

*Ground Beetles (Coleoptera: Carabidae) and Some Other
Invertebrates from the Managed Nature Reserves
"Dolna Topchiya" and "Balabana"
(Lower Valley of the River of Tundzha, Bulgaria)*

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Abstract. The invertebrate fauna of the "Balabana" and "Dolna Topchiya" managed nature reserves is studied, with particular consideration to the ground beetles. The area of study is interesting from a biological point of view, as the Tundzha River constitutes a corridor of penetration of southern and thermophilic elements. On the other hand, the specifics of the territory predetermine the presence of many typically forest and some mountain species, as well as a lot of inhabitants of open biotopes, in particular – steppe forms. During the study, altogether 2041 specimens of carabid beetles belonging to 88 species are captured, as well as 76 other invertebrate species, some of which are with a conservation significance – new, endemic, rare, protected or endangered. Forty-six carabid species are reported for the first time for the Sakar-Tundzha region. Ground beetles are characterized and classified according to their zoogeographical belonging and the life forms they refer to.

Key words: Carabidae, invertebrates, "Balabana", "Dolna Topchiya", Tundzha River, Bulgaria.

Introduction

The investigation of the biota of the protected natural areas is an important component of their functioning and allows the assessment of the value of the given territory and its representativeness as a repository for the gene pool of the particular ecosystems. The work concerning the invertebrates at European level lies in the principles of Natura 2000 and consists in monitoring and conservation of a number of species and, on the other hand, those animals are used as indicator group in the monitoring programs of the targeted habitats.

Efforts in protecting the communities of invertebrates as potential indicators for the

state of the environment and as economic biological agents can be successful only if a sufficient amount of information about their structure and functioning in the different habitats is available. This fact underlines the need for further studies, especially at regional and national levels, and also emphasizes the importance of this study.

Up to this point only partial and insufficient investigations on the invertebrate fauna in the territory of the "Balabana" and "Dolna Topchiya" managed nature reserves have been conducted. Complete and profound studies are lacking, which premises the aim of the present research. The main objective of the study is to determine the species composition of

Carabidae, existing in the research area. The study will be a preliminary step in order to detect the Coleoptera fauna of the Lower valley of the Tundzha River, where this group is poorly studied. The additional notes about the other established invertebrates supplement the faunistic knowledge about the region.

Material and Methods

Study area. “Balabana” and “Dolna Topchiya” managed nature reserves are situated in south-eastern Bulgaria, near the town of Elhovo, along the Lower valley of the river of Tundzha (Fig. 1). The reserves are under the jurisdiction of the Regional Inspectorate of Environment and Water – Stara Zagora. The coordinates of the considered reserves’ centers are: 42°08’48”N, 26°32’23”E (average altitude 104 m a.s.l.) for “Balabana” and 42°12’07”N, 26°33’58”E (average altitude 107 m a.s.l.) for “Dolna Topchiya”.

Geographical location, climate features and natural landscapes in the region are a prerequisite for the great faunistic diversity. The combination of relatively high annual average temperatures with high humidity predetermines the shaping of longose habitats with high conservation significance along the banks of the river. The valley of the Tundzha River in turn represents an original corridor for the penetration of some Mediterranean and Neareastern invertebrate species. Weak exploration work in the area, however, does not allow the evaluation of its conservational value and the degree of the influence of the human factors. The territory of the two reserves includes variety of natural habitats, maintaining diverse animal species composition and faunistic complexes (TEOFILOVA *et al.*, 2016).

The area has not been subjected to detailed faunistic investigations. The lack of reliable faunistic studies impedes the overall assessment of the species abundance, size of the populations, nature of their spatial distribution, biodiversity and extent of anthropogenic impact.

For the whole Tundzha-Sakar region around 80 species of ground beetles

(Coleoptera: Carabidae) are known so far (GUÉORGUIEV & GUÉORGUIEV 1995). A large part of them are typical hygrophilous and mesophilous forms, attached to coastal and forest habitats (mostly representatives of the genera *Bembidion*, *Chlaenius*, *Agonum*, *Carabus*, etc.).

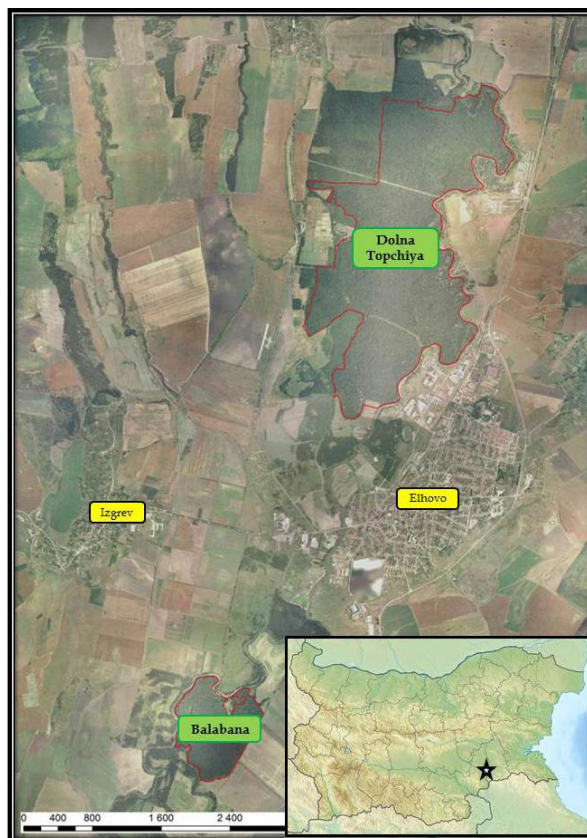


Fig. 1. Map of the location of the two reserves.

Field work and determination of the material. Field work was carried out in the periods: 8 – 12 May, 9 – 14 June and 1 – 5 September 2014. It included: 1) transect method with observations *in situ* or collection of material; 2) stationary method with „pitfall” traps made of plastic bottles, buried at the level of the ground surface, with a 4% solution of formaldehyde as a fixation fluid; this method is suitable for ecological research on adult beetles, and mainly reflects their activity (LÖVEI & SUNDERLAND, 1996); there are no reasonable alternatives to this type of traps in the study of epigeic arthropod communities (SPENCE & NIEMELA, 1994); it is considered that the

application of this method allows approximately 95% of the species active in radius of 50 m around the traps to be caught (BAARS & VAN DIJK, 1984); 3) handpicking and shaking of branches, capturing with a standard entomological sack; 4) collection of standard hydrobiological samples (ISO 10870, 2012) for determining the taxonomic composition of the benthic fauna in the Tundzha River and the channel Dipsiza.

Sampling areas in the "Balabana" Reserve were three: (I) Mesophilous oak (*Quercus* spp.) forest (12 traps); (II) Open habitat - meadow (8 traps); (III) Humid coastal forest with dominant tree species from the genera *Ulmus* and *Fraxinus* (11 traps). Sampling areas in the "Dolna Topchiya" Reserve were also three: (I) Open habitat - meadow (6 traps); (II) Ecotone (8 traps); (III) Humid coastal forest with dominant tree species from the genera *Ulmus* and *Fraxinus* (11 traps).

Captured animals were determined with the help of several main literary sources (BEI-BIENKO, 1965; HŮRKA, 1996; HARDE, 2000; MARINOV *et al.*, 2000; REITTER, 2006; PEHLIVANOV *et al.*, 2010; ARNDT *et al.*, 2011; STERL, 2000; Kryzhanovskij, 2017, unpublished data), and with the kind assistance of relevant specialists in the individual groups of invertebrates: Lyubomira Lyubomirova (aquatic invertebrates; Sofia University, Sofia), Dr. Dragan Chobanov (Orthoptera), Dr. Toshko Ljubomirov (Hymenoptera) (Institute of Biodiversity and Ecosystem Research - Bulgarian Academy of Sciences, Sofia), Dr. Nikolay Kodzhabashev (Forestry University, Sofia) and Dr. Mihail Danilevskiy (Cerambycidae; Institute of Ecology and Evolution - Russian Academy of Sciences, Moscow).

Materials are deposited in the collections of the Institute of Biodiversity and Ecosystem Research (Bulgarian Academy of Sciences, Sofia), Forestry University and Sofia University.

The systematic list of Carabidae follows KRYZHANOVSKIY *et al.* (1995).

Data analysis. According to their zoogeographical belonging ground beetles

were separated in zoogeographical categories and faunal types according to VIGNA TAGLIANTI *et al.* (1999) with some changes (KODZHABASHEV & PENEV, 2006): I. Northern Holarctic and Euro-Siberian faunal type: OLA - Holarctic; PAL - Palaearctic; W-PAL - Western Palaearctic; E-SI - Eurosiberian; E-WSI - Euro-Westsiberian. II. European faunal type: EUR - European; E-PAS - European-Neareastern; CE-PAS - Central European and Neareastern; CE-E - Central and Eastern European; BAL-K - Balkan-Carpathian. III. Euroasiatic faunal type: E-AS - Euroasiatic steppe complex; E-CAS - European and Central Asian; B-CAS - Balkan and Central Asian; B-PAS - Balkan-Neareastern (+ Balkan-Anatolian). IV. Mediterranean (*sensu lato*) faunal type (*species of the Ancient Mediterranean*): E-CA-M - European-Centralasian-Mediterranean; E-PA-M - European-Neareastern-Mediterranean; CA-MED - Mediterranean-Centralasian; MED-PA - Mediterranean-Neareastern; MED - Mediterranean; E-MED - Eastmediterranean; NMED - Northmediterranean; NM-CAS - Northmediterranean-Centralasian. V. Endemic complex: BAL - Balkan endemic.

Categorization of the species in respect of their life forms follows the classification of SHAROVA (1981). The following codes were used: *Life form class 1. Zoophagous.* Life form subclass: 1.2 - Epigeobios; 1.3 - Stratobios; 1.4 - Geobios. Life form groups: 1.2.2 - large walking epigeobionts; 1.2.2(1) - large walking dendroepigeobionts; 1.2.3 - running epigeobionts; 1.2.4 - flying epigeobionts; 1.3(1) - series crevice-dwelling stratobionts; 1.3(1).1 - surface & litter-dwelling; 1.3(1).2 - litter-dwelling; 1.3(1).3 - litter & crevice-dwelling; 1.3(2) - series digging stratobionts; 1.3(2).1 - litter & soil-dwelling; 1.4.2(1) - small digging geobionts; 1.4.2(2) - large digging geobionts. *Life form class 2. Mixophytophagous.* Life form subclass: 2.1 - Stratobios; 2.2 - Stratohortobios; 2.3 - Geohortobios. Life form groups: 2.1.1 - crevice-dwelling stratobionts; 2.2.1 - stratohortobionts; 2.3.1 - harpaloid geohortobionts; 2.3.2 - zabroid geohortobionts; 2.3.3 - dytomeoid geohortobionts. The first digit in the index

shows the class of life form, the second – the subclass, the third – the life form group. In brackets after the subclass the series is shown, when it exists.

Results and Discussion

Faunistic and taxonomic data about the ground beetles

During the study, altogether 2041 specimens of ground beetles belonging to 42 genera and 88 species are captured – 860 specimens and 61 species in “Balabana” and 1181 specimens and 67 species in “Dolna Topchiya” (Appendix 1). This represents 34% of the genera and 12% of the species occurring in Bulgaria. Full list of the established carabids is given in Appendix 1.

The distribution of the species and specimens among the different sampling sites is shown on Table 1. Forests seem to maintain a greater abundance and diversity of carabids than the open habitats. Given the fact that the natural river valleys and the periodically inundated coastal forests are becoming rarer across Europe (TOMIAŁOJC & DYRCZ, 1993) efforts for the conservation of the biological diversity should be directed towards preservation and restoration of this type of habitats and restriction of their anthropogenization.

Representatives of 20 tribes are captured. The most species rich in both of the reserves is the tribe Harpalini, probably due to the presence of inhabitants of the open habitats. Same pattern is also noticed with the abundance of the ground beetles – the largest number of specimens was established for the same tribe in both of the reserves (Table 2).

As a result of the field work 46 species are reported for the first time for the Sakar-Tundzha region, where “Balabana” and “Dolna Topchiya” are located. Those are: *Elaphrus aureus*, *Scarites terricola*, *Clivina fossor*, *Apotomus clypeonites adanensis*, *Asaphidion flavipes*, *Bembidion lampros*, *Bembidion properans*, *Bembidion lunulatum*, *Poecilus cupreus*, *Poecilus cursorius*, *Pterostichus ovoideus*, *Pterostichus melas*, *Abax carinatus*, *Calathus fuscipes*, *Calathus*

melanocephalus, *Calathus cinctus*, *Laemostenus venustus*, *Limodromus assimilis*, *Anchomenus dorsalis*, *Amara tricuspis*, *Amara aenea*, *Amara convexior*, *Amara communis*, *Anisodactylus binotatus*, *Diachromus germanus*, *Parophonus laeviceps*, *Parophonus mendax*, *Parophonus hirsutulus*, *Ophonus laticollis*, *Ophonus cribricollis*, *Harpalus honestus*, *Harpalus atratus*, *Harpalus subcylindricus*, *Harpalus tardus*, *Harpalus latus*, *Carterus dama*, *Dixus eremita*, *Chlaenius nitidulus*, *Chlaenius nigricornis*, *Badister bullatus*, *Philorhizus notatus*, *Syntomus obscuroguttatus*, *Microlestes fissuralis*, *Microlestes minutulus*, *Microlestes negrita negrita*, *Brachinus psophia*. Eleven species could also be pointed out as new for the region, although they were noted in another study, concerning the area of the Lower valley of Tundzha (TEOFILOVA *et al.*, 2016): *Leistus ferrugineus*, *Notiophilus palustris*, *Notiophilus rufipes*, *Calosoma sycophanta*, *Carabus granulatus*, *Bembidion decolor*, *Bembidion inoptatum*, *Bembidion castaneipenne*, *Stomis pumicatus*, *Amblystomus niger*, *Microlestes fulvibasis*. The presence of *Harpalus rubripes* in the studied region is confirmed.

Zoogeographical peculiarities of the ground beetles

The analysis of the data shows that the Northern Holarctic and European-Siberian complex (species distributed mainly in the northern regions of the Holarctic, mostly in Europe and Siberia) prevails, consisting of 24 species (27% of all species). Mediterranean (*s. lato*) complex is immediately after it with 22 species (25%). European-Asiatic type (species ranges lie between the Eurosiberian and Mediterranean zones) includes 21 species (24%). European faunal type (mostly forest dwelling species connected to the middle and southern part of Europe) consists of 17 species (19%). Only 4 (5%) Balkan endemics are found (Fig. 3A). In terms of the quantitative relations, however, European complex is dominant with 50% of all captured ground beetle specimens (Fig. 3B).

Table 1. Number of specimens and species of Carabidae, captured in the different biotopes in both studied reserves.

<i>"Balabana"</i>			<i>"Dolna Topchiya"</i>		
<i>Sampling site</i>	<i>Number of specimens</i>	<i>Number of species</i>	<i>Sampling site</i>	<i>Number of specimens</i>	<i>Number of species</i>
Mesophilous oak forest	314	30	Meadow	320	28
Meadow	240	29	Ecotone	381	32
Humid coastal forest	303	35	Humid coastal forest	477	36
hand catch	3	3	hand catch	3	3
Total:	860	61	Total:	1181	67

Table 2. Number of specimens and species in the different tribes of Carabidae, captured in both studied reserves.

<i>Tribe</i>	<i>"Balabana"</i>		<i>"Dolna Topchiya"</i>		<i>Both reserves</i>	
	<i>Number of specimens</i>	<i>Number of species</i>	<i>Number of specimens</i>	<i>Number of species</i>	<i>Number of specimens</i>	<i>Number of species</i>
Cicindelini	-	-	35	2	35	2
Nebriini	8	2	32	1	40	2
Notiophilini	46	2	36	1	82	2
Carabini	197	7	101	4	298	8
Elaphrini	4	1	-	-	4	1
Scaritini	-	-	1	1	1	1
Clivinini	1	1	-	-	1	1
Dyschiriini	4	1	8	1	12	1
Apotomini	-	-	2	1	2	1
Trechini	59	1	19	1	78	1
Bembidiini	61	5	68	4	129	7
Pterostichini	84	6	82	6	166	7
Sphodrini	14	3	94	4	108	4
Agonini	41	2	92	2	133	2
Amarini	29	5	27	4	56	6
Harpalini	292	16	541	23	833	27
Callistini	-	-	5	3	5	3
Licinini	2	2	1	1	3	2
Lebiini	5	4	30	6	35	6
Brachinini	13	3	7	2	20	4
Total:	860	61	1181	67	2041	88

Representatives of 23 zoogeographical categories are established during the study. The largest number of species is found in the following categories: Palearctic (10 species), European and Neareastern (10 species), European and Central Asian (10 species) and European-Centralasian-Mediterranean (8 species) - one category

from each of the faunal complexes. Similar pattern is observed also in the quantitative relations (Table 3).

Physiographic conditions and habitat peculiarities of the research area determine the presence of various zoogeographical elements. Mesophilous and longose forests keep many nemoral (primarily European

and European-Siberian forest species) elements. At the same time, the valley of the river of Tundzha helps the penetration of some Mediterranean and Neareastern forms. The endemic complex is less covered, probably due to the dynamic conditions caused by the unstable hydrological regime of the river.

Life forms of the ground beetles

The 88 ground beetle species and subspecies, established for the area of "Balabana" and "Dolna Topchiya" reserves, relate to two classes and 17 life form groups proposed by SHAROVA (1981), with clear predominance of class Zoophaga, presented by 55 species (62.5% of all species). Mixophytophagous are 33 species (37.5%). According to SHAROVA (1981) similar distribution is typical for the forest-steppe zones. The most numerous are the surface and litter-dwelling stratobionts (15 species; 17%) and litter and crevice-dwelling stratobionts (10 species; 11%) from class Zoophaga and the harpaloid geohortobionts (15 species; 17%) from class Mixophytophaga (Fig. 4A). These numbers and polidominant pattern of the life form groups are typical for the forests (SHAROVA 1981).

In quantitative relations is noticeable the significant percentage of the mixophytophagous harpaloid geohortobionts, mainly due to the increased presence of species from the genus *Harpalus* in the open parts of the reserves (Fig. 4B).

Notes on the other invertebrate groups

During the field observations are identified 76 invertebrate species (except the ground beetles), under 46 families, 22 orders and 6 classes: Bivalvia - 3 species (3 in "Balabana" and 2 in "Dolna Topchiya"), Gastropoda - 8 species (4 in "Balabana" and 7 in "Dolna Topchiya"), Clitellata - 3 species (1 in "Balabana" and 3 in "Dolna Topchiya"), Malacostraca - 5 species (2 in "Balabana" and 5 in "Dolna Topchiya"), Insecta - 57 species (38 in "Balabana" and 38 in "Dolna Topchiya").

In the "Balabana" Reserve altogether (with the ground beetles) 108 invertebrate species are found and in "Dolna Topchiya" Reserve - 125 species. Full list of the established invertebrate animals are given in Appendix 2. A total of 145 insect species are captured. Most of them are coleopterans and ants (Fig. 5). A number of species with conservation significance - protected, rare, endemic, or species with restricted distribution and species with scientific value - were found during the study (TEOFILOVA *et al.*, 2016).

Conclusions

As a result of the present study 88 species of ground beetles were established. Four Balkan endemics were found among them. Seventy-six other invertebrates were recorded. The real state of the diversity of the invertebrates in the area could be revealed only after future investigations and discovery of additional new species for the region.

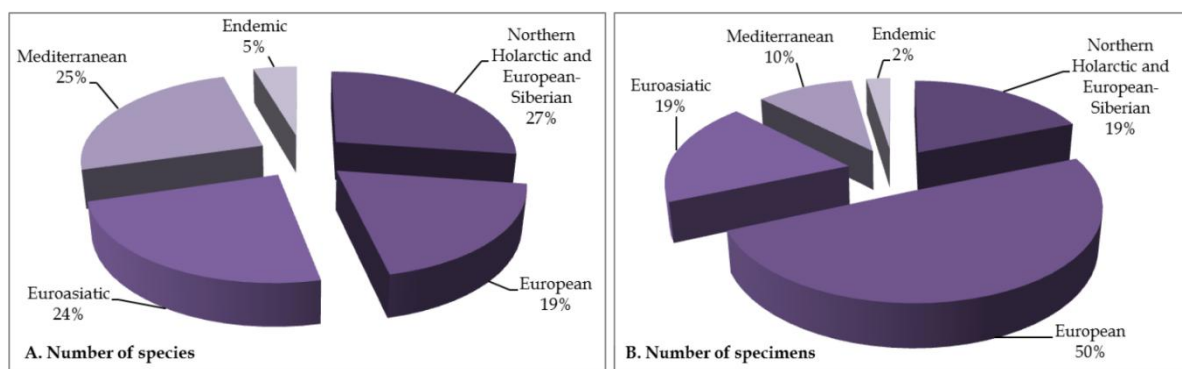
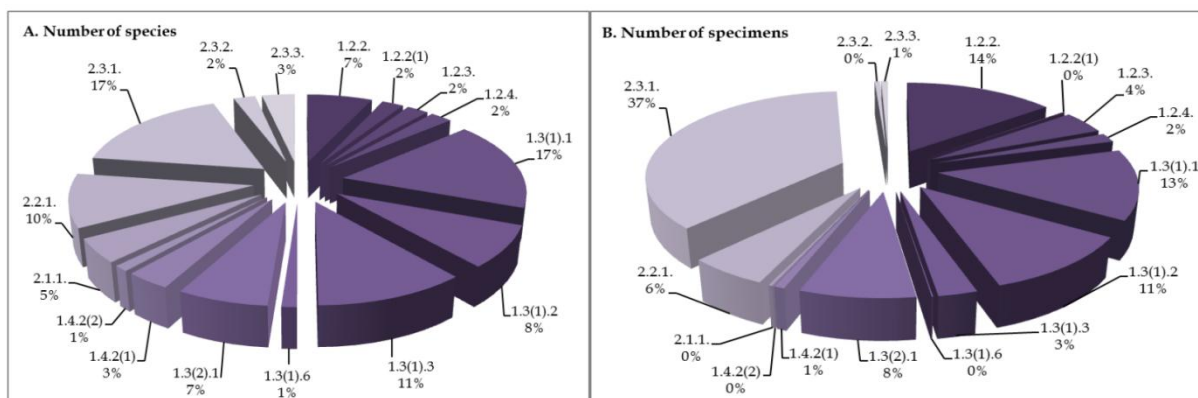


Fig. 3. Qualitative and quantitative zoogeographical peculiarities of the ground beetles from the two studied managed nature reserves.

Table 3. Zoogeographical categories of the ground beetles.

<i>Faunal type</i>	<i>Zoogeographical element</i>	<i>Number of species</i>	<i>%</i>	<i>Number of specimens</i>	<i>%</i>
<i>Northern Holarctic and European-Siberian</i>	OLA	3	3.4	73	3.6
	PAL	10	11.4	180	8.8
	W-PAL	4	4.5	92	4.5
	E-SI	4	4.5	40	2.0
	E-WSI	3	3.4	4	0.2
	EUR	1	1.1	4	0.2
<i>European</i>	E-PAS	10	11.4	499	24.5
	CE-PAS	3	3.4	189	9.3
	CE-E	2	2.3	201	9.8
	BAL-K	1	1.1	118	5.8
	E-AS	6	6.8	50	2.4
<i>Euroasiatic</i>	E-CAS	10	11.4	325	15.9
	B-CAS	1	1.1	1	0.05
	B-PAS	4	4.5	7	0.3
	E-CA-M	8	9.1	125	6.1
	E-PA-M	4	4.5	12	0.6
	CA-MED	2	2.3	7	0.3
	<i>Mediterranean</i>	MED-PA	1	1.1	3
MED		1	1.1	4	0.2
E-MED		2	2.3	4	0.2
NMED		3	3.4	44	2.2
NM-CAS		1	1.1	8	0.4
<i>Endemic</i>		BAL	4	4.5	51

**Fig. 4.** Qualitative and quantitative peculiarities of the life forms of the carabids from the two studied managed nature reserves.

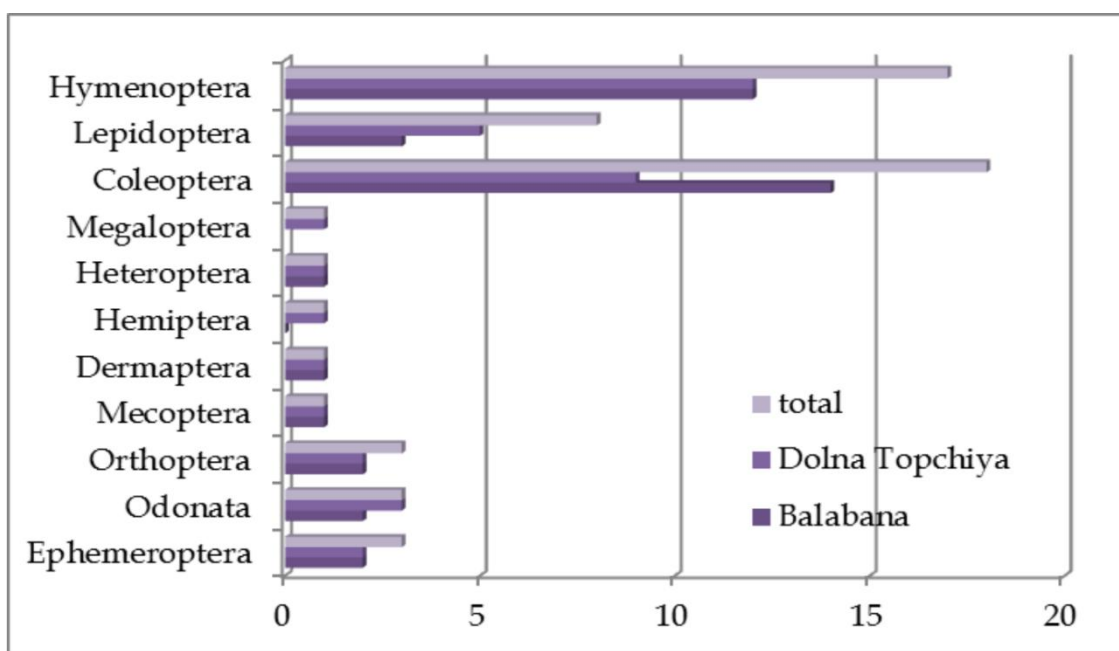


Fig. 5. Number of species of insects from the different orders. For order Coleoptera the data about the ground beetles (Carabidae) are not included.

It should be noted the importance of the territory for the preservation of many southern thermophilic faunistic elements with limited distribution in Europe and Bulgaria. Especially great is the role of the dense longose forests as refugia of mesophylous and hygrophilous mountain faunistic elements.

Mesophylous and humid forests maintain a significant abundance and diversity of invertebrates with specific ecological requirements. A major factor in the conservation of these stenotopic species is the preservation of their original primary habitats.

It is necessary the abiding of all restrictions and prohibitions currently in force within the territory of the reserves to be ensured, as well as the conservation of the natural habitats in unaltered state, which would provide a possibility for the fulfilment of the natural successional changes.

The humidification of the dried up eastern part of the "Balabana" Reserve is advisable. The presence of introduced tree species in both reserves is undesirable, because not characteristic edificators are a prerequisite for unpredictable succession.

Conservation of the biological diversity cannot be achieved without sustainable development of socio-economic conditions. In view of the low level of these conditions in the area, the emergence of conflict is inevitable.

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Appendix 1. Checklist of the carabid beetles, found in the two reserves (codes for the zoogeographical categories, life forms and sampling sites are given in Material and Methods). Species marked with asterisk (*) are reported for the first time for the Sakar-Tundzha region where “Balabana” and “Dolna Topchiya” are located. Species marked with (#) are noted in another study, concerning the area (TEOFILOVA *et al.*, 2016).

№	Species	Range type	Life form	Material	
				“Balabana”	“Dolna Topchiya”
Tribe Cicindelini					
1.	<i>Cylindera (Cylindera) germanica germanica</i> (Linnaeus, 1758)	E-PAS	1.2.4	-	16♀, 17♂ (II)
2.	<i>Cicindela (Cicindela) campestris campestris</i> Linnaeus, 1758	PAL	1.2.4	-	2♂ (II)
Tribe Nebriini					
3.#	<i>Leistus (Leistus) ferrugineus</i> (Linnaeus, 1758)	E-SI	1.3(1).2	2♂ (III)	-
4.	<i>Nebria (Nebria) brevicollis</i> (Fabricius, 1792)	E-PAS	1.3(1).2	1♀, 1♂ (I); 2♀, 2♂ (III)	15♀, 17♂ (III)
Tribe Notiophilini					
5.#	<i>Notiophilus palustris</i> (Duftschmid, 1812)	E-SI	1.3(1).1	2♀, 3♂ (I); 1♀, 3♂ (III)	-
6.#	<i>Notiophilus rufipes</i> Curtis, 1829	E-PAS	1.3(1).1	13♀, 22♂ (I); 2♂ (III)	22♀, 14♂ (III)
Tribe Carabini					
7.#	<i>Calosoma (Calosoma) sycophanta</i> Linnaeus, 1758	PAL	1.2.2(1)	1♀ (I); 1♂ (III)	-
8.	<i>Calosoma (Acalosoma) inquisitor</i> (Linnaeus, 1758)	W-PAL	1.2.2(1)	1♂ (III)	-
9.	<i>Carabus (Eucarabus) ullrichi rhilensis</i> Kraatz, 1876	CE-E	1.2.2	1♂ (hand); 33♀, 25♂ (I); 1♀ (II); 18♀, 19♂ (III)	2♀, 1♂ (II); 10♀, 16♂ (III)
10.	<i>Carabus (Tachypus) cancellatus intermedius</i> Dejean, 1826	BAL	1.2.2	1♀ (I)	-
11.#	<i>Carabus (Carabus) granulatus granulatus</i> Linnaeus, 1758	E-AS	1.2.2	1♀ (I)	-
12.	<i>Carabus (Tomocarabus) convexus gracilior</i> Géhin, 1885	BAL-K	1.2.2	15♀, 13♂ (I); 25♀, 20♂ (III)	2♀, 1♂ (II); 26♀, 16♂ (III)
13.	<i>Carabus (Procrustes) coriaceus kindermanni</i> Walzl, 1838	BAL	1.2.2	6♀, 2♂ (I); 8♀, 4♂ (II); 2♀ (III)	1♀ (hand); 3♀, 2♂ (I); 6♀, 3♂ (II); 8♀, 3♂ (III)
14.	<i>Carabus (Procerus) scabrosus scabrosus</i> Olivier, 1789	BAL	1.2.2	-	♀ (hand)
Tribe Elaphrini					
15.*	<i>Elaphrus (Elaphroterus) aureus aureus</i> P. W. J. Müller, 1821	EUR	1.2.3	2♀, 2♂ (III)	-
Tribe Scaritini					
16.*	<i>Scarites (Parallelomorphus) terricola</i> Bonelli, 1813	PAL	1.4.2(2)	-	1 ex. (II)

Tribe Clivinini					
17.*	<i>Clivina (Clivina) fossor fossor</i> (Linnaeus, 1758)	PAL	1.4.2(1)	1♀ (III)	-
Tribe Dyschiriini					
18.	<i>Dyschiriodes (Eudyschirius)</i> <i>globosus</i> Herbst, 1784	PAL	1.4.2(1)	4 ex. (III)	8 ex. (III)
Tribe Apotomini					
19.*	<i>Apotomus clypeonites adanensis</i> Jedlicka, 1961	E-MED	1.4.2(1)	-	1♀, 1♂ (II)
Tribe Trechini					
20.	<i>Trechus (Trechus) quadristriatus</i> (Schrank, 1781)	E-CA-M	1.3(1).2	19♀, 17♂ (I); 14♀, 9♂ (III)	8♀, 11♂ (III)
Tribe Bembidiini					
21.*	<i>Asaphidion flavipes</i> (Linnaeus, 1761)	W-PAL	1.2.3	16♀, 24♂ (I); 11♀, 3♂ (III)	17♀, 12♂ (III)
22.*	<i>Bembidion (Metallina) lampros</i> (Herbst, 1784)	OLA	1.3(1).1	1♀, 3♂ (I)	12♀, 25♂ (III)
23.*	<i>Bembidion (Metallina) properans</i> (Stephens, 1828)	E-WSI	1.3(1).1	-	1♂ (III)
24.#	<i>Bembidion (Philochthus) decolor</i> Apfelbeck, 1911	BAL	1.3(1).1	1♂ (I)	-
25.#	<i>Bembidion (Philochthus) inoptatum</i> Schaum, 1857	CE-PAS	1.3(1).1	1♀ (III)	-
26.*	<i>Bembidion (Philochthus) lunulatum</i> (Geoffroy in Fourcroy, 1785)	W-PAL	1.3(1).1	-	1♀ (I)
27.#	<i>Bembidion (Peryphanes)</i> <i>castaneipenne</i> Jacquelin du Val, 1852	B-PAS	1.3(1).1	1♂ (I)	-
Tribe Pterostichini					
28.#	<i>Stomis (Stomis) pumicatus</i> (Panzer, 1796)	E-PAS	1.3(1).2	1♀ (I); 1♀, 2♂ (III)	-
29.*	<i>Poecilus (Poecilus) cupreus</i> (Linnaeus, 1758)	E-AS	1.3(2).1	1♀ (hand); 1♀, 2♂ (I)	1♀ (hand); 2♀ (III)
30.*	<i>Poecilus (Poecilus) cursorius</i> (Dejean, 1828)	E-PA-M	1.3(2).1	3♀, 2♂ (III)	1♀ (III)
31.	<i>Pterostichus (Pseudomaseus)</i> <i>anthracinus</i> (Illiger, 1798)	E-PAS	1.3(2).1	-	12♀, 12♂ (III)
32.*	<i>Pterostichus (Phonias) ovoideus</i> (Sturm, 1824)	E-SI	1.3(2).1	1♂ (I); 6♀, 11♂ (III)	1♂ (II); 1♀, 2♂ (III)
33.*	<i>Pterostichus (Feronidius) melas</i> (Creutzer, 1799)	E-PAS	1.3(2).1	1♀ (I); 3♂ (III)	12♀, 12♂ (III)
34.*	<i>Abax carinatus</i> (Duftschmid, 1812)	CE-E	1.3(2).1	25♀, 18♂ (I); 3♀, 3♂ (III)	17♀, 7♂, 2 ex. (III)
Tribe Sphodrini					
35.*	<i>Calathus (Calathus) fuscipes</i> (Goeze, 1777)	PAL	1.3(1).2	2♀ (II)	22♀, 21♂ (I); 21♀, 18♂ (II); 2♀, 4♂, 1 ex. (III)
36.*	<i>Calathus (Neocalathus)</i> <i>melanocephalus</i> (Linnaeus, 1758)	PAL	1.3(1).2	4♀, 3♂ (II); 1♂ (III)	1♀ (I)
37.*	<i>Calathus (Neocalathus) cinctus</i> Motschulsky, 1850	E-CAS	1.3(1).2	1♀, 1♂ (I); 2♀ (II)	1♀ (I); 1♂ (II)

38.*	<i>Laemostenus (Laemostenus) venustus</i> (Dejean, 1828)	NMED	1.3(1).6	-	2♂ (III)
Tribe Agonini					
39.*	<i>Limodromus assimilis</i> (Paykull, 1790)	PAL	1.3(1).1	3♀, 2♂ (I); 5♂ (III)	23♀, 15♂ (III)
40.*	<i>Anchomenus (Anchomenus) dorsalis</i> (Pontoppidan, 1763)	E-CAS	1.3(1).1	5♀ (I); 1♀ (II); 10♀, 15♂ (III)	19♀, 35♂ (III)
Tribe Amarini					
41.*	<i>Amara (Zezea) tricuspadata</i> Dejean, 1831	E-CA-M	2.2.1	1♀ (II)	-
42.*	<i>Amara (Amara) aenea</i> (De Geer, 1774)	OLA	2.3.1	3♀ (II)	3♀, 1♂ (I); 8♀, 1♂ (II)
43.*	<i>Amara (Amara) convexior</i> Stephens, 1828	E-CAS	2.3.1	2♂ (I); 2♀, 13♂ (III)	4♀, 6♂ (III)
44.*	<i>Amara (Amara) communis</i> (Panzer, 1797)	E-SI	2.3.1	7♂ (III)	-
45.	<i>Amara (Amara) lucida</i> (Duftschmid, 1812)	E-PA-M	2.3.1	1♀ (II)	1♀ (II)
46.	<i>Zabrus (Zabrus) tenebrioides</i> (Goeze, 1777)	E-CAS	2.3.2	-	2♀, 1♂ (I)
Tribe Harpalini					
47.*	<i>Anisodactylus (Anisodactylus) binotatus</i> (Fabricius, 1787)	E-AS	2.3.1.	1♀, 1♂ (III)	1♂ (I); 4♂ (III)
48.	<i>Gynandromorphus etruscus etruscus</i> (Quensel en Schönherr, 1806)	NMED	2.2.1	18♀, 15♂ (II)	1♂ (I); 1♂ (II)
49.*	<i>Diachromus germanus</i> (Linnaeus, 1758)	E-MED	2.2.1	-	1♀ (I); 1♂ (III)
50.*	<i>Parophonus (Parophonus) laeviceps</i> (Ménétriés, 1832)	B-PAS	2.1.1	-	1♀ (I)
51.*	<i>Parophonus (Parophonus) mendax</i> (P. Rossi, 1790)	B-PAS	2.1.1	-	2♂ (I)
52.*	<i>Parophonus (Ophononimus) hirsutululus</i> (Dejean, 1829)	CA-MED	2.1.1	-	1♂ (I)
53.*	<i>Ophonus (Metophonus) laticollis</i> Mannerheim, 1825	E-CAS	2.2.1	3♀, 1♂ (I); 1♀, 1♂ (II); 4♀, 4♂ (III)	4♀, 6♂ (III)
54.	<i>Ophonus (Metophonus) rufibarbis</i> (Fabricius, 1792)	W-PAL	2.2.1	-	1♂ (II); 5♀, 1♂ (III)
55.	<i>Ophonus (Metophonus) melleti melleti</i> (Heer, 1837)	E-PAS	2.2.1	2♂ (II)	-
56.	<i>Ophonus (Hesperophonus) azureus</i> (Fabricius, 1775)	E-CA-M	2.2.1	1♀ (I); 9♀, 16♂ (II)	4♂ (II)
57.*	<i>Ophonus (Hesperophonus) cribricollis</i> (Dejean, 1829)	E-CAS	2.2.1	-	1♀ (I); 3♂ (II)
58.	<i>Ophonus (Ophonus) sabulicola</i> (Panzer, 1796)	CE-PAS	2.2.1	1♀, 1♂ (II)	2♀, 4♂ (I)
59.*	<i>Harpalus (Harpalus) honestus</i> (Duftschmid, 1812)	E-WSI	2.3.1	-	2♂ (II)
60.	<i>Harpalus (Harpalus) rubripes</i> (Duftschmid, 1812)	E-AS	2.3.1	4♀, 3♂ (II)	10♀, 10♂ (I); 4♀, 1♂ (II); 1♀ (III)
61.*	<i>Harpalus (Harpalus) atratus</i>	E-PAS	2.3.1	-	2♀, 7♂ (III)

	Latreille, 1804					
62.	<i>Harpalus (Harpalus) flavicornis</i> <i>flavicornis</i> Dejean, 1829	CE-PAS	2.3.1	3♀, 2♂ (II)	40♀, 50♂ (I); 28♀, 57♂ (II)	
63.*	<i>Harpalus (Harpalus) subcylindricus</i> Dejean, 1829	E-CAS	2.3.1	7♀, 22♂ (II)	14♀, 14♂ (I); 14♀, 39♂ (II)	
64.*	<i>Harpalus (Harpalus) tardus</i> (Panzer, 1797)	E-CAS	2.3.1	7♀, 10♂ (I); 3♀, 2♂ (II); 6♀, 7♂ (III)	3♀, 13♂ (I); 2♀, 4♂ (II); 3♀, 4♂ (III)	
65.	<i>Harpalus (Harpalus) albanicus</i> Reitter, 1900	E-PAS	2.3.1	1♀ (II); 1♀ (III)	-	
66.*	<i>Harpalus (Harpalus) latus</i> (Linnaeus, 1758)	E-AS	2.3.1	2♂ (I); 1♂ (II); 18♀, 18♂ (III)	-	
67.	<i>Harpalus (Harpalus) cupreus</i> <i>fastuosus</i> Faldermann, 1836	B-PAS	2.3.1	1♀ (hand); 1♂ (I); 1♂ (II)	-	
68.	<i>Harpalus (Harpalus) dimidiatus</i> (P. Rossi, 1790)	E-PAS	2.3.1	2♀, 2♂ (I); 32♀, 48♂ (II); 2♀, 4♂ (III)	44♀, 36♂ (I); 38♀, 38♂ (II); 1♂ (III)	
69.	<i>Acinopus (Oedematicus)</i> <i>megacephalus</i> (Rossi, 1794)	NMED	2.3.2	-	2♂ (I); 2♀, 3♂ (II)	
70.*	<i>Carterus (Carterus) dama</i> (P. Rossi, 1792)	MED	2.3.3	1♀, 1♂ (II)	2♀ (I)	
71.*	<i>Dixus eremita</i> (Dejean, 1825)	B-CAS	2.3.3	-	1 ex. (I)	
72.	<i>Dixus obscurus</i> (Dejean, 1825)	NM-CAS	2.3.3	1♀ (II)	2 ex. (I); 3♀, 2 ex. (II)	
73.#	<i>Amblystomus niger</i> (Heer, 1841)	E-PA-M	2.1.1	-	1♀ (I)	
Tribe Callistini						
74.	<i>Chlaenius (Dinodes) decipiens</i> (L. Dufour, 1820)	E-CA-M	1.3(1).1	-	1♀, 1♂ (II)	
75.*	<i>Chlaenius (Chlaeniellus) nitidulus</i> (Schränk, 1781)	E-CAS	1.3(1).1	-	1♂ (III)	
76.*	<i>Chlaenius (Chlaeniellus) nigricornis</i> (Fabricius, 1787)	E-AS	1.3(1).1	-	1♂ (II); 1♀ (III)	
Tribe Licinini						
77.	<i>Licinus (Licinus) depressus</i> (Paykull, 1790)	E-WSI	1.3(1).1	1♀ (III)	-	
78.*	<i>Badister (Badister) bullatus</i> (Schränk, 1798)	PAL	1.3(1).1	1♂ (III)	1♀ (III)	
Tribe Lebiini						
79.*	<i>Philorhizus notatus</i> (Stephens, 1827)	E-CA-M	1.3(1).3	1♂ (I)	1♀, 3♂ (II); 1♂ (III)	
80.*	<i>Syntomus obscuroguttatus</i> (Duftschmid, 1812)	E-PA-M	1.3(1).3	1♀, 1♂ (III)	1♀ (III)	
81.*	<i>Microlestes fissuralis</i> (Reitter, 1901)	E-CAS	1.3(1).3	-	1♀ (II)	
82.#	<i>Microlestes fulvibasis</i> (Reitter, 1901)	CA-MED	1.3(1).3	1♂ (II)	1♂ (I); 2♀, 2♂ (II)	
83.*	<i>Microlestes minutulus</i> (Goeze, 1777)	OLA	1.3(1).3	1♂ (II)	4♀ (I); 5♀, 6♂ (II)	
84.*	<i>Microlestes negrita negrita</i> (Wollaston, 1854)	MED-PA	1.3(1).3	-	2♀, 1♂ (II)	
Tribe Brachinini						
85.	<i>Brachinus (Brachinus) crepitans</i>	PAL	1.3(1).3	9♀, 1♂ (II);	1♀ (III)	

	(Linnaeus, 1758)			1♀ (III)	
86.*	<i>Brachinus (Brachinus) psophia</i> Audinet-Serville, 1821	E-CA-M	1.3(1).3	1♀ (II)	-
87.	<i>Brachinus (Brachynidius)</i> <i>bodemeyeri</i> Apfelbeck, 1904	E-CA-M	1.3(1).3	1♂ (II)	-
88.	<i>Brachinus (Brachynidius) explodens</i> Duftschmid, 1812	E-CA-M	1.3(1).3	-	1♂ (I); 2♀, 3♂ (II)

Appendix 2. Species of invertebrates, other than Carabidae, found during the field work in the two reserves: B – “Balabana”; DT – “Dolna Topchiya”.

No	Species	Family	Order	B	DT
Phylum Mollusca					
Class Bivalvia					
1.	<i>Anodonta anatina</i> (Linnaeus, 1758)	Unionidae	Unionoida	+	+
2.	<i>Unio crassus</i> Philipson, 1788	Unionidae	Unionoida	+	-
3.	<i>Unio pictorum</i> (Linnaeus, 1758)	Unionidae	Unionoida	+	+
Class Gastropoda					
4.	<i>Ferrissia clessiniana</i> (Jickeli, 1882)	Planorbidae	Basommatophora	-	+
5.	<i>Valvata piscinalis</i> (O. F. Müller, 1774)	Valvatidae	Heterostropha	+	+
6.	<i>Physa fontinalis</i> (Linnaeus, 1758)	Physidae	Hygrophila	-	+
7.	<i>Radix balthica</i> (Linnaeus, 1758)	Lymnaeidae	Hygrophila	-	+
8.	<i>Stagnicola palustris</i> (O. F. Müller, 1774)	Lymnaeidae	Hygrophila	-	+
9.	<i>Helix lucorum</i> Linnaeus, 1758	Helicidae	Sigmurethra	+	-
10.	<i>Helix pomatia</i> Linnaeus, 1758	Helicidae	Sigmurethra	+	+
11.	<i>Xerolenta obvoia</i> (Menke, 1828)	Hygromiidae	Sigmurethra	+	+
Phylum Annelida					
Class Clitellata					
12.	<i>Lumbricus terrestris</i> Linnaeus, 1758	Lumbricidae	Haplotaxida	+	+
13.	<i>Erpobdella monostriata</i> (Lindenfeld & Pietruszynski, 1890)	Erpobdellidae	Hirudinea	-	+
14.	<i>Piscicola geometra</i> (Linnaeus, 1758)	Piscicolidae	Hirudinea	-	+
Phylum Arthropoda					
Class Malacostraca					
15.	<i>Gammarus arduus</i> G. S. Karaman, 1975	Gammaridae	Amphipoda	-	+
16.	<i>Gammarus komareki</i> Schaferna, 1922	Gammaridae	Amphipoda	-	+
17.	<i>Asellus aquaticus</i> (Linnaeus, 1758)	Asellidae	Isopoda	+	+
18.	<i>Limnomysis benedeni</i> Czerniavsky, 1882	Mysidae	Mysida	-	+
19.	<i>Potamon ibericum</i> (Bieberstein, 1809)	Potamonidae	Decapoda	+	+
Class Insecta					
20.	<i>Cloeon dipterum</i> (Linnaeus, 1761)	Baetidae	Ephemeroptera	+	-
21.	<i>Heptagenia flava</i> Rostock, 1878	Heptageniidae	Ephemeroptera	-	+
22.	<i>Potamanthus luteus</i> (Linnaeus, 1767)	Potamanthidae	Ephemeroptera	+	+
23.	<i>Calopteryx virgo</i> (Linnaeus, 1758)	Calopterygidae	Odonata	-	+
24.	<i>Calopteryx splendens</i> (Harris, 1782)	Calopterygidae	Odonata	+	+
25.	<i>Platycnemis pennipes</i> (Pallas, 1771)	Platycnemididae	Odonata	+	+
26.	<i>Gryllus campestris</i> Linnaeus, 1758	Gryllidae	Orthoptera	+	+
27.	<i>Gryllotalpa gryllotalpa</i> (Linnaeus, 1758)	Gryllotalpidae	Orthoptera	+	-
28.	<i>Aiolopus strepens</i> (Latreille, 1804)	Acrididae	Orthoptera	-	+
29.	<i>Panorpa communis</i> Linnaeus, 1758	Panorpidae	Mecoptera	+	+
30.	<i>Forficula auricularia</i> Linnaeus, 1758	Forficulidae	Dermaptera	+	+

31.	<i>Palomena prasina</i> (Linnaeus, 1761)	Pentatomidae	Hemiptera	-	+
32.	<i>Aphelocheirus aestivalis</i> (Fabricius, 1794)	Aphelocheiridae	Heteroptera	+	+
33.	<i>Sialis lutaria</i> (Linnaeus, 1758)	Sialidae	Megaloptera	-	+
34.	<i>Anthelephila caeruleipennis</i> (LaFerté-Senéctère, 1847)	Anthicidae	Coleoptera	+	+
35.	<i>Byturus tomentosus</i> (De Geer, 1774)	Byturidae	Coleoptera	+	+
36.	<i>Cerambyx cerdo</i> Linnaeus, 1758	Cerambycidae	Coleoptera	+	-
37.	<i>Dorcadion pedestre</i> (Poda, 1761)	Cerambycidae	Coleoptera	+	+
38.	<i>Neodorcadion bilineatum</i> (Germar, 1824)	Cerambycidae	Coleoptera	+	-
39.	<i>Coccinella septempunctata</i> Linnaeus, 1758	Coccinellidae	Coleoptera	+	-
40.	<i>Hispa atra</i> Linnaeus, 1767	Chrysomelidae	Coleoptera	-	+
41.	<i>Lilioceris lili</i> (Scopoli, 1763)	Chrysomelidae	Coleoptera	+	-
42.	<i>Sermylassa halensis</i> (Linnaeus, 1767)	Chrysomelidae	Coleoptera	+	-
43.	<i>Otiorhynchus rugostratus</i> (Goeze, 1777)	Curculionidae	Coleoptera	-	+
44.	<i>Geotrupes stercorarius</i> (Linnaeus, 1758)	Geotrupidae	Coleoptera	-	+
45.	<i>Dorcus parallelipipedus</i> (Linnaeus, 1758)	Lucanidae	Coleoptera	+	+
46.	<i>Lucanus cervus</i> (Linnaeus, 1758)	Lucanidae	Coleoptera	+	+
47.	<i>Dendroxena quadripunctata</i> (Scopoli, 1772)	Silphidae	Coleoptera	+	-
48.	<i>Nicrophorus vespillo</i> (Linnaeus, 1758)	Silphidae	Coleoptera	+	-
49.	<i>Silpha obscura</i> Linnaeus, 1758	Silphidae	Coleoptera	-	+
50.	<i>Scaphidium quadrimaculatum</i> Olivier, 1790	Scaphidiidae	Coleoptera	+	-
51.	<i>Protaetia aeruginosa</i> (Linnaeus, 1767)	Scarabeidae	Coleoptera	+	-
52.	<i>Arctia villica</i> (Linnaeus, 1758)	Arctiidae	Lepidoptera	-	+
53.	<i>Brenthis daphne</i> (Bergsträsser, 1780)	Nymphalidae	Lepidoptera	+	-
54.	<i>Maniola jurtina</i> (Linnaeus, 1758)	Nymphalidae	Lepidoptera	-	+
55.	<i>Melanargia galathea</i> (Linnaeus, 1758)	Nymphalidae	Lepidoptera	+	-
56.	<i>Pararge aegeria tircis</i> (Godart, 1821)	Nymphalidae	Lepidoptera		+
57.	<i>Zerynthia polyxena</i> (Denis & Schiffermüller, 1775)	Papilionidae	Lepidoptera	-	+
58.	<i>Zerynthia cerisy</i> (Godart, [1824])	Papilionidae	Lepidoptera	-	+
59.	<i>Pieris rapae</i> (Linnaeus, 1758)	Pieridae	Lepidoptera	+	-
60.	<i>Apis mellifera</i> Linnaeus, 1758	Apidae	Hymenoptera	+	+
61.	<i>Camponotus piceus</i> (Leach, 1825)	Formicidae	Hymenoptera	+	+
62.	<i>Formica cunicularia</i> Latreille, 1798	Formicidae	Hymenoptera	+	-
63.	<i>Formica rufa</i> Linnaeus, 1761	Formicidae	Hymenoptera	+	+
64.	<i>Formica rufibarbis</i> Fabricius, 1793	Formicidae	Hymenoptera	+	-
65.	<i>Lasius alienus</i> (A. Förster, 1850)	Formicidae	Hymenoptera	+	+
66.	<i>Lasius citrinus</i> Emery, 1922	Formicidae	Hymenoptera	-	+
67.	<i>Lasius niger</i> (Linnaeus, 1758)	Formicidae	Hymenoptera	+	+
68.	<i>Lepisiota frauenfeldi</i> (Mayr, 1855)	Formicidae	Hymenoptera	-	+
69.	<i>Leptothorax affinis</i> Mayr, 1855	Formicidae	Hymenoptera	-	+
70.	<i>Leptothorax recedens</i> (Nylander, 1856)	Formicidae	Hymenoptera	+	-
71.	<i>Liometopum microcephalum</i> (Panzer, 1798)	Formicidae	Hymenoptera	-	+
72.	<i>Plagiolepis pygmaea</i> (Latreille, 1798)	Formicidae	Hymenoptera	+	-
73.	<i>Ponera coarctata</i> (Latreille, 1802)	Formicidae	Hymenoptera	+	-
74.	<i>Tetramorium caespitum</i> (Linnaeus, 1758)	Formicidae	Hymenoptera	+	+
75.	<i>Scelio fulvipes</i> A. Förster, 1856	Scelionidae	Hymenoptera	-	+
76.	<i>Vespula germanica</i> (Fabricius, 1793)	Vespidae	Hymenoptera	+	+