

First purposive study of beetles (Coleoptera) from endogeal environments in Bulgaria: collection sites and preliminary results

Rostislav Bekchiev* & Borislav Guéorguiev

National Museum of Natural History, 1 Tsar Osvoboditel Blvd, 1000 Sofia, Bulgaria; e-mails: bekchiev@nmnhs.com; bobivg@yahoo.com

*Corresponding author

ABSTRACT

So far, special attention to the endogeal and MSS (Mesovoid Shallow Substratum) fauna was not paid in Bulgaria, though typical subterranean species of the Coleoptera have been described. The aim of present study is to put on record the results of a broad-scale study of the coleopteran fauna from the MSS and lower (euedaphic) soil horizons in the country. We carried out investigations in the period April 2006–July 2014, mainly in the Vitosha Mt., Pirin Mt., Stara Planina Mts., Slavyanka Mt., Belasitsa Mt., Erma and Kresna Gorge, Western Rhodopes Mts., and Srednagora Mts. For the time being, material from the following families was identified to the genus and species levels: Anobiidae, Aphodiidae, Carabidae, Clambidae, Corylophidae, Curculionidae, Endomychidae, Histeridae, Leiodidae, Monotomidae, Scyrtidae, Silvanidae, Silphidae, Staphylinidae (Pselaphinae) and Zopheridae. We report for the first time the subgenus *Antisphodrus* Schaufuss, 1865 (Carabidae) and *Zustalestus* Reitter, 1912 (Curculionidae) from Bulgaria. *Blemus discus discus* (Fabricius, 1792) is recorded for the second time from the country.

KEY WORDS

Coleoptera; endogeal and MSS fauna; Bulgaria; news records.

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INTRODUCTION

The superficial, cave and hemiedaphic invertebrate fauna in Bulgaria has been an object of comprehensive investigations for almost 120 years already. In the same time still very little is known about invertebrates living in the lower soil layers (so called euedaphic or endogeic environments) and especially in the network of fissures and crevices in the maternal rock below the soil horizon.

The latter environment is usually referred to as Mesovoid Shallow Substratum (MSS), according to the works of Juberthie et al. (1980, 1981), or superficial subterranean habitats (SSHs), according

to Culver & Pipan (2008). In regard to the Coleoptera, it seems that this specific environment has been widely discussed by southwest Europe authors (Ruffo, 1959; Laneyrie, 1960; Coiffait, 1963) prior to its formal introduction by Juberthie et al. (1980). At present, at least four basic types of MSS habitats are discriminated (Juberthie, 2000, Ortúñu et al., 2013), based on different combinations of abiotic and biotic factors.

Typical endogeic species can be found in most of the soil-dwelling groups of Arthropoda: the Lower insects (Japygidae), beetles (Carabidae, Leiodidae), myriapods (Diplopoda, Chilopoda), isopods (Isopoda), spiders (Araneae), etc.

Undoubtedly, one of the most interesting groups among them are the beetles represented by a relatively high number of endemic species. Special attention to the endogean and MSS fauna in Bulgaria has been paid only recently (Deltchev et al., 2011; Langourov et al., 2014). Typical endogean or hypogean beetles, excluding those collected in caves and precipices, were found occasionally (Knirsh, 1930; Genest & Juberthie, 1983; Genest, 1983; Hurka, 1990; Janák & Moravec, 2008).

The aim of present study is to put on record the results of a broad-scale study of the coleopteran fauna inhabiting MSS and lower (euedaphic) soil horizons in Bulgaria. Here we give a list of the collecting localities and a register of the taxa found in the different sites.

MATERIAL AND METHODS

The investigation was carried out in the period April 2006-July 2014, manly in the Vitosha Mt.,

Pirin Mt., Stara Planina Mts., Slavyanka Mts., Belasitsa Mt., Erma and Kresna Gorge, Western Rhodopes Mts., and Sredna gora Mts (Fig. 1., Table 1).

The traps were made from PVC pipe with diameter of the holes 8 cm and length of 60 and 80 cm. One hundred and eight holes were drilled on each pipe, at 10 cm distance from its end. Traps were put into 60 or 80 cm deep hole dug as deep as the limestone or silicate layer. Ten centimeters high plastic cup tied to polythene rope, and filled with solution of ethilenglycol or ethilenglycol with few drops of formalin was put into the end of the pipe. Traps were covered by solid plastic covers in order to avoid penetration of superficial fauna into the pipe and infiltration of water during heavy rains. In some cases we also used olfactory attractant (fish).

The identification of the taxa has been made as follows: Curculionidae (Luigi Magnano), Histeridae (Evgeni Chehlarov), Pselaphinae (first author), and all other families (second author).

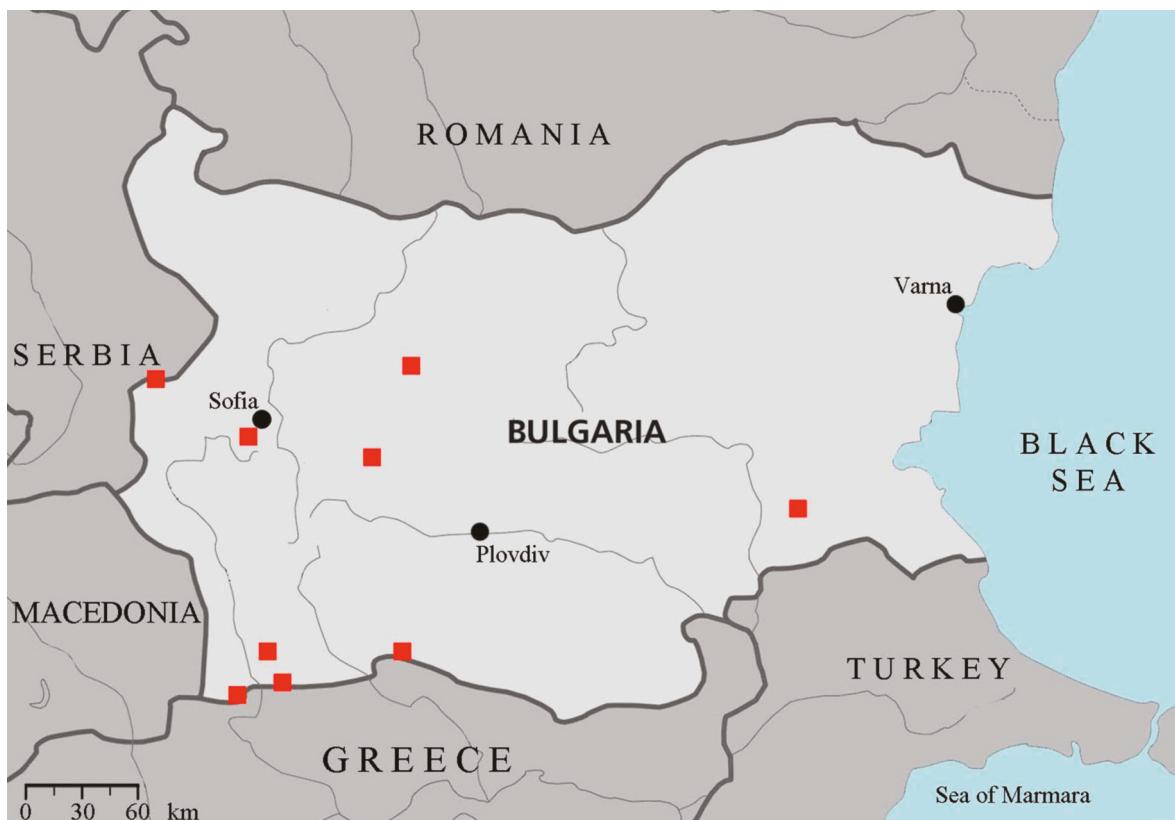


Figure 1. Distribution of localities with MSS traps in Bulgaria.

TRAP NO.	DATE OF SETTING	SITE DESCRIPTION	LENGTH OF TUBE
V-N-1	29.IV.2006	Vitosha Mts., northern slope, above Boyana, Boyanski kamak place, at the bottom of a 4-5 m deep microcave; dry, alt. 847 m.	70 cm
V-N-2&3	30.IV.2006	Vitosha Mts., northern slope, two traps set ca. 30-35 m above Boyanski kamak, in a scree in mixed forest of <i>Fagus silvestris</i> and <i>Carpinus betulus</i> ; alt. 847 m.	60 cm
V-E-1	13.V.2006	Vitosha Mts., eastern slope, approx. 28 km south of Sofia, on the road Sofia-Samokov, Yarema place; forest of <i>Fagus sylvatica</i> , in a brown soil, humid, close to a small river, alt. 1363 m	80 cm
V-W-1	10.VI.2006	Vitosha Mts., western slope, village of Bosnek, near the cave Duhlata, karst, stony substrate mixed with clay, alt. 964 m	80 cm
V-W-2	24.VI.2006	Vitosha Mts., western slope, village of Bosnek, near the cave Duhlata, karst, stony substrate, clay, alt. 992 m	60 cm
V-W-3	24.VI.2006	Vitosha Mts., western slope, village of Bosnek, near the cave Duhlata, karst, stony substrate, clay, alt. 992 m	70 cm
V-SL-1-2	06.VI.2013	Vitosha Mts., Bosnek Vill., near Akademik cave, N 42°29'28.28" E 23°11'18.28"	60 cm
V-SL-3	06.VI.2013	Vitosha Mts., Bosnek Vill., scree on the road to Chvipetlyovo	60 cm
V-SL-4	06.VI.2013	Bosnek Vill., Popov Izvor Karst spring	60 cm
V-SL-5	02.X.2013	Bosnek Vill., near Pepelyankata Cave	60 cm
V-SL-6	02.X.2013	Bosnek Vill., near Duhlata Cave	80 cm
BK-mss1	29.IV.2006	Vitosha Mt., above Boyana, Boyanski kamak place, at the bottom of a 4-5 m deep microcave; dry, alt. 847 m.	80 cm
Du-mss4	24.VI.2006	Vitosha Mt., near Bosnek Village, near Duhlata Cave, karst, stony substrate, clay, alt. 992 m	80 cm
P-W-2	7.V.2006	Pirin Mts., western slope, above village of Ilindentsi, Zandana Area, karst, in a scree, dry soil/ sandy substrate, alt. 492 m	70 cm
P-W-4	14.V.2006	Pirin Mts., western slope, village of Gradeshnitsa, near Gradeshnichka banya, at the base of stony/sandy cliff, dry, sandy/ stony substrate, alt. 312 m	60 cm
P-N-1	24.V.2006	Pirin Mts., northern slope, approx. 6 km before Predela Area, humid ravine, <i>Fagus sylvatica</i> forest, at the base of <i>Fagus</i> tree, thick layer of leaf litter, humid soil mixed with stones, alt. 676 m,	60 cm
P-N-2	24.V.2006	Pirin Mts., northern slope, approx. 6 km before Predela Area, humid ravine, <i>Fagus sylvatica</i> forest, humid soil and gravel, alt. 676 m	80 cm
P-E-1&2	25.V.2006	Pirin Mts., eastern slope, 3 km before village of Gospodintsi, Gotse Deltshev District, approx. 30 m away of the main road Bansko-Gotse Deltshev and approx. 5-6 m of a small river; in scree at the base of a limestone rocks, close to broad-leaf tree; alt. 585 m	60 cm
P-S-1	25.V.2006	Pirin Mts., southern slope, approx. 900 m after Popovi livadi Hut on the main road Gotse Deltshev-Katuntsi, ca. 40-50 m away of the road, marble stone debris on a small meadow; alt. 1367 m	50 cm
P-S-2&3	18.VI.2006	Pirin Mts., southern slope, approx. 1700 m away of the main road Gotse Deltshev-Katuntsi, on the secondary road to Orelyak Peak; in a small valley, <i>Fagus</i> forest, alt. 1560 m	60 cm

Table 1. Distribution of localities with MSS traps in Bulgaria (continued).

TRAP NO.	DATE OF SETTING	SITE DESCRIPTION	LENGTH OF TUBE
P-S-4&5	8.VI.2006	Pirin Mts., southern slope, St. Iliya Site near village of Kalimantsi; close to the chapel, under the venerable <i>Quercus coccifera</i> trees, alt. 494 m	60 cm
P-S-6	27.VI.2006	Pirin Mts., southern slope, Peshternik Site near village of Kalimantsi; against the large travertine, under the double willow, alt. 380 m	70 cm
P-S-7	27.VI.2006	Pirin Mts., southern slope, Peshternik Site near village of Kalimantsi; close to the large travertine, in a smaller travertine, under a hazel bush	60 cm
WR-1	23.IV.2006	West Rhodopes Mts., central parts, approx. 1100 m after the crossroad to village of Borovo towards village of Belitsa; on the left side of the road, in a small rocky valley, overgrown with bushes and <i>Pinus nigra</i> , ca. 50 m of the road, alt. 657 m	55 cm
WR-2	23.IV.2006	West Rhodopes Mts., central parts, approx. 1100 m after the crossroad to village of Borovo towards village of Belitsa; on the left side of the road, in a small rocky valley, overgrown with bushes and <i>Pinus nigra</i> , ca. 100 m of the road, alt. 666 m	80 cm
WR-3&4	23.IV.2006	West Rhodopes Mts., central parts, on the way to village of Belitsa; narrow valley on the right side of the road, ca. 80 m of the road, <i>Pinus nigra</i> and deciduous bushes, alt. 666-668 m	60 cm
WR-5	14.VII.2007	West Rhodopes Mts., southern parts, near village of Koshnitsa, below the cave Uhlovitsa; right slope, above the trek, at the foot of hornbeam bushes, not far from a old beech tree, humid and shady place, gravels in the soil, alt. 928 m	80 cm
EG-1&2	11.VI.2006	Rui Mts., Erma Gorge, ca. 30 m before the tunnel, on the slope overgrown with hazel bush, ash-trees; rocky substrate, at the foot of rocks; 685 m	60 cm
SP-1	6.VI.2006	Stara Planina Mts., Toplya Site near village of Golyama Zhelyazna; ca. 20 m of the entrance of Toplya Cave; ca. 25-30 m of the river; karst slope overgrown with scarce bushes and deciduous trees; 460 m	70 cm
SP-2	7.VI.2006	Stara Planina Mts., Toplya Site near village of Golyama Zhelyazna; ca. 5 m of the entrance of Yalovitsa Cave; karst slope inca. 25-30 m of the river; karst slope in young <i>Quercus</i> forest; 608 m	50 cm
S-1	4.VII.2006	Slavyanka Mts., Livade Site near village of Goleshevo in Alibotush Reserve; karst slope in <i>Pinus</i> forest; ca. 1700 m, N 41°23'532" E 23°36'307"	60 cm
SG-1	29.IV.2006	Sredna gora Mts., St. Ivan Site near Panagyurishte, abandoned vineyard overgrown with scattered Prune trees and blackberries in close proximity to forest of <i>Pinus nigra</i> ; deep soil layer, lower horizon mixed with stones, 584 m	100 cm
SG-2	29.IV.2006	Sredna gora Mts., same coordinates and site description; situated ca. 30 m apart of SG-1.	60 cm
SG-3	29.IV.2006	Sredna gora Mts., situated ca. 30 m apart of SG-1. Trap set in young artificial forest of <i>Pinus nigra</i> ; brown forest soil mixed with stones; 5-7 cm thick layer of pine needles	80 cm
SG-4	29.IV.2006	Sredna gora Mts., same coordinates and site description; trap is situated ca. 10 m apart of SG-3. Trap set in young artificial forest of <i>Pinus nigra</i> ; brown forest soil mixed with stones; 5-7 cm thick layer of pine needles	60 cm
DH-1&2	10.V.2007	Derventsky Heights, village of Dennitsa, crossroad to Stefan Karadzhovo, Yambol District, sink-hole in <i>Quercus</i> forest, at the base of a big stone; alt. 365 m	60 cm

Table 1 (continued). Distribution of localities with MSS traps in Bulgaria.

RESULTS

Up to now, material from the following families was identified to genus and/or species level: Anobiidae, Aphodiidae, Carabidae, Clambidae, Corylophidae, Curculionidae, Endomychidae, Histeridae, Leiodidae, Monotomidae, Scyrtidae, Silvanidae, Silphidae, Staphylinidae (Pselaphinae), and Zopheridae (Table 2).

DISCUSSION

Carabidae

Thirty one ground-beetle taxa at the species level were collected in the traps. Eight of them, including one undescribed species from the genus *Laemostenus*, are Balkan endemic species. The subgenus *Antisphodrus* Schaufuss, 1865 is a new taxon to the fauna of Bulgaria. So far, no species of this group was known from the core area of the Balkan Peninsula. *Antisphodrus* display scattered distribution in the Northern Mediterranean as its species occur from Spain in the west to Iran in the east. They have restricted distribution by loci and are confined to endogean and hypogean, primarily limestone habitats. The only female specimen we collected from this subgenus belongs to a new species for the science. Currently, the description of this form is prevented for the lack of enough material.

The ground-beetles collected might be divided conditionally in three categories in view of their degree of specialization to underground way of life. The first group includes three true endogean species. *Trechus subacuminatus* and *Laemostenus* (*Antisphodrus*) sp. are hither to found only in the MSS-niche in Bulgaria. The two species are partly depigmented, and possess small, but functioning eyes. With certainty, both are very rare and strictly localized everywhere since they were not caught before using the standart methods of collecting. To the same group belongs also *Duvalius regisborisi*, which formerly was found only in caves. It is an eyeless beetle well-adapted to life in the underground environment. The second group contains seven species (*Blemus discus discus*, *Laemostenus cimmerius* *weiratheri*, *L. plasoni*, *L. terricola punctatus*, *Trechus austriacus*, *T. irenis*, and *T. subnotatus*), the most of them found repeatedly in caves but now also caught in MSS-traps. That category

occupies an intermediate position between the euedaphic (endogean) species and the soil-inhabiting species.

The separation of this group is evidenced from their frequency and number of individuals found in the MSS-traps we put. The third group includes edaphic (or soil) species, which are primarily forest dwellers. This species complex is the dominant one with respect to the number of species-twenty species from fiftheen genera (Table 2). Most of those species are forest dwellers, except for *Bembidion dalmatinus* and *Syntomus pallipes*, which are characteristic of open and ecotone habitats. It is worth noting that the dominant species in the MSS-traps in the Vitosha Mt. is *Aptinus bombarda*. We did not find it in the traps put in other places. *Blemus discus discus* is recorded here for the second time for the country (see Hieke & Wrase, 1988).

Leiodidae

Twenty three taxa of the species level from Leiodidae have been identified till now. This figure excludes the species of *Colon* Herbst, 1797 and *Leiodes* Latreille, 1796 which identification is still unaccomplished. The most typical example of the MSS-environment is the endogean *Guerguievella petrovi*. This very small, blind and depigmented beetle belongs to a monotypic genus and species that was discovered not long ago (Giachino & Guéorguiev, 2007). The type series of this species includes three dozens of specimens made available by hand-collecting in six separate visits of the Kraypatnata Peshtera" Cave near Smilyan Village. The visits were carried out in the period 1962-2004.

Recently, we collected *Guerguievella petrovi* twice in MSS-traps in a mass, as the samples significantly differ to each other in the number of individuals. The first sample, exposed in the dry summer-autumn season, contained three specimens, while the next one, exposed in the wet autumn-winter season, contained more than 60 specimens. The cholevine species, like *Choleva angusara*, *C. glauca*, *Nargus badius*, *Ptomaphagus sericatus*, and *Sciodrepoides watsoni*, are detritophagous. They are sometimes collected in caves in Bulgaria and now they were found in MSS-traps. Other species, such as the leiodines (*Agathidium* spp., *Hydnobius* spp., *Leiodes* spp.), eat fungi and live above the ground or underground (Newton, 1998).

	Family	Species and subspecies	Trap No.	Collection date	References
1	Familia ANOBIIDAE	<i>Ptinus</i> sp.	V-N-1 P-W-2 P-S-4&5	30.4.-3.6.2006 7.5.-18.6.2006 7.12.2006-19.4.2007	Present paper
2	Familia APHODIIDAE	<i>Ataenius horticola</i> Harold, 1869 - Fig. 2.	P-W-2	14.05.-6.07.2006	Guéorguiev & Bekchiev, 2009
3		<i>Oxyomus sylvestris</i> (Scopoli, 1763)	P-W-4	7.05.-18.06.2006	Present paper
4	Familia CARABIDAE	<i>Abax (Abacopercus) carinatus carinatus</i> (Duftschmid, 1812)	SP-2; V-N-2 P-N-1; V-SL-4	6.6.-6.9.2006; 30.4.-3.6.2006; 7.9.2006; 6.6-02.10.2013	Langourov et al., 2014; present paper
5		<i>Amara (s.str.) saphyrea</i> Dejean, 1828	SG-1 SG-2	29.4.-29.5.2006 28.12.2006-20.04.2007	Present paper
6		<i>Aptinus (s.str.) bombarda</i> (Illiger, 1800)	V-N-1 V-N-2&3	3.6.-25.7.2006; 30.4.-3.6.2006; 5.11.2006-6.6.2007	Langourov et al., 2014
7		<i>Bembidion (Peryphanes) dalmatinum dalmatinum</i> Dejean, 1831	V-SL-3	6.6-2.10.2013	Langourov et al., 2014
8		<i>Blemus discus discus</i> (Fabricius, 1792) - Fig. 3	V-SL-4	6.6-2.10.2013	Langourov et al., 2014
9		<i>Carabus (Procrustes) coriaceus cerisyi</i> Dejean, 1826	SG-1	6.8.2006-18.11.2006	Present paper
10		<i>Cychrus semigranosus balcanicus</i> Hopffgarten, 1881	V-SL-3	6.6-2.10.2013	Langourov et al., 2014
11		<i>Duvalius (Paraduvalius) regisborisi</i> (Buresch, 1926)	SP-1	6.6.-6.9.2006	Present paper
12		<i>Harpalus (s.str.) atratus</i> Latreille, 1804	SP-2	6.6.-6.9.2006	
13		<i>Laemostenus(Actenipus) plasoni</i> (Reitter, 1885)	P-N-1 P-S-1 P-S-2&3	7.9.2006-3.7.2007; 9.2006-4.7.2007; 4.7.-17.10.2007	Present paper
14		<i>Laemostenus (Antispodrus) sp.</i>	EG-1&2	25.06.-2.12.2006	Present paper; new subgenus to the fauna of Bulgaria
15		<i>Laemostenus (Pristonychus) cimmerius weiraetheri</i> J. Müller, 1932	V-SL-1-2 V-SL-4	6.6-2.11.2013; 6.6-2.10.2013	Langourov et al., 2014
16		<i>Laemostenus (Pristonychus) terricola punctatus</i> (Dejean, 1828)	V-N-1; V-N-1; V-W-2; V-W-3; SG-4; BK-mss1 Du-mss4	3.06.-25.7.2006; 5.11.2006-6.6.2007; 26.8.-3.12.2006; 26.8.2006; 6.8.-18.9.2006; 3.06.-25.07.2006 26.08.-3.12.2006	Langourov et al., 2014 and present paper
17		<i>Leistus (Pogonophorus) rufomarginatus</i> (Duftschmid, 1812)	V-SL-4	6.6-2.10.2013	Langourov et al., 2014

Table 2 (1/6). List of the registered edaphicolous and hypogaeicolous Coleoptera from MSS- traps.

	Family	Species and subspecies	Trap No.	Collection date	References
18	Familia CARABIDAE	<i>Leistus (Pogonophorus) spinibarbis rufipes</i> Chaudoir, 1843	V-SL-5	2.11.2013-26.6.2014	Present paper
19		<i>Molops (s.str.) alpestris rhilensis</i> Apfelbeck, 1904	P-N-1 P-S-1 WR-2	7.9.2006-3.7.2007; 9.2006-4.7.2007; 3.4.-9.6.2006	Present paper
20		<i>Molops (s.str.) dilatatus dilatatus</i> Chaudoir, 1868	WR-1	23.4.2006-9.6.2006	Present paper
21		<i>Molops (s.str.) piceus bulgaricus</i> Mařan, 1938	V-N-2&3	5.11.2006-6.6.2007	Langourov et al., 2014
22		<i>Myas (s.str.) chalybaeus</i> (Pallardi, 1825)	SP-2	6.6.-6.9.2006	Present paper
23		<i>Platynus proximus</i> (J. Frivaldszky, 1879)	SP-1	06.06.-06.09.2006	Present paper
24		<i>Pterostichus (s.str.) merklii</i> (J. Frivaldszky, 1879)	SP-1	6.6.-6.9.2006	Present paper
25		<i>Pterostichus (Petrophilus) melanarius melanarius</i> (Illiger, 1798)	V-SL-4 V-SL-5 V-SL-6	6.6-2.10.2013; 2.10-2.11.2013; 2.10-2.11.2013	Langourov et al., 2014
26		<i>Pterostichus (Platysma) niger</i> (Schaller, 1783)	V-N-1 V-N-2&3	3.6.-25.7.2006; 5.11.2006-6.6.2007	Langourov et al., 2014
27		<i>Syntomus pallipes</i> (Dejean, 1825)	SG-1	29.4.-29.5.2006	Present paper
28		<i>Synuchus vivalis</i> (Illiger, 1798)	SG-4	6.8.-18.9.2006	Present paper
29		<i>Tapinopterus (s.str.) balcanicus</i> Ganglbauer, 1891	V-N-1 V-N-2 V-N-2 & 3 WR-1 WR-3 & 4	3.6.-25.07.2006; 30.4.-3.6.2006; 5.11.2006-6.6.2007; 9.6.-17.7.2006; 23.4.-9.6.2006	Langourov et al., 2014: present paper
30		<i>Tapinopterus (s.str.) cognatus kalofirensis</i> Mařan, 1933	SP-2	6.6.-6.9.2006	Present paper
31		<i>Trechus (s.str.) austriacus</i> Dejean, 1831	V-W-1 P-E-2 SG-1 SG-2 V-SL-1-2 V-SL-4 V-SL-5	24.6.-3.12.2006; 7.9.2006-4.7.2007; 29.4.-29.5.2006; 18.9.-28.12.2006; 6.6-2.11.2013; 2.10-02.11.2013; 2.10-02.11.2013	Langourov et al., 2014; present paper
32		<i>Trechus (s.str.) irenis</i> Csiki, 1912	V-SL-4	6.6-2.10.2013	Langourov et al., 2014
33		<i>Trechus (s. str.) subacuminatus</i> A. Fleischer, 1898	EG-1&2	11.06.-25.06.2006/ 2.12.2006-18.04.2007	Present paper New species for Bulgaria.
34		<i>Trechus (s. str.) subnotatus</i> Dejean, 1831	SG-3	18.11.-28.12.2006	Present paper

Table 2 (2/6). List of the registered edaphicolous and hypogaeicolous Coleoptera from MSS- traps.

	Family	Species and subspecies	Trap No.	Collection date	References
35	Familia CLAMBIDAE	<i>Clambus</i> sp.	EG-1&2 P-S-4&5	2.12.2006-8.4.2007; 7.12.2006-9.4.2007	Present paper
36	Familia CORYLOPHIDAE	<i>Sericoderus lateralis</i> (Gyllenhal, 1827)	SG-3	20.4.-1.5.2007	Langourov et al., 2014
37	Familia CURCULIONIDAE	<i>Acalles</i> sp.	P-E-1&2	7.9.2006-4.7.2007	Present paper
38		<i>Brachysomus</i> sp.	WR-1	1.4.-25.11.2007	Present paper
39		<i>Dodecastichus geniculatus</i> (Germar, 1817)	EG-1&2	25.6.-2.7.2006	Present paper
40		<i>Dodecastichus obsoletus</i> (Stierlin, 1861)	EG-1&2	25.6.-2.7.2006	Present paper
41		<i>Otiorhynchus</i> (s.str.) <i>albidus</i> Stierlin, 1861	P-S-4&5	19.8.-15.11.2007; 19.5.-13.7.2007	Present paper
42		<i>Otiorhynchus</i> (s.str.) <i>balcanicus</i> Stierlin, 1861	V-W-3 P-S-4&5	26.8.2006; 23.6.- 7.7.2006; 7.12.2006- 19.4.2007; 13.7.-19.8.2007; 19.8.-15.11.2007	Langourov et al., 2014; present paper
43		<i>Otiorhynchus</i> (s.str.) <i>bisulcatus</i> (Fabricius, 1781)	V-W-2 EG-1&2	26.7-26.8.2006; 25.6.-2.7.2006	Langourov et al., 2014; present paper
44		<i>Otiorhynchus</i> (s.str.) <i>coarctatus</i> Stierlin, 1861	V-W-2	26.7.2006	Langourov et al., 2014
45		<i>Otiorhynchus</i> (s.str.) <i>corneolus</i> Weise, 1906	V-W-1 V-W-2 V-W-3 EG-1&2	24.6.-3.12.2006; 26.7-26.8.2006; 4-16.6.2007; 25.6.-2.7.2006	Langourov et al., 2014; present paper
46		<i>Otiorhynchus</i> (s.str.) <i>crataegi</i> Germar, 1824	V-W-2	26.7.2006	Langourov et al., 2014
47		<i>Otiorhynchus</i> (s.str.) <i>juglandis</i> Apfelbeck, 1895	V-W-2; V-W-3 SG-1 SG-2 P-E-1&2 P-S-2&3 P-S-4&5 WR-3&4	26.7.2006; 26.8.2006; 5-20.8.2007; 29.5.- 17.6.2006; 7.9.2006- 4.7.2007; 4.7.-17.10.2007; 23.6.-7.7.2006; 1.4.-25.11.2007	Langourov et al., 2014; present paper
48		<i>Otiorhynchus</i> (s.str.) <i>ovalipennis</i> Boheman, 1843	P-S-4 & 5	23.6.-7.07.2006; 7.12.2006-19.4.2007; 19.5.-13.7.2007; 19.8.-15.11.2007	Present paper
49		<i>Otiorhynchus</i> (<i>Podoro-pelmus</i>) aff. <i>metsovensis</i> Magnano, 1999	P-S-2 & 3	4.7.-17.10.2007	Present paper; probably new species
50		<i>Otiorhynchus</i> (<i>Zustalestus</i>) <i>consobrinus</i> Reitter, 1913	P-S-1	4.7.-17.10.2007	Present paper; new subgenus for Bulgaria

Table 2 (3/6). List of the registered edaphicolous and hypogaeicolous Coleoptera from MSS- traps.

	Family	Species and subspecies	Trap No.	Collection date	References
51	Familia CURCULIONIDAE	<i>Stomodes rotundicollis</i> Frivaldszky, 1880	P-S-2&3	4.7.-17.10.2007	Present paper
52		<i>Sitophilus oryzae</i> (Linnaeus, 1763)	P-S-2&3	4.7.-17.10.2007	Present paper
53		<i>Tychius</i> sp.	P-S-4&5	23.6.-7.7.2006	Present paper
54	Familia ENDOMYCHIIDAE	<i>Hylaia reissi</i> Csiki, 1911	WR-2 EG-1&2 P-S-2&3 V-N-1; V-SL-3	9.06.-19.07.2006 25.06.-2.12.2006 4.07.-17.10.2007 5.11.2006-6.06.2007 02.11.2013-30.07.2014	Present paper
55		<i>Lycoperdina pulvinata</i> Reitter, 1884	S-1	9.6.2007	Present paper
56	Familia HISTERIDAE	<i>Abraeus perpusillus</i> (Marsham, 1802)	DH-1&2	10-20.5.2007	Present paper
57	Familia LEIODIDAE	<i>Agathidium</i> (s.str.) <i>bohemicum</i> Reitter, 1884	EG-1&2	25.6.-2.12.2006	Guéorguiev & Bekchiev, 2009
58		<i>Apocatops nigrita</i> (Erichson, 1837)	EG-1&2	25.6.-2.12.2006	Present paper
59		<i>Catops chrysomeloides</i> (Panzer, 1798)	V-SL-4	6.6 - 2.10.2013	Langourov et al., 2014
60		<i>Catops fuliginosus</i> Erichson, 1837	V-W-3 P-N-2 P-S-4&5 EG-1&2 V-SL-4	26.8.-3.12.2006; 16.6.2006; 27.06.-7.12.2006; 25.6.-2.12.2006; 2.10-2.11.2013	Langourov et al., 2014; present paper
61		<i>Catops grandicollis</i> Erichson, 1837	SG-1; SG-2	29.04.-29.05.2006; 1.05.-25.05.2007	Present paper
62		<i>Catops neglectus</i> Kraatz, 1852	P-N-2 WR-2 EG-1&2 SG-3 V-N-2&3	7.9.2006-3.7.2007; 23.4.-9.6.2006; 25.6.-2.12.2006; 18.11.-28.12.2006; 5.11.2006-6.6.2007	Guéorguiev & Bekchiev, 2009; Langourov et al., 2014
63		<i>Catops picipes</i> (Fabricius, 1792)	V-SL-4	2.10-02.11.2013	Langourov et al., 2014
64		<i>Catops subfuscus</i> Kellner, 1846	P-N-2	24.5.-16.6.2006	Guéorguiev & Bekchiev, 2009
65		<i>Catops tristis</i> (Panzer, 1794)	P-N-1 P-S-1	7.9.2006-3.7.2007; 9.2006-4.7.2007	Present paper
66		<i>Choleva</i> (s.str.) <i>agilis</i> (Illiger, 1798)	V-SL-4	6.6 - 2.10.2013	Langourov et al., 2014
67		<i>Choleva</i> (s.str.) <i>angustata</i> (Fabricius, 1781)	SG-1 V-SL-4	29.4.-29.5.2006; 6.6 - 2.10.2013	Langourov et al., 2014; present paper
68		<i>Choleva</i> (s.str.) <i>glauca</i> Britten, 1918	P-S-1 V-SL-4	9.2006-4.7.2007; 6.6 - 2.10.2013	Langourov et al., 2014 and present paper
69		<i>Choleva</i> (s.str.) <i>macedonica</i> Karaman, 1954 - Fig. 4	V-SL-4	6.6 - 2.10.2013	Langourov et al., 2014

Table 2 (4/6). List of the registered edaphicolous and hypogaeicolous Coleoptera from MSS- traps.

	Family	Species and subspecies	Trap No.	Collection date	References
70		<i>Choleva</i> (s.str.) <i>oblonga</i> Latreille, 1807	SG-2	20.4.-1.5.2007	Present paper
71		<i>Choleva</i> (s.str.) <i>reitteri</i> Petri, 1915	EG-1&2 V-SL-4	25.6.-2.12.2006; 6.6-2.10.2013	Langourov et al., 2014 and present paper
72		<i>Choleva</i> (<i>Cholevopsis</i>) <i>paskoviensis</i> Reitter, 1913	P-E-2; P-S-2; SG-1	7.09.2006-4.07.2007; 11.2006-4.07.2007; 6.08.-18.09.2006	Present paper
73		<i>Colon</i> sp.	P-E-2; P-S-4&5; EG-1&2	7.9.2006-4.7.2007; 7.12.2006-19.4.2007; 25.6.-2.12.2006; 18.4.- 17.6.2007	Present paper
74		<i>Guergievella petrovi</i> Giachino et Guéorguiev, 2007	WR-5	14.7.-13.10.2007	Present paper
75		<i>Hydnobius punctatus</i> Hampe, 1861	EG-1&2	25.6.-2.12.2006	Guéorguiev & Bekchiev, 2009
76		<i>Leiodes</i> sp.	P-W-2 P-S-4&5 EG-1&2	7.5.-18.6.2006; 7.12.2006-19.4.2007; 25.6.-2.12.2006	Present paper
77		<i>Liocyrtusa nigriclavis</i> (Hlisnikovský, 1967)	EG-1&2	25.6.-2.12.2006	Guéorguiev & Bekchiev, 2009
78		<i>Nargas</i> (s.str.) <i>badius rotundus</i> Karaman, 1954	V-E-1 P-N-1 EG-1&2 V-SL-4	16.4.-15.7.2007; 7.9.2006-3.7.2007; 17.6.-9.7.2007; 6.6-2.10.2013	Langourov et al., 2014 and present paper
79		<i>Nargas</i> (<i>Demorchus</i>) sp.	V-W-3	26.08.-3.12.2006	Present paper
80		<i>Ptomaphagus</i> (s.str.) <i>sericatus</i> (Chaudoir, 1845)	P-S-1 EG-1&2 V-SL-4	11.06.-25.06.2006; 9.2006-4.07.2007; 25.06.-2.12.2006; 17.06.- 9.07.2007; 02.10- 02.11.2013	Langourov et al., 2014; present paper
81		<i>Sciodrepoides watsoni</i> <i>watsoni</i> (Spence, 1815)	EG-1&2 V-N-2 P-N-1 P-N-2 SG-3	25.6.-2.12.2006; 30.4.- 3.6.2006; 7.9.2006- 3.7.2007; 7.9.2006- 3.7.2007; 29.05.- 17.6.2006; 17.6.- 6.8.2006	Langourov et al., 2014 and present paper
82	Familia MONOTOMIDAE	<i>Rhizophagus</i> (<i>Rhizophagus</i>) <i>ferrugineus</i> (Paykull, 1800)	DH-1&2	6.09-3.11.2007	Present paper
83		<i>Rhizophagus</i> (<i>Rhizophagus</i>) <i>perforatus</i> Erichson 1845	V-SL-4	6.6-2.10.2013	Langourov et al., 2014
84	Familia SCIRTIDAE	<i>Cyphon</i> sp.	SG-1	29.04.-29.05.2006	Present paper
85	Familia SILVANIDAE	<i>Oryzaephilus surinamensis</i> (Linnaeus, 1758)	V-SL-4	6.6-2.10.2013	Langourov et al., 2014

Table 2 (5/6). List of the registered edaphicolous and hypogaeicolous beetle (Coleoptera) taxa from MSS- traps.

	Family	Species and subspecies	Trap No.	Collection date	References
86	Familia SILPHIDAE	<i>Silpha obscura orientalis</i> Brullé, 1832	P-S-2&3	4.07.-17.10.2007	Present paper
87	Familia STAPHYLINIDAE (PSELAPHINAE)	<i>Batrisodes elysius</i> Reitter, 1884	P-W-4	6.7.2006	Present paper
88		<i>Bryaxis dalmatinus</i> (Reitter, 1881)	P-S-4&5 V-SL-1-2	27.6.-7.12.2006; 6.6-2.11.2013	Bekchiev, 2008; Langourov et al., 2014
89		<i>Bryaxis beroni</i> Karaman, 1969 - Fig. 5	EG-1&2	23.06.2008	Present paper
90		<i>Bryaxis islamitus</i> (Reitter, 1885)	P-N-2	4.07.-16.11.2007	Present paper
91		<i>Bryaxis roumaniae</i> Raffray, 1904	P-E-1&2; P-N-2; V-SL-3	4.07.-17.10.2007; 4.07-16.11.2007/P.S.; 02.10-02.11.2013	Langourov et al., 2014; present paper
92		<i>Bryaxis nodicornis</i> Aubé, 1833	V-SL-4	06.06-02.10.2013	Langourov et al., 2014
93		<i>Bythinus acutangulus</i> <i>lunifer</i> Karaman, 1948	P-N-2	4.07-16.11.2007	Present paper
94		<i>Claviger cf. elysius</i> Reitter, 1884	P-E-1	07.09.2006- 04.07.2007	Present paper
95		<i>Trimium caucasicum</i> Kolenati, 1846	P-S-4&5 P-S-6	19.04.-19.06.2007 15.11.2007	Present paper
96		<i>Trimium puncticeps</i> Reitter, 1880	V-SL-6	07.2014	Present paper
97		<i>Trimium expandum</i> Reitter, 1884	P-S-4&5	27.06.-7.12.2006	Bekchiev, 2008
98		<i>Tychus apfelbecki</i> Karaman, 1955	P-E-1	7.9.2006- 4.7.2007	Bekchiev, 2008
99	Familia ZOPHERIDAE	<i>Langelandia</i> sp.	P-W-2 P-E-1&2 P-S-4&5 DH-1&2	6.7.2006 7.9.2006-4.7.2007 7.12.2006-19.4.2007 10-20.5.2007	Present paper

Table 2 (6/6)285-296. List of the registered edaphicolous and hypogaeicolous Coleoptera from MSS- traps.

Choleva macedonica is worth mentioning. It has been described by a single male specimen collected from the cave of Bela Voda (Karaman, 1954), in the south of Republic of Macedonia. The cave lies on the left bank of Vardar River, close to the archeological site Prosek at the Demir-Kapija Canyon. Szymczakowski (1976) expressed doubts about the status of *C. macedonica* and listed it as questioned synonym of *C. sturmi* Brisout de Barneville, 1863. Subsequently the species status of the former was confirmed (Nonveiller et al., 1999) and since then it is considered distinct species (Perreau, 2004). *C. macedonica* was recently announced from Bulgaria (Langourov et al., 2014). Based on two male speci-

mens (one of them without head and pronotum), the record at Popov Izvor Karst Spring (see Table 2) represents the second finding of the species after the description and the first one out of Republic of Macedonia. The study of the aedeagus supports the view of Karaman (ibid.) that it is a distinct species, not synonym of *C. sturmi*.

From an ecological point of view, the most striking fact to us seems the coexistence of five species of *Choleva* (s. str.) at the same place and probably in the same time (Popov Izvor Karst spring, N42.50275 E23.15317, 06.VI-02.X.2013): *Choleva agilis*, *Ch. angustata*, *Ch. glauca*, *Ch. macedonia*, and *Ch. reitteri*.

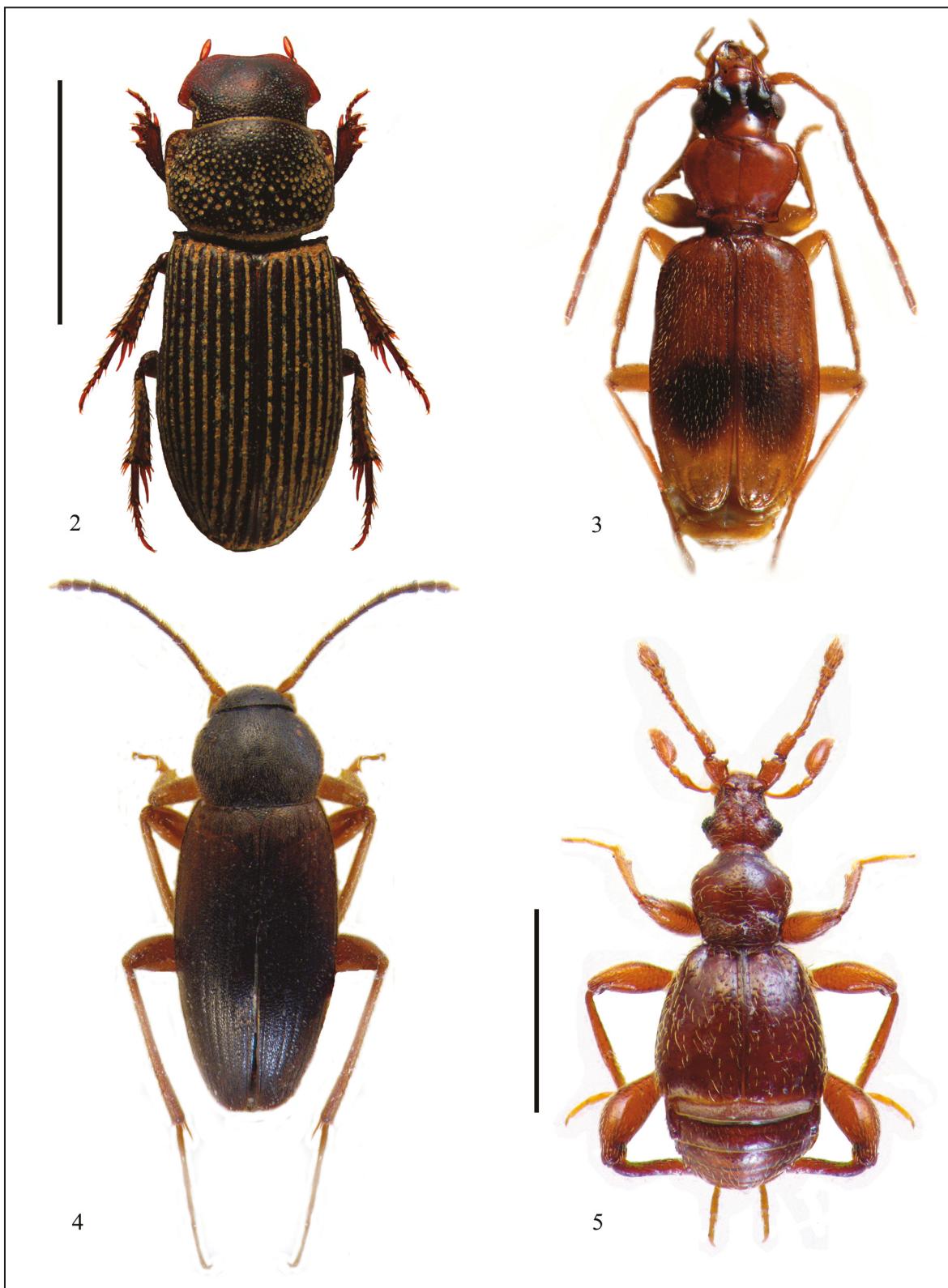


Figure 2. Habitus of *Ataenius horticola*; Figure 3. Habitus of *Blemus discus*; Figure 4. Habitus of *Choleva macedonica* (scale figs. 2–4: 2.5 mm); Figure 5. Habitus of *Bryaxis beroni* (scale: 1.0 mm).

Staphylinidae (Pselaphinae)

All species that were captured with MSS traps usually can be found in leaf litter, rotten wood or under bark of trees and under stones. Apparently these species penetrate deep in the soil and some of them (*Bryaxis islamitus*, *Batrisodes elysius*) can be found also in caves (Besuchet, 1978, 1993; Bekchiev, 2011). We could suppose that the reason for this vertical migration is the alteration of appropriate microclimatical conditions (temperature, humidity) on the surface of the soil during the different seasons. Interesting fact is the founding of *Bryaxis beroni* in MSS, up to now this species was known only from caves (Bekchiev, 2008; Hlaváč et al., 2008).

Curculionidae

Seventeen species of weevils have been caught in the MSS-trap as eleven of them belong to the genus *Otiorhynchus* Germar, 1822. The representatives of this genus are usually known as wingless rhizophagous. It is worth noting the finding of two taxa. The first of them is *Otiorhynchus consobrinus*. It belongs to the Balkan endemic subgenus *Zustalestus* Reitter, 1912 and is new to the Bulgarian fauna. So far, this species was known only from Croatia. The second species deserving attention is *Otiorhynchus (Podoropelmus)* sp. aff. *metsovensis* Magnano, 1999. This taxon might belong to a new species for the science, but additional material and works are needed to prove it.

other families

Besides species of the above discussed four families, we found in the traps also representatives of other twelve families (Table 2).

Among the last species, the most characteristic endogean element seems to be the genus *Langelandia* Aubé, 1842. The species from this genus are always blind and partially depigmented, and they are collected sometimes sifting soil litter. We have distinguished at least three morphospecies of *Langelandia* as only *L. anophthalma* Aubé, 1842 was hitherto reported for Bulgaria. The material from this genus will be object of a separate study.

The representatives of *Hylaia* Guérin-Ménéville, 1857 and *Lycoperdina* Latreille, 1807 (both

endomychids) have been collected also in Bulgaria shifting leaf litter, and rarely they fall in the pitfall traps "Barber". These beetles eat fungi and live in the ground, so their finding in the MSS-traps was not a surprise. An interesting fact is the collection of *Ataenius horticola*. The only species from subfamily Euparinae in continental Europe was only recently recorded from Bulgaria with detailed data (Guéorguiev & Bekchiev, 2009).

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