion	Galio-Carpinetum			
		Huy 1	Huy 2	Huy 3	Huy 4	Huy 5	Huy 6	Huy 8	Huy 7	Huy 9	Huy 10	Huy 11	
	Chordeumatida												
	Chordeumatidae												
1.	*Melogona voigti* (Verhoeff, 1899)			1 *	6 **	3 **		9 ***	3 *			2 *	open land
2.	*Mycogona germanica* (Verhoeff, 1892)			6 **	16 **	16 ****	41 ****	7 ***		30 ***	38 ****	5 **	woodland
	Craspedosomatidae												
3	*Craspedosoma rawlinsii* Leach, 1814			2 *	3 *			3 **	1 *		4 **	15 ***	woodland
	Glomerida												
	Glomeridae												
4.	*Glomeris hexasticha* Brandt, 1833	5 **	16 ***	10 **	37 ****	16 ****			3 *			1 *	woodland
5.	*Glomeris marginata* (Villers, 1789)	105 *****	189 *****	87 ****	144 ***	111 *****	70 *****	37 ****	164 *****	151 *****	41 ****	233 *****	woodland
6.	*Glomeris tetrasticha* Brandt, 1833					1 *							woodland
7.	*Glomeris undulata* var. *conspersa* C. L. Koch, 1847	2 *	1 *	16 ****	31 ****	19 ***	8 ***	1 *	31 ***	47 ****	2 *	1 *	woodland
	Julida												
	Julidae												
8.	*Allajulus nitidus* (Verhoeff, 1891)			19 ****	19 ****	26 ****	3 **	13 ***	4 **	7 **	6 **	37 ***	woodland
9.	*Brachyiulus pusillus* (Leach, 1814)		2 *										eurytopic
10.	*Cylindroiulus caeruleocinctus* (Wood, 1864)	45 ****	40 ****	199 *****	179 *****	1 *	3 **	4 **	5 **	5 **	4 **	4 *	open land
11.	*Cylindroiulus punctatus* (Leach, 1815)					1 *							woodland

12.	*Kryphioiulus occultus* (C. L. Koch, 1847)		1 *										open land
13.	*Julus scandinavius* Latzel,1884			3 *	9 **	14 ***	2 **	12 ***	20 ***		65 ****	37 ***	woodland
14.	*Leptoiulus belgicus* (Latzel, 1884)	1 *		3 *					1 *			2 *	woodland
15.	*Megaphyllum projectum kochi* (Verhoeff, 1907)		1 *		13 **	10 ***	2 **	2 **	55 ****		4 **	5 **	open land
16.	*Megaphyllum unilineatum* (C. L. Koch 1838)	99 *****	245 *****										open land
17.	*Ommatoiulus sabulosus* (Linne, 1758)		1 *	5 **	21 ***								open land
18.	*Ophyiulus pilosus* (Newport, 1842)	1 *		1 *									open land
19.	*Tachypodoiulus niger* (Leach, 1815)			32 ****	55 ****	16 ***	8 ***	47 ****	44 ****	53 ****	60 ****	75 ****	woodland
20.	*Unciger foetidus* (C. L. Koch, 1838)			26 ****	3 *	4 **	2 **	8 ***	32 ***	10 **	5 **	6 **	woodland
	Nemasomatidae												
21	*Nemasoma varicorne* C. L. Koch, 1847								1 *		2 *		woodland
	Polydesmida Polydesmidae												
22.	*Brachydesmus superus* Latzel, 1884				1 *							9 **	open land
23.	*Polydesmus angustus* Latzel, 1884			8 **	9 **	10 ***	1 *	31 ****	11 **	20 ***	10 ***	6 **	woodland
24.	*Polydesmus denticulatus* C. L. Koch, 1847			4 *		3 **	3 **	5 **	1 *	2 *	45 ****	10 **	woodland
25.	*Polydesmus inconstans* Latzel, 1884	1 *	1 *						1 *			1 *	open land
	Trichopolydesmidae												
26.	*Ophiodesmus albonanus* (Latzel, 1895)				2 *								often synanthropic
	∑ Species	8	10	15	15	15	11	13	16	9	13	17	
	∑ Individuals	259	497	422	548	251	143	179	377	325	286	449	

RESULTS

Results of trapping

From the pitfall traps 3,736 specimens of millipedes from 26 species and 7 families were recorded (Table 1). For centipedes 588 specimens from 15 species were caught (Table 2), 5 geophilomorphs and 10 lithobiomorphs. The over-representation of Lithobiomorpha is a consequence of the method of collection used (pitfall traps).

Table 1 shows the dominances of the 26 diplopod species caught by pitfall traps. These are very different. There is a large number of subrecedent species, which occured only in between one or four of the investigation sites (*C. punctatus*, *G. tetrasticha*, *L. belgicus*, *N. varicorne*, *Ophiodesmus albonanus* and *Ophyiulus pilosus*). *G. marginata* is the only diplopod species which occured eudominantly or at least dominantly at all sites. *C. caeruleocinctus* was also found at all sites, but only eudominant or dominant on the calcareous grasslands.

In contrast to the diplopods, the dominance structure of the chilopods was relatively balanced (Table 2). Only a few species occurred subdominantly or recedently (*L. erythrocephalus*, *G. electricus*, *G. flavus*, *S. acuminata* and *S. crassipes*). Subrecedent species were not found. Only *L. mutabilis* was found eudominantly at almost all study sites.

The activity abundances of diplopods were different between the sites investigated, especially the basophilic grasslands and semi-natural dry grasslands which showed outstandingly high values (Fig. 2). The highest activity abundance was found at site Huy 4 (Festuco-Brometalia). At the oak-hornbeam woods (with exception of Huy 11) as well as the beech forests of the Cephalanthero-Fagion (Huy 7), they were relatively similiar.

The activity abundances of the chilopods were much lower than those of the diplopods and were not particularly different as between the sites studied (Fig. 2).

Results of additional catches

Tables 3 & 4 give an overview of the species and the individual numbers that were recorded by the additional sampling methods at the trapping sites Huy 1–11. With these methods 158 individuals of diplopods and 130 of chilopods were captured and determined; a further 32 specimens were juveniles and could not assigned to species level. On this basis the beech forests Huy 5 and Huy 6 were those most densely colonized by myriapods. Most specimens were found in litter and dead wood (Table 5) and sieving of these substrates was the most effective method. Using hand sampling one additional species, *Proteroiulus fuscus* (Am Stein, 1857), was found (at Huy 10).

At the additional study sites S 1–11, in total 92 millipedes and 60 centipedes were found. The species and individual numbers are shown in Tables 3 & 4. The steppe meadow (S 6), beech wood (S 3) and the wet area at the bottom of a slope (S 4) were particularly well populated the first especially for diplopods (*G. marginata*). As at the pitfall trapping sites, sieving of litter was an effective sampling method (Table 5).

With the additional sampling at the sites Huy 1–11 and S 1–11, four diplopod species were found that had not been recorded previously (*Enantiulus nanus*, *Polyxenus lagurus*, *Proteroiulus fuscus* and *Strongylosoma stigmatosum* – marked with * in Table 3). Including these increased the total number of diplopod species to 30 in 10 families. *G. marginata* occurred continuously at nearly all sites and with all methods used (Tables 1 & 3).

For chilopods, two additional species were found (*Lithobius pelidnu*s and *Cryptops hortensis* – marked with * in Table 3) increasing the total number of species to 17.

Table 2. Species spectrum, number of individuals and dominances of the Chilopoda caught by pitfall traps in the study sites of the FFH area Huy. Abbreviations as in Table 1.

No	Species	Calcareous grasslands				Beech forests				Bedstraw-oak-hornbeam forests			Preference type
		Alysso-Sedion albi		Festuco-Brometalia		Asperulo-Fagetum			Cephalanthero-Fagion	Galio-Carpinetum			
		Huy 1	Huy 2	Huy 3	Huy 4	Huy 5	Huy 6	Huy 8	Huy 7	Huy 9	Huy 10	Huy 11	
	Geophilomorpha												
	Geophilidae												
1.	*Geophilus electricus* (Linne, 1758)				1 **	1 **			5 ***		1 **	3 ***	eurytopic
2.	*Geophilus flavus* (Leach, 1814)										1 **		eurytopic
	Linotaeniidae												
3.	*Strigamia acuminata* (Leach, 1815)			4 ***		2 **		1 **	3 ***		1 **		woodland
4.	*Strigamia crassipes* (C. L. Koch, 1835)			4 ***									open land
	Schendylidae												
5.	*Schendyla nemorensis* (C. L.Koch, 1837)			1 **					3 ***	2 ***	5 ****	3 ***	eurytopic
	Lithobiomorpha												
	Lithobiidae												
6.	*Lithobius calcaratus* C. L. Koch, 1844	4 *****	10 *****	7 ****	4 ****		3 ***	8 ***		3 ***		3 ***	open land
7.	*Lithobius crassipes* L. Koch, 1862			2 ***	4 ****	3 ***	1 **	2 **	8 ****		4 ****	5 ***	woodland
8.	*Lithobius dentatus* C. L. Koch, 1844				1 **	39 *****	4 ***	9 ***	12 ****	10 ****	6 ****	11 ****	woodland
9.	*Lithobius erythrocephalus* C. L. Koch 1847			1 **									woodland
10.	*Lithobius forficatus* (Linné, 1758)				4 ****	2 **	1 **			1 **	2 ***		eurytopic
11.	*Lithobius macilentus* L. Koch, 1862						1 **	2 **				1 **	woodland
12.	*Lithobius microps* Meinert, 1868	4 *****	7 *****	2 ***									open land
13.	*Lithobius mutabilis* L. Koch, 1862			21 *****	14 *****	19 ****	18 *****	69 *****	35 *****	27 *****	8 ****	34 *****	eurytopic woodland
14.	*Lithobius nodulipes* Latzel, 1880			10 ****	6 ****	10 ****	20 *****	4 ***	2 **	7 ****	4 ****	14 ****	woodland
15.	*Lithobius piceus* L. Koch, 1862			3 ***	2 ***	1 **	1 **	3 **	10 ****	9 ****	2 ***	3 ***	woodland
	∑ Species	2	2	10	8	8	8	8	8	7	10	9	
	∑ Individuals	8	17	55	36	77	49	98	78	59	34	77	

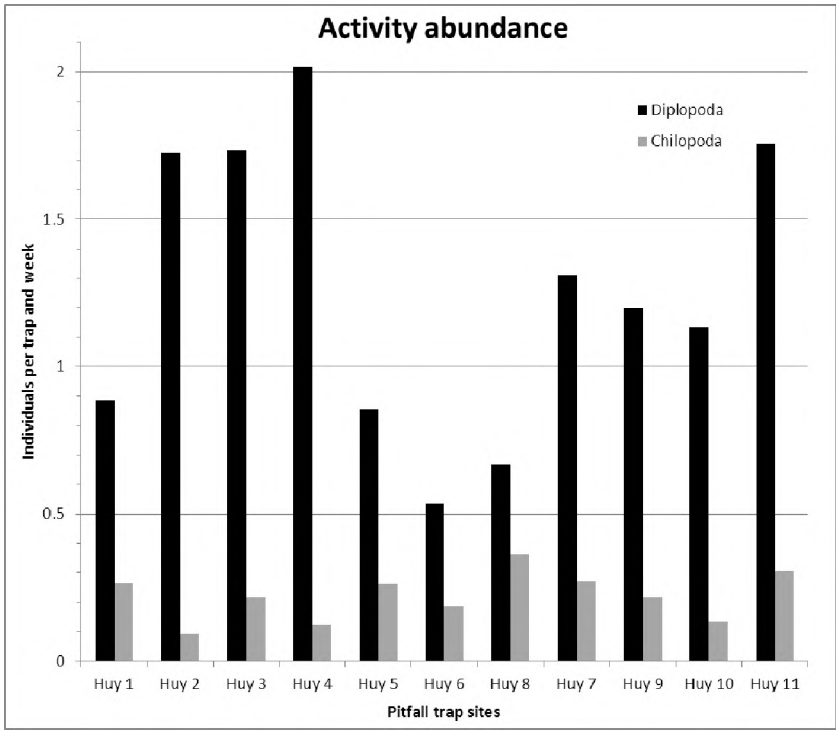

Fig. 2. Activity abundances of Diplopoda and Chilopoda at the study sites Huy 1–11.

Discussion and assessment

For Europe 1,529 Diplopoda species are known (www.faunaeuropea.org). Of these only 133 are known to occur in Germany (Voigtländer et al. 2011, Reip et al. in press) and only 46 in Saxony-Anhalt (Voigtländer 2009a). The myriapod fauna of the FFH area "Huy" thus indicates, with 30 species (65 % of the myriapod fauna of Saxony-Anhalt), a very rich diplopod assemblage.

The Chilopoda show a similar pattern. According to Voigtländer (2009b), 507 species of Chilopoda are known in Europe; most of these belong to the Lithobiomorpha. For Germany 61 species are known at present (Voigtländer et al. 2011, Spelda et al. in press), 31 of these in Saxony-Anhalt (Voigtländer 2003b). With its 17 Chilopoda species (i.e. 55 % of those known for Saxony-Anhalt) the FFH area "Huy" can also be considered to be very species-rich for this group.

To obtain a complete species spectrum the study shows once again that different sampling methods have to be used. Some species are not active enough to be adequately sampled by pitfall traps. This is especially true for the "bark-dwellers" (*P. fuscus*, *P. lagurus*, *L. pelidnus*) as well as *E. nanus* (Voigtländer 1987, Spelda 1999b). Among the chilopods especially the contrast between the number of individuals caught with pitfall traps and by other methods is particularly striking with *L. crassipes* (32 and 92 individuals, respectively). This species also seems to be little "trap-agile". Notable also is the total number of *L. forficatus* in the beechwood (S 10). Presumably, the species was introduced with wood waste deposited here from the village.

Table 3. Species spectrum and number of individuals of Diplopoda from pitfall traps (Huy 1–11) and additional sampling sites (S 1–11). * – only found by using the additional sampling methods.

No	Diplopoda	Huy 1	Huy 2	Huy 3	Huy 4	Huy 5	Huy 6	Huy 7	Huy 8	Huy 9	Huy 10	Huy 11	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11
1.	*Allajulus nitidus*					6																	
2.	*Brachydesmus superus*																						1
3.	*Craspedosoma rawlinsii*									1		2											
4.	*Cylindroiulus caeruleocinctus*	1	1	1	2									2					1		2		1
5.	*Cylindroiulus punctatus*					6																	
6.	*Enantiulus nanus* *					4												1	1	1			
7.	*Glomeris hexasticha*		1			2							1					2		1			
8.	*Glomeris marginata*	2	3	1		5	13	1	2	6	4	23	3	1	2	1		20	2	3	1	2	3
9.	*Glomeris undulata* var. *conspersa*				2	6				1			1	1	1			5	1				
10.	*Julus scandinavius*					1						2				5			1				
11.	*Kryphioiulus occultus*		1															1					
12.	*Leptoiulus belgicus*	1											1			1		1					2
13.	*Megaphyllum projectum kochi*					1					1	2							1	1			
14.	*Megaphyllum unilineatum*		3																				
15.	*Mycogona germanica*					3	5	2		2	1				3	2							
16.	*Nemasoma varicorne*						3	1								1	1						
17.	*Ommatoiulus sabulosus*				3								1										
18.	*Ophiodesmus albonanus*					1																	
19.	*Polydesmus angustus*					1					5	1			3				1				
20.	*Polydesmus denticulatus*											3			1								
21.	*Polyxenus lagurus* *		9													1							
22.	*Proteroiulus fuscus* *										1												
23.	*Strongylosoma stigmatosum* *															2							
24.	*Tachypodoiulus niger*					3				2	1	1					1						
25.	*Unciger foetidus*					1				1													
	∑ Species	3	6	2	3	13	3	3	1	6	6	7	5	3	5	7	2	6	7	4	2	1	4
	∑ Individuals	4	18	2	7	40	21	4	2	13	13	34	7	4	10	13	2	30	8	6	3	2	7

Table 4. Species spectrum and number of individuals of Chilopoda from pitfall traps (Huy 1–11) and additional sampling sites (S 1–11). * – only found by using the additional sampling methods.

No	Chilopoda	Huy 1	Huy 2	Huy 3	Huy 4	Huy 5	Huy 6	Huy 7	Huy 8	Huy 9	Huy 10	Huy 11	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11
1.	*Lithobius calcaratus*		4			2	2					2	1	2				5					
2.	*Lithobius crassipes*			1	1	12	22	2	2	11	22	8			5	3	1		1			1	
3.	*Lithobius dentatus*									1		1											
4.	*Lithobius forficatus*					2	1	1		3	3	2	1						1			11	
5.	*Lithobius macilentus*														1				1				
6.	*Lithobius microps*													1						2			1
7.	*Lithobius mutabilis*					3	2					2			3	7				1			
8.	*Lithobius nodulipes*															4							
9.	*Lithobius pelidnus* *						3				1		1										
10.	*Lithobius piceus*					1						3											
11.	*Geophilus flavus*					5							1	1				1					
12.	*Geophilus electricus*											1											
13.	*Strigamia acuminata*											2			1	1							
14.	*Strigamia crassipes*					1																	
15.	*Cryptops hortensis* *					1							1										
	∑ Species	0	1	1	1	8	5	2	1	3	3	8	5	3	4	4	1	2	3	2	0	2	1
	∑ Individuals	0	4	1	1	27	30	3	2	15	26	21	5	4	10	15	1	6	3	3	0	12	1

The study sites in the Huy showed a wide species spectrum (Tables 2 & 4), not only in their combined numbers, but also for each site. As well as eurytopic species, especially open-land species, many typical woodland species also occurred. Community structure and characteristic species composition are of special importance for evaluation of the condition of a habitat (Römbke et al. 1997, Spelda 1999b, Voigtländer & Düker 2001, Voigtländer 2009b). This was true for all sites.

Table 5. Number of specimens of Diplopoda and Chilopoda in different habitat types at the pifall-trap sites Huy 1–11 and the additional sampling sites S 1–11 found by sieving, hand sampling and soil cores.

Site	Biotop	Sieving/Substrate			Hand collecting
		Moss	Litter	Dead wood	Litter or dead wood
Huy1	Basophilic grasslands				4
Huy2	Basophilic grasslands				10
Huy3	Semi-natural dry grasslands				3
Huy4	Semi-natural dry grasslands	4			5
Huy5	Asperulo-Fagetum beech forests		17	37	17
Huy6	Asperulo-Fagetum beech forests		19	30	9
Huy7	Medio-European limestone beech forests		11		2
Huy8	Asperulo-Fagetum beech forests		3		1
Huy 9	Galio-Carpinetum oak-hornbeam forests		14	19	
Huy10	Galio-Carpinetum oak-hornbeam forests		21	20	7
Huy11	Galio-Carpinetum oak-hornbeam forests		25	24	13
∑ Individuals		**4**	**110**	**130**	**71**
S1	Open area of a quarry	6			8
S2	Edge of the quarry, shrubs		10		
S3	Beech wood			14	7
S4	Moist place in a cutting area		21		13
S5	Mature beech wood				3
S6	Steppe meadow				22
S7	Pine mixed forest		13		1
S8	Boulder slope		13		
S9	Ruderal area				3
S10	Waste wood in a beech wood			14	
S11	*Prunus-Rosa* shrub		9		
∑ Individuals		**6**	**66**	**28**	**57**

With respect to their Diplopoda assemblage, the rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi have to be classified as especially valuable from a nature conservation viewpoint. They not only have a high proportion of open-land species, such as *O. sabulosus*, *M. unilineatum*, and *C. caeruleocinctus*, but have also a very typical xerothermic community for this type of biotope (see Voigtländer & Düker 2001).

In contrast, the Chilopoda assemblage is very sparse. Only two species occur, *L. calcaratus* and *L. microps*, both known as inhabitants of open sites. The combination of these two species is characteristic for dry and mesoxeric meadows (Voigtländer 2003a).

The semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) were, with 19 millipede species, the most diverse sites. They were characterized by a combination of eurytopic, open-land and woodland species. Such a combination of species can be also found in the Chilopoda, which together result in the high species richness of this area (12 species).

At the sites Huy 3 and Huy 4 the activity abundance of the diplopods (1.734 and 2.018 ind./trap/week) and chilopods were higher than normal. Comparative mean values for five

calcareous dry meadows in the Saale-Unstrut-Triasland (Saxony-Anhalt) are 1.106 (Diplopoda) and 1.181 (Chilopoda) ind./trap/week (Voigtländer 2008 and unpublished data).

Of the woodland sites studied, the Galio-Carpinetum oak-hornbeam woods Huy 9–11 are the most species-rich sites with 19 species (18 from traps and 1 from additional sampling). The Medio-European limestone beech forests of the Cephalanthero-Fagion with 16 species of Diplopoda and 8 of Chilopoda seems to be the most species-poor site. However, only one site was studied there as against three sites as usual. In the beechwoods, euryecious and stenoecious woodland species dominated.

Among the specially investigated sites, the areas of S 4 (moist location), S 1 (quarry, open area) and S 7 (pine mixed forest) are striking with their high species numbers. The lowest species numbers were found in the beechwoods (S 5, S 10), where sampling took place from under the bark of living trees and from bark lying on the ground, and the ruderal site (S 9).

Remarkable species

Brachyiulus pusillus (Leach, 1814) occurs only moderately frequent in Germany. The species has already been recorded from the North Harz Foreland (Voigtländer 2009a). It is known from floodplains and riverbanks as well as from fallow land and dry meadows at lower altitudes. Within the area studied here, it was only found in a basophilic grassland (Huy 2) and under adjacent *Rosa* and *Prunus* shrubs.

Megaphyllum unilineatum (C. L. Koch 1838). This extremly xerothermic species occurred in the study area only at Huy 1 and 2, both basophilic grasslands. Due to the increasing intensification of agriculture and development on suitable habitats, the species is already extinct in many areas of Baden-Württemberg (Spelda 1999c). It is listed as endangered (category 3) on the Red List of Germany (Reip et al., in press).

Mycogona germanica (Verhoeff, 1892) is endemic to the European central uplands and has its main distribution area in Germany. The study area is located on the northern border of its area of continuous occurrence. With the exception of the basophilic grasslands (Huy 1, Huy 2) and the limestone beech forest (Huy 7), *M. germanica* was found in all biotope types of the present study.

Ophiodesmus albonanus (Latzel, 1895) is a thermophilic and very small species (4.5–5.0 mm) only known for Germany from a small number of (predominantly synanthropic) localities. It was found at site Huy 4 (semi-natural dry grasslands) and the limestone beech forest Huy 5, which represent its first records for Saxony-Anhalt!

Polyxenus lagurus Linne, 1758 is an inhabitant of the bark of living trees and is only occasionally caught in traps. Searching by hand provides the best results. In the Huy region only sampling by hand was successful (9 specimens at Paulskopf, pine bark, 18 Apr 2010, coll. M. Jung and 1 ind. at the site S 4, Kellerloch, 16 Aug 2011, own collection).

Geophilus electricus (Linné, 1758). Up to now this species has only rarely been recorded in Germany. In Saxony-Anhalt it also shows a scattered distribution (Voigtländer 2009b); in the study area it occurred at five sites (Huy 4, 5, 7, 10 and 11) with only few specimens in each case (max. 5 individuals).

Lithobius nodulipes Latzel, 1880 inhabits submontane to montane sites. The species extends in Saxony-Anhalt from the Harz mountain up to the northern Harz Foreland. With the exception of the calcareous grasslands, the species was found in high numbers at all the study sites.

Lithobius pelidnus Haase, 1880 is very rare and only very locally distributed in Germany. In Saxony-Anhalt the species had been recorded from bogs of the Hochharz as well as from the Rhin-Havel-Luch (Voigtländer 2004). However, it may be assumed that the "rareness" of this

species is probably a methodological artifact. The species prefers tree trunks (Spelda 1999a) and also sometimes occurs under bark and in dead wood and sampling of such microhabitats is usually neglected. In the Huy, *L. pelidnus* was sporadically found in dead wood sievings and in hand sampling on dead tree trunks and stumps (1 ♂, 2 ♀♀) as well as in moss and leaf-litter sievings (each 1 ♀). Within its overall distribution area, the species is restricted to cool-humid habitats but was also recently found in Luneburg Heath in an open heathland, in pine woods and in a *Betula*-afforestation (Lindner et al. 2010). Also at the Huy, the species was found in two extremely different biotope types: in the open area of the quarry "Gletschertöpfe" as well as in the woodlands Huy 6 and Huy 10. This morphologically very variable species obviously has a much broader ecological range than assumed before.

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STRESZCZENIE

[Krocionogi (Diplopoda) i pareczniki (Chilopoda) z obszarów chronionych Gór Huy w Saksonii, Niemcy]

Krocionogi i pareczniki zbadano na 11 stanowiskach z typową regionalną roślinnością na obszarze chronionym według dyrektywy siedlisk Natura 2000 w landzie Saksonia-Anhalt jako „Huy nördlich Halberstadt", Niemcy. Dwa z tych stanowisk reprezentują zespoły muraw wapiennych Alysso-Sedion albi, dwa to seminaturalne suche łąki bądź zarośla na podłożu wapiennym, trzy to żyzne buczyny Asperulo-Fagetum, jedno – środkowo-europejska buczyna nawapienna Cephalanthero-Fagion a trzy z nich to grąd środkowoeuropejski Galio-Carpinetum. Wije zbierano metodą pułapek Barbera przez półtora roku. Dodatkowo, wije zbierano ręcznie, za pomocą armatki glebowej i metodą przesiewek z 11 dalszych stanowisk reprezentujących różne mikrośrodowiska. W badaniach wykazano 30 gatunków krocionogów i 17 gatunków pareczników, co wskazuje na duże bogactwo fauny wijów Gór Huy. Przeanalizowano strukturę zgrupowań i skład gatunkowy w odniesieniu do charakterystyki wszystkich stanowisk. Do ważniejszych stwierdzeń zaliczono tu: *Ophiodesmus albonanus* (Latzel, 1895), *Megaphyllum unilineatum* (C.L. Koch 1838), *Brachyiulus pusillus* (Leach, 1814), *Mycogona germanica* (Verhoeff, 1892), *Polyxenus lagurus* Linne, 1758, *Geophilus electricus* (Linné, 1758), *Lithobius nodulipes* Latzel, 1880 and *Lithobius pelidnus* Haase, 1880.

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