

## **Beetle communities (Insecta: Coleoptera) of rock debris on the Kamenec hill (Czech Republic: České středohoří mts)**

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Keywords: ecology, rock debris, Coleoptera, pitfall traps, Czech Republic

### **Introduction**

An exceptional type among Central European ecosystems, usually only minimally affected by human activities, is created by rock debris - mostly sites never covered by forests continually from the last glacial period (RŮŽIČKA 1993). Usually, specific microclimate features, suitable for many specific invertebrate species with relict distribution are formed (e.g., RŮŽIČKA et al. 1989, 1995, RŮŽIČKA & ZACHARDA 1994, RŮŽIČKA 1999a, 1999b).

The purpose of the present study is an examination of the beetle community in selected rock debris at Kamenec hill. At the same locality, mosses, lichens and ferns (KUBÁT 1971, PUJMANOVÁ 1988, 1989), spiders (ČEŘOVSKÝ & HOLEC 1996, RŮŽIČKA 1999) and beetles (HONCŮ, this volume) were also studied.

### **Area of study**

The present study was conducted at the Kamenec hill (ca. 50°42' N 14°21' E, 1.5 km S of the Starý Šachov village), in a rock debris on the northern slope at 330-360 m a. s. l., constituted by stones of the diameter 20-130 cm. Ice formations are known at lower margins and in a terrain depression in the middle of the slope (RŮŽIČKA 1999). The locality is well known for the long time by its considerable air movements (reviewed in KUBÁT 1971).

The traps are labelled No. I to No. VI throughout the text. The field numbers of individual traps (used on locality labels of the voucher specimens) are also given in square brackets. In total, six traps were placed on the following sites (Fig. 1):

*Trap No. I* [field number 29]: bottom left margin of the rock debris close to mixed forest, trap 50 cm deep under surface, close to ice, stones with rich moss coverage;

*Trap No. II* [field number 30]: bottom part of the rock debris close to mixed forest, trap 30 cm deep under surface, stones with rich moss coverage;

*Trap No. III* [field number 31]: middle left part of the rock debris, trap 50 cm deep under surface, stones with only weak moss coverage;

*Trap No. IV* [field number 32]: upper part of the rock debris, trap 30 cm deep under

surface, stones with only weak moss coverage;

*Trap No. V* [field number 33]: right part of the rock debris, a terrain depression in the middle of the slope, trap 40 cm deep under surface, stones with only weak moss coverage;

*Trap No. VI* [field number 34]: bottom right margin of the rock debris close to mixed forest, trap 30 cm deep under surface, close to ice, stones with rich moss coverage and a thick layer of leaves.

Traps Nos. I to IV were situated along the supposed vertical microclimatic gradient from bottom to upper margin in the left part of the rock debris, additional two traps (Nos. V and VI) were placed in right part of the rock debris, in positions with colder microclimate with ice formations (Fig. 1).

## Material and methods

The material was collected using pitfall traps with 1 : 1 solution of water and ethylene glycol. Fish meat and ripened cheese were used as bait. The material was placed into 75% ethanol; a small part of voucher specimens was dry mounted and is deposited in the author's collection. The beetles were identified by the following specialists: Carabidae - PAVEL MORAVEC; Staphylinidae - STANISLAV SNÄLL, PAVEL MORAVEC, LUBOMÍR HROMÁDKA (*Philonthus*), PETR ŠTOURÁČ (*Quedius*), MICHAEL SCHÜLKE (*Mycetoporus*); Silphidae, Leiodidae, Dasytidae, Scarabaeidae - JAN RŮŽIČKA; Pselaphidae - PETER HLAVÁČ. Species names are treated according to JELÍNEK (1993).

The traps were exposed between April 14, 1995 and June 20, 1996, serviced six times (May 19, June 30, August 21 and October 21, 1995; May 1 and June 20, 1996).

The similarity of samples (based on presence/absence of species in individual traps) was compared using coefficient of Sørensen (= c. of Dice; SNEATH & SOKAL 1973, KREBS 1989). For clustering, the hierarchical analysis in Q-mode, using UPGMA (unweighted pair-group method using arithmetic averages) after SNEATH & SOKAL (1973) was used.

The program NTSYS-pc 1.80 (ROHLF 1994) was used for the cluster analysis.

## Results and discussion

Altogether, 1853 specimens of 53 species of Coleoptera were trapped (Tables 1, 2). The most abundant beetle family was Leiodidae with 1267 specimens, followed by Staphylinidae (247 specimens), Silphidae (220 specimens) and Carabidae (108 specimens), only 11 specimens belong to the other three families.

More beetle species were trapped in similar study on the same locality, using unbaited pitfall traps with formaldehyde (HONCŮ, this volume). However, baited traps used in this study attracted mostly necrophagous species, in distinctly more numerous quantity (Tables 1, 2).

Using an UPGMA cluster analysis based on presence/absence data and the coefficient of Sørensen, it is possible to split the traps into two main clusters (Fig. 2): (1) traps from the bottom part of the rock debris (Nos. I and VI), placed closely to ice; (2) the remaining traps from middle and upper parts of the rock debris. Here, trap No. V, situated in a terrain depression in the middle of the slope, is separated from the rest of traps (Nos. II to IV).

The following species of beetles exhibit the affinity to the cold, stable microclimate conditions of the bottom part of the rock debris (Table 1): *Pterostichus negligens* (STURM, 1824) (Carabidae); *Choleva lederiana lederiana* REITTER, 1902, *Choleva nivalis* (KRAATZ,

1856) and *Catops longulus* KELLNER, 1846 (all Leiodidae); *Leptusa flavicornis* BRANCIK, 1874, *Mycetoporus* cf. *monticola* FOWLER, 1888 and *Proteinus crenulatus* PANDELLÉ, 1867 (all Staphylinidae). Similarly, boreo-montane or arcto-alpine species of mosses, lichens and ferns were reported from the same locality by KUBÁT (1971) and PUJMANOVÁ (1988, 1989), and those of spiders by ČEŘOVSKÝ & HOLEC (1996) and RŮŽIČKA (1999). Many of these species can be considered as glacial relicts in Central Europe (RŮŽIČKA 1993).

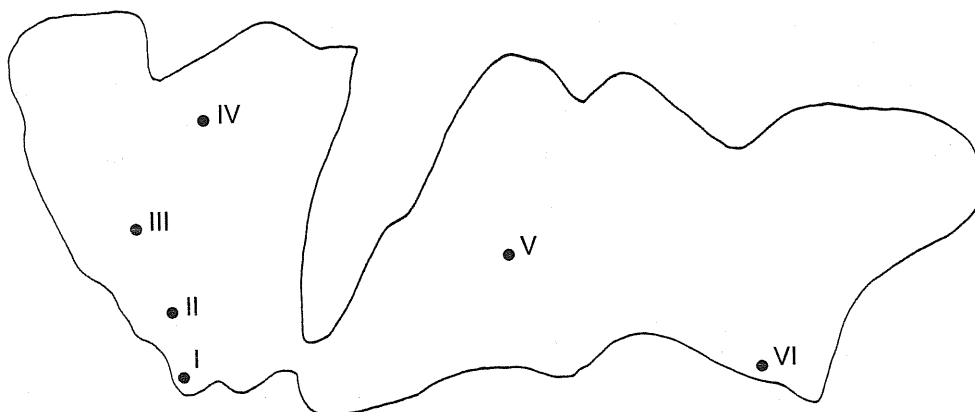


Fig. 1. Schematic view of the rock debris on the northern slope of the Kamenec hill, with indicated positions of individual traps. For further details, see text.

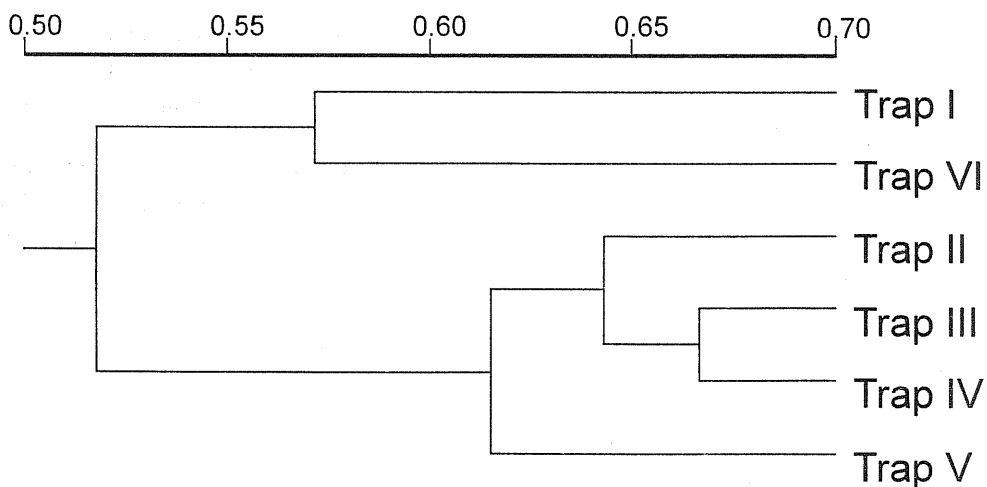


Fig. 2. The phenogram of beetle samples from traps in rock debris of the Kamenec hill using the presence/absence data, the coefficient of Sørensen and UPGMA. For Nos. of traps, see text and Fig. 1.

## Summary

Fifty three beetle species (Coleoptera) in 1853 specimens were collected in rock debris of the Kamenec hill (České středohoří mts, northern Bohemia, Czech Republic) during the period of April, 1995 to June, 1996. Four baited pitfall traps, placed in a line from bottom to upper part of the rock debris, and two additional traps, placed close to ice in the right part of rock debris, were serviced six times.

The following remarkable species of Coleoptera (exhibiting the affinity to the cold, stable microclimate conditions of the bottom part of the rock debris) are reported: *Pterostichus negligens* (STURM, 1824) (Carabidae); *Choleva lederiana lederiana* REITTER, 1902, *Choleva nivalis* (KRAATZ, 1856) and *Catops longulus* KELLNER, 1846 (all Leiodidae); *Leptusa flavicornis* BRANZIK, 1874, *Mycetoporus* cf. *monticola* FOWLER, 1888 and *Proteinus crenulatus* PANDELLÉ, 1867 (all Staphylinidae).

Using an UPGMA cluster analysis based on presence/absence data and the coefficient of Sørensen, it is possible to split the traps into two main clusters: (1) traps from the bottom part of the rock debris, placed closely to ice; and (2) the remaining traps from middle and upper parts of the rock debris.

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Tab. 1. The summary abundance of individual species in traps, the beetles of the rock debris on the Kamenec hill, April 14, 1995 to June 20, 1996

species / trap No.	I	II	III	IV	V	VI	total
<b>Carabidae</b>							
<i>Abax parallepipedus</i> (Piller et Mitterpacher, 1783)		1					1
<i>Pterostichus negligens</i> (Sturm, 1824)	5			1	80	20	106
<i>Pterostichus oblongopunctatus</i> (Fabricius, 1787)				1			1
<b>Dasytidae</b>							
<i>Danacea pallipes</i> (Panzer, 1793)				1			1
<b>Geotrupidae</b>							
<i>Anoplotrupes stercorosus</i> (Hartmann in L. G. Scriba, 1791)	8	1					9
<b>Leiodidae</b>							
<i>Catops coracinus coracinus</i> Kellner, 1846	14	3	17	17	3	41	95
<i>Catops fuliginosus fuliginosus</i> Erichson, 1837		1	1	1			3
<i>Catops kirbyi kirbyi</i> (Spence, 1815)			1				1
<i>Catops longulus</i> Kellner, 1846	30	10	13	4	19	15	91
<i>Catops nigricans</i> (Spence, 1815)	1						1
<i>Catops nigrata</i> Erichson, 1837	11	22	11	13	24	25	106
<i>Catops picipes</i> (Fabricius, 1792)	6	8	6	5		25	50
<i>Catops subfuscus subfuscus</i> Kellner, 1846	6	44	25	6	5	5	91
<i>Catops tristis tristis</i> (Panzer, 1794)	26	23	127	77	28	44	325
<i>Choleva glauca</i> Britten, 1918		1					1
<i>Choleva lederiana lederiana</i> Reitter, 1902	16	3		1	6	22	48
<i>Choleva nivalis</i> (Kraatz, 1856)					1		1
<i>Leptinus testaceus</i> J. Müller, 1817		1				2	3
<i>Ptomaphagus variicornis</i> (Rosenhauer, 1847)		1	2	2			5
<i>Sciodrepoides fumatus fumatus</i> (Spence, 1815)		2		2			4
<i>Sciodrepoides watsoni watsoni</i> (Spence, 1815)	6	67	187	60	115	7	442
<b>Pselaphidae</b>							
<i>Brachygluta fossulata</i> (Reichenbach, 1816)		1					1
<b>Silphidae</b>							
<i>Nicrophorus humator</i> Olivier, 1790		7	3	1			11
<i>Nicrophorus vespillo</i> (Linnaeus, 1758)			2	3	3		8
<i>Nicrophorus vespilloides</i> Herbst, 1784	7	39	20	31	14		111
<i>Oiceoptoma thoracica</i> (Linnaeus, 1758)	2	7	34	27	20		90

Tab. 1. Continued

<b>Staphylinidae</b>							
<i>Aleochara bipustulata</i> (Linnaeus, 1761)				1			1
<i>Aleochara curtula</i> (Goeze, 1777)					1		1
<i>Anthobium melanocephalum</i> (Illiger, 1794)	1						1
<i>Atheta crassicornis</i> (Fabricius, 1792)			5	3			8
<i>Atheta fungi</i> (Gravenhorst, 1806)	3						3
<i>Atheta sodalis</i> (Erichson, 1837)			1		4	2	7
<i>Atheta subtilis</i> (W. Scriba, 1866)						1	1
<i>Autalia longicornis</i> Scheerpeltz, 1947						3	3
<i>Leptusa flavicornis</i> Brancsik, 1874						2	2
<i>Lordithon lunulatus</i> (Linnaeus, 1761)	2					1	3
<i>Lordithon trinotatus</i> (Erichson, 1839)	1						1
<i>Megarthus simuato-collis</i> (Boisduval et Lacordaire, 1835)	1						1
<i>Mycetoporus</i> cf. <i>monticola</i> Fowler, 1888	2		1		4		7
<i>Omalium caesum</i> Gravenhorst, 1806						2	2
<i>Omalium excavatum</i> Stephens, 1834					1		1
<i>Omalium littorale</i> Kraatz, 1858	2						2
<i>Omalium rivulare</i> (Paykull, 1789)	2			2		3	7
<i>Oxypoda lividipennis</i> Mannerheim, 1830	1						1
<i>Oxypoda vittata</i> Märkel, 1842			1				1
<i>Philontus succicola</i> C. G. Thomson, 1860	1			1			2
<i>Proteinus atomarius</i> Erichson, 1840	2	9	6	7	6	3	33
<i>Proteinus brachypterus</i> (Fabricius, 1792)	112	4			7	9	132
<i>Proteinus crenulatus</i> Pandellé, 1867	15					7	22
<i>Quedius limbatus</i> Heer, 1839				2			2
<i>Quedius maurus</i> (C. R. Sahlberg, 1834)						1	1
<i>Tachinus laticollis</i> Gravenhorst, 1802	1						1
<i>Tachinus signatus</i> (Gravenhorst, 1802)	1						1
total number of specimens	285	255	464	270	339	240	1853
total number of species	28	21	20	25	16	21	53

Tab. 2. The summary abundance of individual species in different periods, the beetles of the rock debris on the Kamenec hill, April 14, 1995 to June 20, 1996

species / period	14.iv.- 19.v. 1995	19.v.- 30.vi. 1995	30.vi.- 21.viii. 1995	21.viii.- 21.x. 1995	21.x. 1995 - 1.v. 1996	1.v.- 20.vi. 1996	total
<b>Carabidae</b>							
<i>Abax parallepipedus</i>			1				1
<i>Pterostichus negligens</i>	13	23	18	46		6	106
<i>Pterostichus oblongopunctatus</i>		1					1
<b>Dasytidae</b>							
<i>Danacea pallipes</i>			1				1
<b>Geotrupidae</b>							
<i>Anoplotrupes stercorosus</i>		1		8			9
<b>Leiodidae</b>							
<i>Catops coracinus coracinus</i>	34	4	45	12			95
<i>Catops fuliginosus fuliginosus</i>	1			1	1		3
<i>Catops kirbyi kirbyi</i>				1			1
<i>Catops longulus</i>	17	9	18	38	4	5	91
<i>Catops nigricans</i>				1			1
<i>Catops nigrita</i>	38	21	29	16		2	106
<i>Catops picipes</i>		14	5	25	4	2	50
<i>Catops subfuscus subfuscus</i>	46	34	5	6			91
<i>Catops tristis tristis</i>	73	44	13	99	47	49	325
<i>Choleva glauca</i>	1						1
<i>Choleva lederiana lederiana</i>	11	18	11	7	1		48
<i>Choleva nivalis</i>	1						1
<i>Leptinus testaceus</i>						3	3
<i>Ptomaphagus variicornis</i>	3	2					5
<i>Sciodrepoides fumatus fumatus</i>		2	1			1	4
<i>Sciodrepoides watsoni watsoni</i>	32	102	134	150		24	442
<b>Pselaphidae</b>							
<i>Brachygluta fossulata</i>						1	1
<b>Silphidae</b>							
<i>Nicrophorus humator</i>	6	4	1				11
<i>Nicrophorus vespillo</i>	2	3		2		1	8
<i>Nicrophorus vespilloides</i>	33	25	1	43		9	111
<i>Oiceoptoma thoracica</i>	73	15		2			90

Tab. 2. continued

<b>Staphylinidae</b>							
<i>Aleochara bipustulata</i>	1						<b>1</b>
<i>Aleochara curtula</i>		1					<b>1</b>
<i>Anthobium melanocephalum</i>					1		<b>1</b>
<i>Atheta crassicornis</i>	2	6					<b>8</b>
<i>Atheta fungi</i>				3			<b>3</b>
<i>Atheta sodalis</i>	1	1	3	1	1		<b>7</b>
<i>Atheta subtilis</i>			1				<b>1</b>
<i>Autalia longicornis</i>		1	2				<b>3</b>
<i>Leptusa flavicornis</i>						2	<b>2</b>
<i>Lordithon lunulatus</i>			1	2			<b>3</b>
<i>Lordithon trinotatus</i>				1			<b>1</b>
<i>Megarthrus sinuatocollis</i>		1					<b>1</b>
<i>Mycetoporus cf. monticola</i>		3				4	<b>7</b>
<i>Omalium caesum</i>		1	1				<b>2</b>
<i>Omalium excavatum</i>				1			<b>1</b>
<i>Omalium littorale</i>	1			1			<b>2</b>
<i>Omalium rivulare</i>	2	3		1	1		<b>7</b>
<i>Oxypoda lividipennis</i>				1			<b>1</b>
<i>Oxypoda vittata</i>	1						<b>1</b>
<i>Philontus succicola</i>			1	1			<b>2</b>
<i>Proteinus atomarius</i>	5	17	6	5			<b>33</b>
<i>Proteinus brachypterus</i>	22	4	1	101		4	<b>132</b>
<i>Proteinus crenulatus</i>	2	7		11	1	1	<b>22</b>
<i>Quedius limbatus</i>		1				1	<b>2</b>
<i>Quedius maurus</i>						1	<b>1</b>
<i>Tachinus laticollis</i>				1			<b>1</b>
<i>Tachinus signatus</i>		1					<b>1</b>
total number of specimens	421	369	299	587	61	116	<b>1853</b>
total number of species	25	30	22	29	9	17	<b>53</b>