Ecofaunistical investigations of Collembola, Araneae and Coleoptera in mosaic-like habitats in the Cinege Valley, Hungary

By

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Abstract. The structure and ecology of Collembola, Araneae and Coleoptera communities were investigated in different habitats of Cinege Creek valley (South of Lake Balaton, West Hungary) during 1992-94. The aim was - depending on the result of the investigation - to establish a separate local nature conservation and recreation area. The study area consists of 16 smaller habitats, which differ from each other in the composition of the vegetation and the water regime of the soils. Animals were collected from the selected sampling sites using mainly two different methods: *1)* Separating animals with the Berlese method from A-horizon-soil and the litter. *2)* Using pitfall traps containing ethylene glycol. Both species diversity and the frequency of occurrence (abundance) were highest in the oak-forest (study area VI) and in the reeds (study area I), while the lowest on the area with horsetails and sedges (study area II). The community structures of collembolans, beetles and spiders in these different habitats were compared. The species compositions clearly reflected the microclimatic characters of the individual habitats. At the same time, also some rare species were identified from this area. The study area as a less polluted natural environment can be considered available for selection a conservation territory. It seems to be especially important to protect these particular mosaic-like habitats for sustaining their high animal taxonomic and functional biodiversity.

Nowadays, Hungary has only few areas which are considered completely or nearly free from human influence. These nearly intact regions are usually far from each other and often show a mosaic-like arrangement. It is of particular importance to find those ones, which are situated in or around densely populated areas and to become acquainted with their wildlife and ecological relationships. Lake Balaton is the most popular recreation area in Hungary. Our study site is located in the neighborhood of Siófok town, one of the significant centers along the Balaton coast. The main purpose of our study was to decide, whether the investigated area was worth establishing a local nature conversation area or not. For this purpose we made a faunistic analysis focusing on the following three arthropod groups: Collembola, Araneae and Coleoptera.

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Materials and methods

Site description

The investigated area lies south of Siófok, in a valley, stretching from north to south 6000 meters long. It is about 400–600 meters wide. The heart of the 300 ha region is the Cinege Creek, which is cut by eleven fishing ponds formed by swelling up the creek. The neighboring landscape is characterized by consecutive rows of hills and valleys. The planned nature conversation area comprises the bottom of the Cinege Creek valley and the facing slopes, which are not steeper than 10 %. The climate is mild warm and moderately wet. The number of sunny hours per year varies between 2000 and 2500. The annual mean temperature during the vegetation period reaches 17.4 °C. The annual mean temperature of the hottest summer day is 33.5 °C, while that of the coldest winter day is –15.5 °C. The annual precipitation is about 650 mm from which 350-380 mm comes down in the vegetative period. The area is covered with snow usually during 32 days a year. The most typical direction of the wind is north-western. The average windspeed is about 3 m/sec. The watershed of the creek is quite small, altogether 19 km. The headwater is situated in the would be nature conservation area. The creek flows directly into the Balaton. The lowest pond made up in the creek is overgrown with aquatic plants and reed, thus the deposition and purification of the water is rather intensive.

Soil

The area of interest is covered mostly by soil developed on loess bedrock of the Pleistocene, Baranya-Somogy-Tolna Loess Formation which is of variable thickness. Ramann-type, brown, forest soils occur on the slopes of the hills; whereas, chernozem soil types occur in the valleys (flat lying lands). The different soil types are a result of differences in hydro-geological conditions.

Flora

The Cinege Valley is a fairly diverse, beautiful landscape, comprising several phytocoenoses of great value, situated along the banks of the creek and ponds, in the depressions of the valley and in the fields and woodlands among the ponds. These phytocoenoses can be arranged into larger categories in which the animals have been investigated.

List of study areas characterized by their prevailing phytocoenoses and their relation to human effects (some characteristic plant species are given as example); FHI: phytocoenosis free from human influence, NC: phytocoenosis proposed for natural conservation, MHD: phytocoenosis exposed to moderate human disturbance

I area: Large reeds and swamp. - Lemno-Spirodeletum FHI, Myriphyllo-Potamogenetum FHI, Scirpo-Phragmitetum austro-orientale NC, Sparganietum erecti FHI, Sparganio-Glycerietum FHI, Caricetum acutiformis-ripariae FHI. - *Lemna minor, Hydrocharis morsus-ranae, Myriophyllum spicatum, Iris pseudacorus, Thelypteris palustris, Sparganium erectum, Glyceria maxima, Carex riparia, Caltha palustris, Equisetum palustre, Calystegia sepium, Sium latifolium.*

II area: Steppe. - Arrhenatheretum elatioris MHD, Astragalo-Festucetum rupicolae FHI. - *Adonis vernalis, Pulsatilla grandis, Festuca rupicola, Chrysopogon gryllus, Euphorbia segueriana, Stipa capillata, Astragalus austricus.*

III area: Gallery forest with willow and poplar trees. - Salicetum albae-fragilis FHI, Fraxino-Ulmetum FHI. - *Rubus caesius, Dryopteris filix-mas, Dryopteris carthusiana, Myosotis sparsiflora, Myosoton aquaticum.*

IV area: Scrub forest. -Agrostio-Typhoideum FHI, Astragalo-Festucetum rupicolae FHI. - *Ficaria verna, Violoa odorata, Physalis alkekengi, Humulus lupulus, Circae lutetiana, Festuca rupicola, Euphorbia segueriana, Crataegus monogyna.*

V area: Meadow. - Cirsio cani-Festicetum pratensis FHI, Agrostetum stoloniferae FHI, Alopecuretum pratensis FHI, Deschampsietum caespitosae FHI. - *Colchicum autumnale, Cirsium canum, Arrhenatherum elatius, Alopecurus pratensis, Pastinaca sativa, Hypochoeris radicata, Lathyrus pratensis, Serratula tinctoria, Centaurea jacea, Deschampsia caespitosa.*

VI area: Deciduous forest. - Quercetum petraeae-cerris FHI. - *Pulmonaria mollissima, Pulmonaria obscura, Silene vulgaris, Geum urbanum, Stellaria holostea, Carex sylvatica, Ajuga reptans, Campanula trachelium, Aethusa cynapium, Brachypodium sylvaticum.*

Collectings

We collected samples from suitable places using mainly two different methods: *1)* The majority of the animals was collected using pitfall traps. These were put at six different habitats as mentioned above. At all habitats, five pieces of 2 dl plastic glasses were placed in five meter distance from each other. The glasses were filled up with ethylene glycol. The traps were emptied monthly. If it was necessary, we used the isolation method of salting. The collected material was stored in 70% methanol until examination. *2)* We collected samples of soil and leaf litter from which the animals were isolated using the Berlese method. Sometimes we used singling and sweeping techniques.

Results

During 1993-94 several collecting trips were organized to the area. As a result of our investigations, a list of species was compiled. To identify the species we used the following books: Gisin, 1960; Fjellberg, 1980; Dunger, 1994; Horvatovich, 1974; Jones, 1983; Locket & Millidge, 1986; Loksa, 1969, 1972, 1981; Roberts, 1985; Sauer & Wunderlich, 1985.

Collembola

Nearly 1500 specimens of 41 Collembola species were collected from the study areas. There were considerable differences between the sampled habitats regarding the number of families and species as well as the individual abundance. The differences were primarily the function of humidity and diversity of the habitats. The richest families were Entomobryidae and Isotomidae. Study area I proved to be

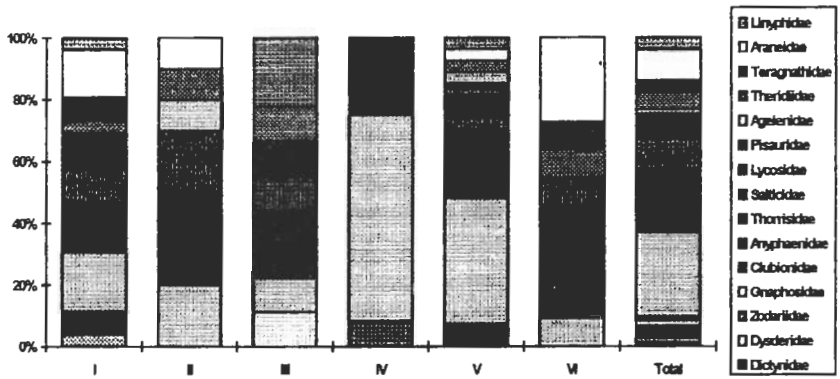

Fig. 1. Species composition of the Collembola families in different habitats

the most diverse one, for it consisted of more smaller habitats. The most abundant species were *Podura aquatica, Isotomurus palustris* and *Hypogastrura denticulata.*

Only seven species were found in area II (steppe). This area was dry during summer and only moderately wet during the rest part of the year. The most abundant species was *Isotoma notablis* which prefers dry fields. We could collect only a few specimens of the remaining species.

In the areas III, V and VI the number of species was similar, but the composition of species differed strongly. The abundance of the common species was various according to the habitat.

Comparison of the species composition in different areas clearly shows that the similarity primarily depends on the humidity of the area. The largest similarities were seen between areas VI and V, VI and IV, I and III. The largest difference turned out to be between study areas II and III.

Araneae

For the spiders, study area IV was found to be the richest both in species and families. This habitat was an undisturbed grassy glade surrounded by dense hawthorn shrubbery. The highest species and individual abundance was represented by the Gnaphosidae compared with the remaining 12 families. Such outstanding participation of the Gnaphosidae was experienced also in the steppe (area II), where this family made up 67% of the total individual abundance, with a large number of rare thermophil and xerophil species, such *as Oxyptila nigrita, Micaria fulgens, Microlepis dives, Zelotes villicus, Z. pygmaeus, Z. petrensis, Z. electus.* These species were very abundant as well. However, in the steppe only three

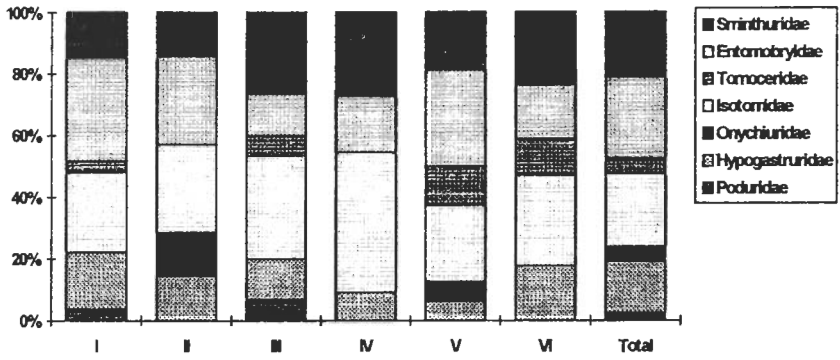

Fig. 2. Species composition of the Araneae families in different habitats

more families were detected. Both the differences and similarities between areas II and IV can be explained with the origin of the scrub forest, which developed from a steppe-like habitat, through arising of the shrubbery. The middle part of study area IV hosts a lot of steppe-inhabiting species (see the high ratio of Gnaphosidae), on the other hand it provides new habitats, thus appearing various different families just like web-spinning families (Theridiidae, Araneidae, Linyphiidae, Dictynidae), for which the shrubs offer an important supporting system; or species of the genera *Agelena, Mangora, Xysticus*, which do not tolerate the hot and arid microclimate of the steppe.

As a habitat, the reeds (study area I) proved to be also rich, with high individual abundance, though none of the detected families occurred with outstanding species diversity, nevertheless the family composition was fairly diverse. Neither areas III (gallery forest) and V (meadow) nor area VI (deciduous forest) comprised very high species and individual abundances, but the trapped material differed considerably according to the habitat type: in study area III some hygrophil species occurred (*Trochosa ruricola, Diplostyla concolor, Zelotes pedestris*), while in area VI *Zilla diodia, Araniella cucurbitina, Enoplognatha ovata* were found.

Studying the similarities of species composition, we can see that there are large differences among the different habitats. The low values of the Jaccard indices result from the low numbers of species in some areas and the presence of euryoec species.

Coleoptera

Regarding the composition of the beetle fauna, the reeds (area I) proved to be a significant habitat. Most of the beetle families turning up in the course of the examination were found there, most numerous one being the Carabidae. Further

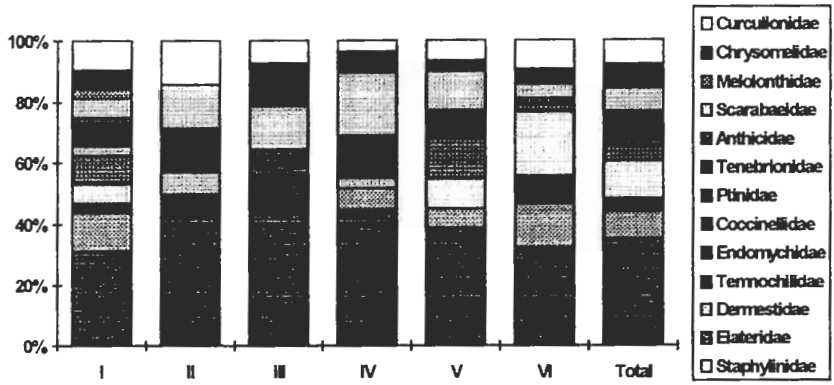

Fig. 3. Species composition of the Coleoptera families in different habitats

families with high individual abundance were the Silphidae, Catopidae and Dermestidae. Among the carabids *Calathus fuscipes* and *C. melanocephalus* were prevailing; both are euryoec and eurytop species. The high diversity values in the reeds were due to the marginal situation of this type of vegetation, thus straying specimens from different habitats could also occur in our traps.

Altogether six beetle families with 14 species were determined in the steppe (area II). 44% of the total number of the species found here belonged to the carabids. Relatively rich families were Tenebrionidae, Scarabaeidae and Curculionidae. The most abundant species of the Tenebrionidae was *Opatrum sabulosum*. The most frequent carabids were *Calathus fuscipes* and *Pseudoophonus rufipes*, further *Harpalus anxius*, which latter prefers dry and sunny habitats.

The less favourable microclimate of area II provides less ecological niches for the inhabitant species, thus the lower diversity value is not surprising.

The least families of beetles were found in study area III. 65% of the 14 species found here belonged to the carabids. The most abundant species were *Carabus nemoralis* and *Abax nemoralis*. Both of them prefer forest habitats, so they possibly migrated from the forest into this rather wet area. The diversity of area IV (scrub forest) was higher than areas II and III but not as high as those of areas I and VI. We found 29 species of 9 families here. The most abundant species were *Geotrupes vernalis, Calathus fuscipes* and *Carabus convexus*.

Study area V was similar to area VI but the number of species was a little bit higher here. In addition to Carabidae, families Staphilinidae, Elateridae and Scarabeidae were also frequent (10-10%). The most abundant species was *Calathus fuscipes*.

In area VI (deciduous forest) we found only 9 families but the number of species was the highest (42) here. The rate of Carabidae decreased (33%) and the rates of Staphilinidae (21%) and Silphidae (14%) increased. It is interesting that the most abundant species of Scarabaeidae was *Geotrupes stercorosus* and not *G. vernalis*.

We collected a lot of specimens of *Carabus convexus, Abax paralellepipedus* and *Pterostichus oblongopunctatus*, too.

Largest similarities were found between the areas VI and V as well as areas V and IV. The largest difference was between areas VI and II.

Conclusions

The result of our investigation proved that the small but diverse mosaic-like habitats could preserve a lot of valuable species. We found some protected species as *Carabus convexus, C. coriaceus, C. germani, C. granulatus, C. nemoralis, C. schendreli, C. ullrichi.* Others (*Zelotes civicus, Zelotes hermanni, Abax paralell-epipedus, Pterostichus oblongopunctatus, Micaria/Micariolepis dives, Oxyptila nigrita*) indicate the conditions and value of the area. The smaller microhabitats offer good circumstances for the different species. Here the diversity could be high. The most important environmental factors were the humidity and the vegetation of the area.

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Table 1. Similarities of species compositions of Collembola (cj: Jaccard Index; 27, ...: number of specimens)

Study area	I	II	III	IV	V	VI
I	27	5	14	6	12	10
II	cj = 0.172	7	1	4	3	5
III	cj = 0.500	cj = 0.047	15	5	9	8
IV	cj = 0.187	cj = 0.285	cj = 0.238	11	10	11
V	cj = 0.387	cj = 0.238	cj = 0.409	cj = 0.588	16	13
VI	cj = 0.294	cj = 0.263	cj = 0.333	cj = 0.647	cj = 0.650	17

Table 2. Similarities of species compositions of Araneae (cj: Jaccard Index; 26, ...: number of specimens)

Study area	I	II	III	IV	V	VI
I	26	2	3	0	4	2
II	cj = 0,057	11	1	1	6	2
III	cj = 0,094	cj = 0,053	9	1	3	2
IV	cj = 0	cj = 0,048	cj = 0,053	11	3	0
V	cj = 0,08	cj = 0,182	cj = 0,088	cj = 0,083	28	3
VI	cj = 0,057	cj = 0,100	cj = 0,111	cj = 0	cj = 0,083	11

Table 3. Similarities of species compositions of Coleoptera (cj: Jaccard Index; 32, ...: number of specimens)

Study area	I	II	III	IV	V	VI
I	32	7	4	11	12	7
II	cj = 0.179	14	1	8	5	4
III	cj = 0.095	cj = 0.037	14	7	5	8
IV	cj = 0.220	cj = 0.228	cj = 0.194	29	12	7
V	cj = 0.235	cj = 0.125	cj = 0.125	cj = 0.250	31	15
VI	cj = 0.102	cj = 0.075	cj = 0.163	cj = 0.107	cj = 0.254	43

Table 4. The Collembola species and number of specimens in the different habitats

Species	Study areas						
	I	II	III	IV	V	VI	Total
Poduridae	53	-	34	-	-	-	87
Podura aquatica Linné	53	-	34	-	-	-	87
Hypogastruridae	165	8	86	11	8	61	339
Hypogastrura denticulata (Bagnall)	131	-	68	-	-	-	199
Hypogastrura luteospina Stach	-	-	-	-	-	12	12
Hypogastura vernalis (Carl)	6	-	-	-	-	-	6
Xenilla maritima Tullberg	-	-	-	11	8	17	36
Friesea mirabilis (Tullberg)	12	-	18	-	-	-	30
Anurida tullbergi Schött	5	-	-	-	-	-	5
Neanura conjuncta (Stach)	11	8	-	-	-	32	51
Onychiuridae	-	3	-	-	7	-	10
Tullbergia quadrispina (Börner)	-	3	-	-	-	-	3
Onychiurus campatus Gisin	-	-	-	-	7	-	7
Isotomidae	104	23	31	33	39	66	296
Folsomia nana Gisin	18	-	6	-	13	23	60
Folsomia candida (Willem)	7	-	7	2	6	11	33
Isotomiella minor (Schäffer)	-	2	-	5	-	3	10
Isotomina bipunctata Axelson	4	-	-	-	-	-	4
Proisotoma crassicauda (Tullberg)	2	-	-	-	-	-	2
Proisotoma minuta (Tullberg)	18	-	3	14	17	22	74
Isotoma notabilis (Schäffer)	-	21	-	8	-	-	29
Isotoma viridis Bourlet	13	-	-	4	3	7	27
Isotoma olivacea Tullberg	-	-	4	-	-	-	4
Isotomurus palustris (Müller)	42	-	11	-	-	-	53
Tomoceridae	37	-	31	-	18	44	130
Tomoceris vulgaris (Tullberg)	37	-	31	-	11	27	106
Tomocerus minor (Lubbock)	-	-	-	-	7	17	24
Entomobryidae	164	8	2-	9	34	27	262
Entomobrya handschini Stach	2	-	-	-	6	-	8
Entomobrya lanuginosa (Nicolet)	16	-	-	-	-	-	16
Entomobrya marginata (Tullberg)	31	4	-	-	2	-	37
Entomobrya multifasciata (Tullberg)	24	-	-	-	-	-	24
Orchesella flavescens (Bourlet)	18	-	3	-	4	-	25
Orchesella cincta (Nicolet)	-	-	-	-	3	-	3
Pseudosinella wahlgreni (Börner)	-	-	-	2	-	7	9
Heteromurus nitidus (Templeton)	7	-	-	-	-	-	7
Lepidocyrtus lanuginosus (Gmelin)	31	-	17	-	11	2	61
Lepidocyrtus cyaneus Tullberg	22	4	-	7	8	18	59
Lepidocyrtus paradoxus Uzel	13	-	-	-	-	-	13
Sminthuridae	82	15	39	8	28	93	265
Sminthurides aquaticus (Bourlet)	41	-	31	-	-	-	72
Sminthurides pumilis (Krausbayer)	3	-	2	-	-	-	5
Sminthurides malmgreni (Tullbergi)	22	3	-	-	-	-	25
Bourletiella insignis (Reuter)	4	-	-	5	19	27	55
Sminthurus lubbocki Tullberg	-	-	2	1	3	32	38
Dicyrtoma fusca (Lucas)	-	-	4	2	6	11	23
Dicyrtoma ornata (Nicolet)	12	-	-	-	-	-	12
Neelus minimus Willem	-	12	-	-	-	23	35

Table 5. The Araneae species and number of specimens in the different habitats

Species	Study areas						
	I	II	III	IV	V	VI	Total
Atypidae					4		4
Atypus piceus Sulzer	-	-	-	-	4	-	
Amaurobiidae	3						3
Titanoeca schineri L.Koch	3	-	-	-	-	-	
Dictynidae	2				1		3
Dictyna arundinacea Linné	1	-	-	-	-	-	
Dictyna latens Fabricius	-	-	-	-	1	-	
Dictyna uncinata Thorell	1	-	-	-	-	-	
Dysderidae			1				1
Harpactea rubicunda C.L.Koch	-	-	1	-	-	-	
Zodariidae				3			3
Zodarion germanicum C.L.Koch	-	-	-	3	-	-	
Gnaphosidae	11	4	3	39	35	2	94
Drassodes pubescens Thorell	3	2	-	-	4	-	9
Haplodrassus signifer C.L.Koch	1	-	-	-	-	-	1
Haplodrassus silvestris Blackwall	-	-	-	-	1	-	1
Zelotes apricorum L.Koch	2	-	-	-	-	-	2
Zelotes aurantiacus Miller	-	-	-	-	6	-	6
Zelotes civicus Simon	-	-	-	3	-	-	3
Zelotes electus C.L.Koch	-	-	-	15	-	-	15
Zelotes hermanni Chyzer	-	-	-	-	5	-	5
Zelotes latreillei Simon	-	-	-	-	4	-	4
Zelotes longipes L.Koch	-	-	-	-	13	-	13
Zelotes pedestris C.L.Koch	4	2	3	-	5	2	16
Zelotes petrensis C.L.Koch	-	-	-	-	3	-	3
Zelotes praeficus L.Koch	-	-	-	5	1	-	6
Zelotes pusillus C.L.Koch	-	-	-	1	-	-	1
Zelotes pygmaeus Miller	-	-	-	-	1	-	1
Zelotes subterraneus C.L.Koch	-	-	-	-	1	-	1
Zelotes villicus Thorell	-	-	-	-	3	-	3
Micaria fulgens Walckenaer	-	-	-	1	1	-	2
Micaria pulicaria Sundevall	1	-	-	-	-	-	1
Micaria romana L.Koch	-	-	-	1	-	-	1
Clubionidae	2		3	2	1	1	9
Clubiona sp. juv.	2	-	-	-	1	-	3
Agroeca brunnea Blackwall	-	-	-	-	-	1	1
Phrurolithus festivus C.L.Koch	-	-	3	2	-	-	5
Anyphaenidae						1	1
Anyphaena accentuata Walckenaer	-	-	-	-	-	1	1
Thomisidae	12	4	3	5	5	3	32
Hariaeus sp. juv.	-	-	-	-	1	-	1
Miumenops tricuspidatus Fabricius	-	1	-	-	-	-	1
Xysticus erraticus Blackwall	-		-	-	1	-	1
Xysticus kochi Thorell	-	2	-	-	1	-	3
Oxyptila nigrita Thorell	-	-	-	2	1	-	3
Oxyptila praticola C.L.Koch	5	-	3	-	1	2	11
Philodromus albidus Kulczynski	-	-	-	-	-	1	1
Thanatus formicinus Clerck	-	1	-	3	-	-	4
Tibellus maritimus Menge	2	-	-	-	-	-	2
Tibellus oblongus Walckenaer	2	-	-	-	-	-	2
Salticidae	3	4	1		1	1	10

Marpissa nivoyi Lucas	1	-	-	-	-	-	1
Ballus depressus Walckenaer	-	-	-	-	-	1	1
Euophrys erratica Walck.	-	-	1	-	-	-	1
Euophrys frontalis Walck.	-	3	-	-	1	-	4
Euophrys petrensis C.L.Koch	1	-	-	-	-	-	1
Evarcha arcuata Clerck	-	1	-	-	-	-	1
Myrmarachne formicaria De Geer	1	-	-	-	-	-	1
Lycosidae	13		1		22		36
Pardosa lugubris Walckenaer	11	-	-	-	20	-	31
Trochosa ruricola De Geer	-	-	1	-	-	-	1
Pirata piraticus Clerck	1	-	-	-	-	-	1
Tricca lutetiana Simon	-	2	-	-	-	-	2
Aulona albimana Walckenaer	1	-	-	-	-	-	1
Pisauridae					1		1
Pisaura mirabilis Clerck	-	-	-	-	1	-	1
Agelenidae		1			3		4
Agelena glaciens C.L.Koch	-	1	-	-	3	-	4
Theridiidae	1	4	1		1	2	9
Episinus angulatus Blackwall	1	-	-	-	-	-	1
Euryopis flavomaculata C.L.Koch	-	-	1	-	1	-	2
Steatoda phalerata Panzer	-	4	-	-	-	-	4
Enophlognatha ovata Clerck	-	-	-	-	-	2	2
Tetragnathidae	2					1	3
Tetragnatha montana Simon	1	-	-	-	-	-	1
Tetragnatha pinicola L.Koch	1	-	-	-	-	-	1
Meta mengei Blackwall	-	-	-	-	-	1	1
Araneidae	8	1			4	7	20
Araneus marmoreus Clerck	1	-	-	-	-	-	1
Araniella cucurbitina Clerck	-	-	-	-	-	1	1
Hyposinga heri Hahn	1	-	-	-	-	-	1
Singa hamata Oliver	4	-	-	-	-	-	4
Singa nitidula C.L.Koch	2	-	-	-	-	-	2
Zilla diodia Walckenaer	-	-	-	-	-	4	4
Mangora acalypha Walck.	-	1	-	-	4	2	7
Linyphiidae	1		2		3		6
Walckenaeria melanocephala O.P.-Cambr.	-	-	1	-	-	-	1
Diplostyla concolor Wider	1	-	1	-	-	-	2
Linyphia triangularis Clerck	-	-	-	-	3	-	3

Table 6. The Coleoptera species and number of specimens in the different habitats

Species	Study area						
	I	II	III	IV	V	VI	Total
Carabidae	92	27	16	76	133	135	479
Carabus convexus Fabricius	-	-	1	21	8	36	66
Carabus coriaceus Linné	1	-	-	-	3	-	4
Carabus germani Sturm	5	-	-	-	-	-	5
Carabus granulatus Linné	2	-	1	-	-	-	3
Carabus nemoralis Müller	-	-	4	1	-	9	14
Carabus scheidleri Fabricius	1	-	-	1	2	-	4
Carabus ullrichi Germar	-	-	-	-	1	-	1
Leistus rufomarginatus Duftschmid	4	-	-	-	-	2	6
Notiophilus rufipes Curtis	-	-	-	-	-	1	1
Trechus quadristriatus Schrank	-	-	-	-	-	1	1
Ophonus nitidulus Stephens	-	-	1	-	-	1	2
Pseudoophonus rufipes De Geer	1	8	-	-	6	1	16
Harpalus anxius Duftschmid	-	5	-	12	-	-	17
Harpalus atratus Latroille	-	1	-	-	1	5	7
Harpalus distinguendus Duftschmid	-	1	-	-	-	-	1
Harpalus rubripes Duftschmid	-	-	-	3	-	-	3
Harpalus serripes Quensel	-	-	-	3	-	-	3
Harpalus tardus Panzer	-	-	1	1	8	7	17
Pterostrichus melas Creutzer	-	-	-	3	3	-	6
Pterostrichus oblongopunctatus Fabricius	-	-	-	-	-	21	21
Pterostrichus vulgaris Linné	5	-	-	1	-	-	6
Abax parallelepipedus Piller et Mit.	-	-	3	-	1	35	39
Abax parallelus Duftschmid	-	-	1	-	6	1-	17
Calathus ambiguus Paykull	-	-	-	1	-	-	1
Calathus fuscipes Goeze	36	11	-	27	93	-	167
Calathus melanocephalus Linné	36	-	-	1	-	-	37
Laemostenus terricola Herbst	-	-	-	-	1	1	2
Platyderes rufus Duftschmid	-	-	-	-	-	5	5
Amara aenea (De Geer)	-	1	-	1	-	-	2
Amara anthobia A. Villa et J.B. Villa	-	-	2	-	-	-	2
Amara familiaris (Duftschmid)	-	-	2	-	-	-	2
Oodes helopioides (Fabricius)	1	-	-	-	-	-	1
Silphidae	30	-	-	2	10	52	94
Necrophorus fossor Erichson	-	-	-	1	-	4	5
Necrophorus vespilloides (Herbst)	-	-	-	-	-	15	15
Necrophorus vespillo (Linné)	4	-	-	-	-	2	6
Oeceoptoma thoracicum Linné	-	-	-	-	-	6	6
Silpha carinata Herbst	24	-	-	1	9	23	57
Silpha obscura Linné	1	-	-	-	1	-	2
Silpha tristis Illiger	1	-	-	-	-	-	1
Phosphuga atrata (Linné)	-	-	-	-	-	2	2
Catopidae	27	3	-	-	-	21	51
Choleva oblonga Latreille	-	-	-	-	-	2	2
Sciodrepoides watsoni (Spence)	27	3	-	-	-	17	47
Nargus velox (Spence)	-	-	-	-	-	1	1
Ptomaphagus variicornis Rosenhauer	-	-	-	-	-	1	1
Staphylinidae	5	-	-	-	29	62	96
Ontholestes haroldi (Epph.)	-	-	-	-	-	6	6
Staphylinus caesareus Cederh.	1	-	-	-	6	2	9
Ocypus olens (Müll.)	-	-	-	-	22	-	22

Ocypus bharicus Müller	-	-	-	-	1	1	2
Ocypus pedator Gravenhorst	-	-	-	-	-	1	1
Philonthus decorus Gravenhorst	-	-	-	-	-	45	45
Philonthus intermedius (Lacordaire)	-	-	-	-	-	3	3
Abemus chloropterus (Panczer)	-	-	-	-	-	1	1
Platydracus fulvipes (Scopoli)	-	-	-	-	-	1	1
Tachinus rufipennis Gyllenhal	-	-	-	-	-	2	2
Drusilla canaliculata (Fabricius)	4	-	-	-	-	-	4
Elateridae	3	-	-	-	4	1	8
Lacon/Agrypnus murinus (Linné)	1	-	-	-	1	-	2
Athous niger (Linné)	1	-	-	-	-	-	1
Melanotus niger/ punctolineatus (Pellrin)	1	-	-	-	1	-	2
Pseudathous hirtus (Herbot)	-	-	-	-	1	-	1
Agriotes ustulatus (Schaller)	-	-	-	-	1	1	2
Dermestidae	30	3	-	35	-	-	68
Dermestes laniarius Illig	30	3	-	35	-	-	68
Temnochilidae	-	-	-	-	1	-	1
Thymalus limbatus Fabricius	-	-	-	-	1	-	1
Endomychidae	-	-	-	2	1	-	3
Dapsa denticollis Grm.	-	-	-	2	1	-	3
Coccinellidae	-	-	-	1	1	-	2
Anisosticta novemdecimpunctata (Linné)	-	-	-	-	1	-	1
Coccinella septempunctata (Linné)	-	-	-	1	-	-	1
Ptinidae	-	-	-	-	-	3	3
Ptinus calcaratus	-	-	-	-	-	3	3
Tenebrionidae	8	3-	-	28	-	-	66
Opatrum sabulosum (Linné)	-	27	-	27	-	-	54
Crypticus quisquilius (Linné)	7	3	-	1	-	-	11
Alphitophagus bifasciatus Schwarc	1	-	-	-	-	-	1
Anthicidae	4	-	-	-	-	-	4
Formicomus pedestris Rossi	4	-	-	-	-	-	4
Scarabaeidae	2	2	2	91	69	131	297
Geotrupes stercorosus (Scriba)	-	-	1	2	1	126	130
Geotrupes vernalis Linné	-	-	-	79	64	5	148
Aphodius lividus Ol.	-	1	-	-	-	-	1
Onthophagus coenobita Herbst	1	-	-	1	-	-	2
Onthophagus ovatus (Linné)	1	1	1	7	1	-	11
Onthophagus vacca (Linné)	-	-	-	1	-	-	1
Onthophagus verticicornis Laich	-	-	-	1	3	-	4
Melolonthidae	4	-	-	-	-	-	4
Valgus hemipterus (Linné)	4	-	-	-	-	-	4
Chrysomelidae	2	-	2	3	1	11	19
Lema melanopa Linné	1	-	-	-	1	-	2
Crysochus asclepiadeus Pall.	-	-	-	-	-	4	4
Hydrotassa marginella Linné	-	-	-	-	-	7	7
Crepidodera ferruginea (Scopoli)	1	-	1	2	-	-	4
Crysomela cuprina (Duftschman)	-	-	-	1	-	-	1
Aphthona euphorbiae Schrank	-	-	1	-	-	-	1
Curculionidae	15	4	1	2	5	9	36
Otiorhynchus raucus Fabricius	1	2	1	2	4	3	13
Otiorrhynchus rugosostriatus Goeze	2	-	-	-	-	-	2
Brachysomus setiger Boh.	12	-	-	-	-	-	12
Polydrusus coruscus Germ.	-	-	-	-	-	1	1
Trachyphloeus parallelus Seidl.	-	-	-	-	1	4	5
Trachyphloeus spinimanus Germ.	-	2	-	-	-	-	2