

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

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ABSTRACT

So far, special attention to the endogean 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; endogean 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 (MMS), 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, Ortuño 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 (euendaphic) 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, mainly 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 olphactory 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).

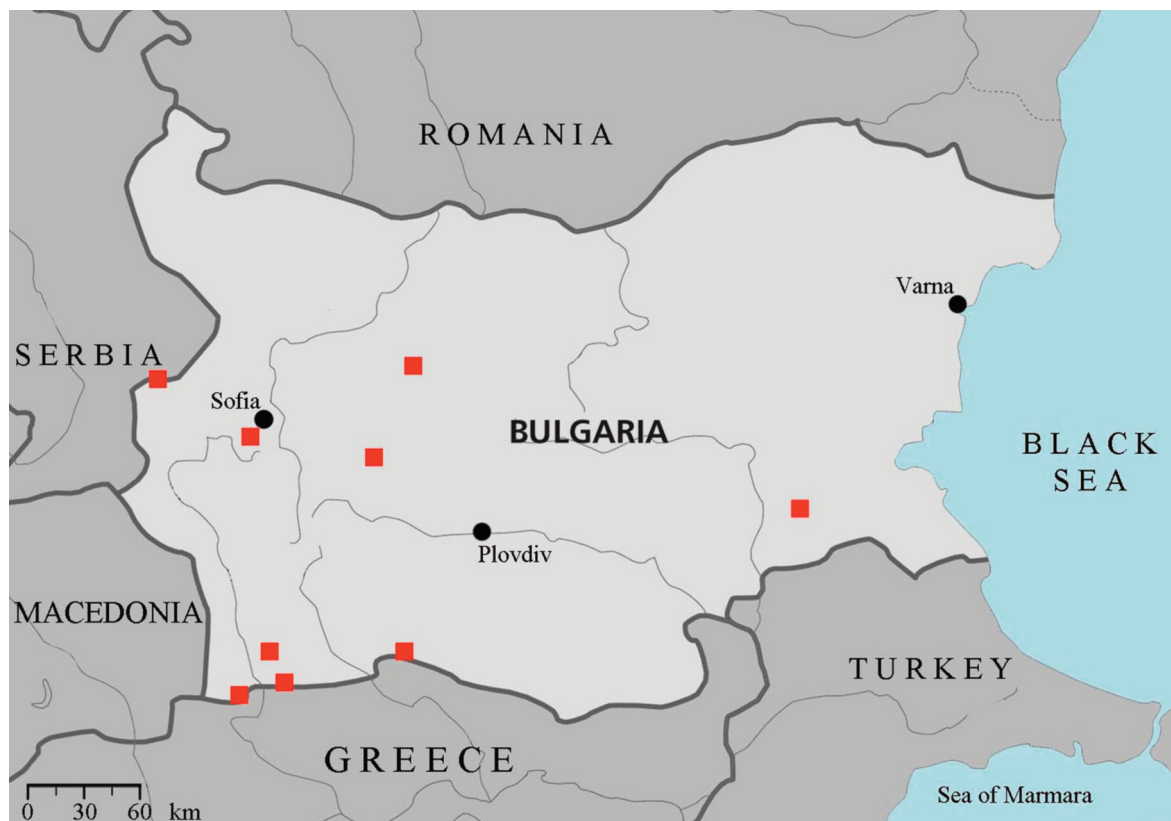


Figure 1. Distribution of localities with MSS traps in Bulgaria.

| 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 Chuipetlyovo | 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 silvatica</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 in ca. 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 Karadzovo, 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 eu-edaphic (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 fifteen genera (Table 2). Most of those species are forest dwellers, except for *Bembidion dalmatinum* 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 bombardata*. 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)</i> <i>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.) bombardia</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)</i> <i>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)</i> <i>coriaceus cerisyi</i> Dejean, 1826 | SG-1 | 6.8.2006-18.11.2006 | Present paper |
| 10 | | <i>Cychrus semigranosus</i> <i>balcanicus</i> Hopffgarten, 1881 | V-SL-3 | 6.6-2.10.2013 | Langourov et al., 2014 |
| 11 | | <i>Duvalius (Paraduvalius)</i> <i>regisborisi</i> (Buresch, 1926) | SP-1 | 6.6.-6.9.2006 | Present paper |
| 12 | | <i>Harpalus (s.str.)</i> <i>atratus</i> Latreille, 1804 | SP-2 | 6.6.-6.9.2006 | |
| 13 | | <i>Laemostenus (Actenipus)</i> <i>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</i> (<i>Antisphodrus</i>) sp. | EG-1&2 | 25.06.-2.12.2006 | Present paper; new subgenus to the fauna of Bulgaria |
| 15 | | <i>Laemostenus (Pristony-</i> <i>chus) cimmerius weira-</i> <i>theri</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 (Pristony-</i> <i>chus) 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)</i> <i>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 hypogeicolous Coleoptera from MSS- traps.

| | Family | Species and subspecies | Trap No. | Collection date | References |
|----|----------------------|---|--|--|---|
| 18 | Familia CARABIDAE | <i>Leistus (Pogonophorus)</i> <i>spinibarbis rufipes</i> Chaudoir, 1843 | V-SL-5 | 2.11.2013-26.6.2014 | Present paper |
| 19 | | <i>Molops (s.str.)</i> <i>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</i> <i>dilatatus</i> Chaudoir, 1868 | WR-1 | 23.4.2006-9.6.2006 | Present paper |
| 21 | | <i>Molops (s.str.) piceus</i> <i>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> (Palliard, 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.) mer-</i> <i>klii</i> (J. Frivaldszky, 1879) | SP-1 | 6.6.-6.9.2006 | Present paper |
| 25 | | <i>Pterostichus (Petrophi-</i> <i>lus) melanarius melana-</i> <i>rius</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)</i> <i>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.)</i> <i>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.)</i> <i>cognatus kalofirensis</i> Mařan, 1933 | SP-2 | 6.6.-6.9.2006 | Present paper |
| 31 | | <i>Trechus (s.str.)</i> <i>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.)</i> <i>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 hypogeicolous 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-</i> <i>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 hypogeicolous 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 ENDOMYCHIDAE | <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 (s.str.) 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 (s.str.) agilis</i> (Illiger, 1798) | V-SL-4 | 6.6 - 2.10.2013 | Langourov et al., 2014 |
| 67 | | <i>Choleva (s.str.) 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 (s.str.) 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 (s.str.) 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 hypogeicolous 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>Guerguievella 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> (Hlisenkovský, 1967) | EG-1&2 | 25.6.-2.12.2006 | Guéorguiev & Bekchiev, 2009 |
| 78 | | <i>Nargus</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>Nargus</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 surinamen-</i> <i>sis</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 hypogeicolous 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>Batrissodes 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 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 hypogeicolous 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*.

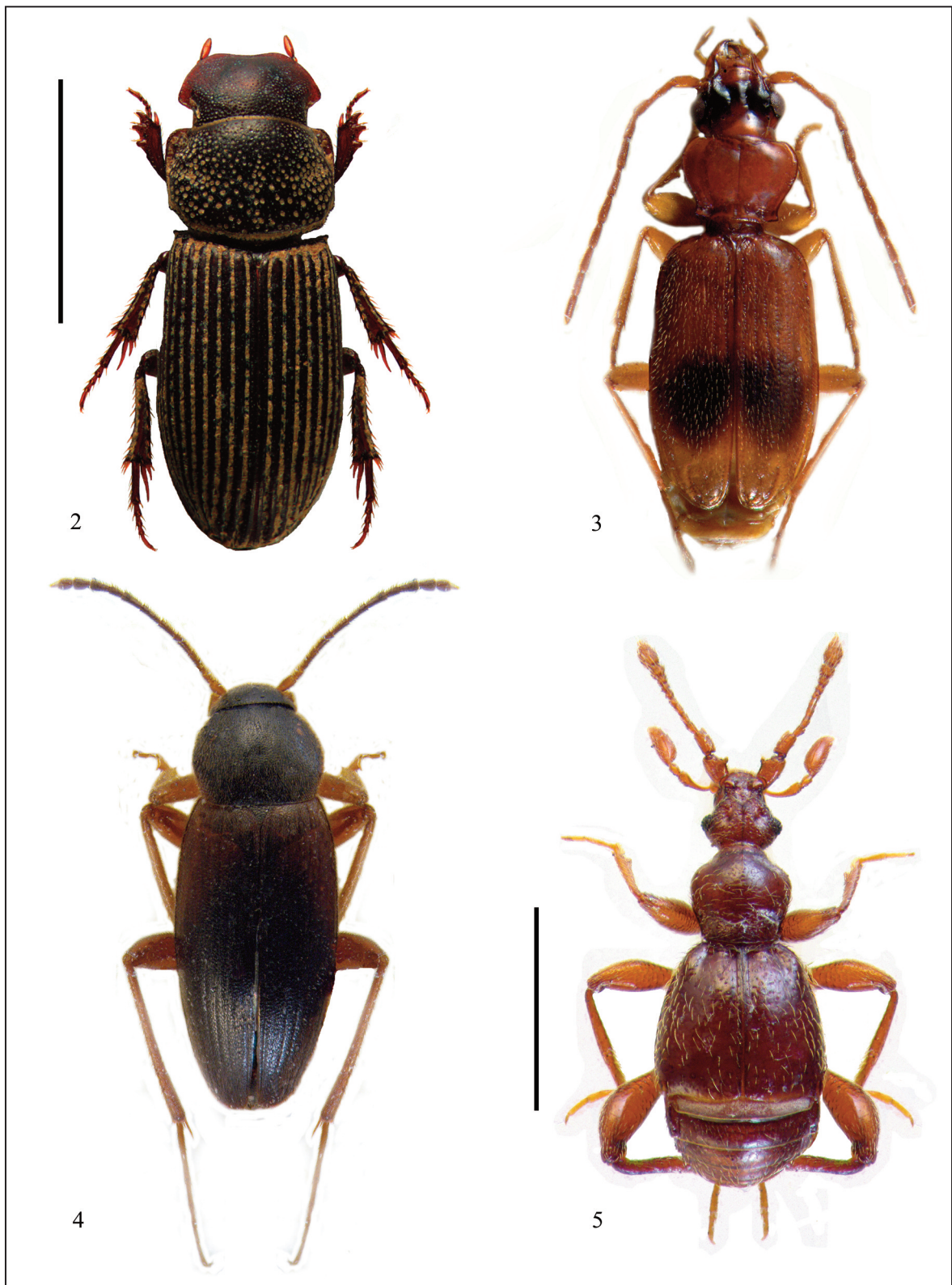


Figure 2. Habitus of *Ataenius horticola*; Figure 3. Habitus of *Blemus discus*; Figure 4. Habitus of *Choleva macedonica* (scale figs. 2–4: 2.5 mm); Figure 5. Habitus of *Bryaxis beroni* (scale: 1.0 mm).

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 heroni* 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. anophtalma* 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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