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DATA ON GROUND BEETLES FAUNA (COLEOPTERA: CARABIDAE) FROM THE NATURE RESERVE SPRING FROM CORBII CIUNGI (DÂMBOVIȚA)

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ABSTRACT. The article presents the results of the research carried out on the ground beetles fauna of the Nature Reserve Spring from Corbii Ciungi, Dâmbovița County, during April-December 2012. There were identified 62 species of ground beetles; only seven of them can be considered relatively rare for the Romanian fauna. There are presented data on similarity of the investigated habitats and grouping of the ground beetles species according to: biogeographically characteristics, trophic preferences, tolerance towards moisture values and habitat characteristics. Are analyzed the numerical rapports between the ground beetles species and values of diversity and equitability for each collecting station.

Key words: fauna, beetles, ground beetles, reserve, Corbii Ciungi.

REZUMAT. Date asupra faunei de carabide (Coleoptera: Carabidae) din Rezervația Naturală Izvorul de la Corbii Ciungi (Dâmbovița). Articolul prezintă rezultatele cercetărilor efectuate asupra faunei de carabide din Rezervația Naturală Izvoarele de la Corbii Ciungi, județul Dâmbovița, în perioada aprilie-decembrie 2012. Au fost identificate 62 de specii de carabide, dintre care şapte specii pot fi considerate relativ rare pentru fauna României. Sunt prezentate date cu privire la similaritatea habitatelor investigate şi gruparea speciilor de carabide în funcție de: caracteristicile biogeografice, preferințele trofice, toleranța față de valorile umidității şi caracteristicile habitatului. Sunt analizate raporturile numerice dintre speciile de carabide şi valorile diversității şi echitabilității pentru fiecare stație de colectare.

Cuvinte cheie: faună, coleoptere, carabide, rezervație, Corbii Ciungi.

INTRODUCTION

The article aims to provide an inventory of ground beetles species of the Nature Reserve Spring from Corbii Ciungi (Dâmbovița County) and some of the structural features of ground beetles fauna of this area.

The study, conducted in 2012, adds data to the previous obtained by other authors (Ciubuc, 2007), on ground beetles fauna from this reserve.

Beginning with year 1959, L. Botoşăneanu and Şt. Negrea performed a systematic study on springs and groundwater fauna of the Romanian Plain. The most interesting discovery, made during this research, was the finding at Neajlov Valley, near the village Corbii Ciungi, a complex of springs, a marshes and rivulets collectors, with cold water, relatively stenothermal all year and neutral pH.

The rich biological material collected for two years (14 May 1959 - 5 April 1961) from this area, formed the basis of publication of the first faunal lists, which highlighted extraordinary diversity of the springs complex and relict character of many species found here (Botoşăneanu & Negrea, 1961; Botoşăneanu & Negrea, 1962). Initial data were then supplemented and included in a monograph paper, which presents the results of research conducted on the 70th springs or complex of springs from the Romanian Plain (Motaş et al., 1962). For the complex of springs from Corbii Ciungi were mentioned 73 over specific taxa, most hydrobionts (aquatic macroinvertebrates).

Based on these faunal data, completed by the floristic data, the authorities made the decision to declare the complex of springs from Corbii Ciungi reserve, on 24 June 1966, through the decision of People's Council of Argeş Region, under the title: *Nature Reserve Spring from Corbii Ciungi*, with an area of about 8 hectares.

In the period 2005-2007, under the coordination of C. Ciubuc (Ciubuc, 2007) was made the last study on fauna of the complex of springs from Corbii Ciungi. This was the first time there such captures were made in the riparian area, springs adjacent and rivulets collectors. On this occasion, species from 31 families of beetles, among which 20 species of ground beetles have been identified.

MATERIALS AND METHODS

The complex of springs is located in Romanian Plain, in the lower basin of the Argeş River, on the left bank of the Neajlov Valley, about 800 meters from the Neajlov River and approximately 2 km from the exit of the village Corbii Mari, to village Izvoru (the former village Corbii Ciungi), the right side of the National Road 61, (at about 200 meters from it), at an average altitude of 110 m. The complex consists of a large number of springs: reocren, limnocren and helocren, performed on an arc of circle with a length of approximately 600 meters; these are grouped into two complexes (fountains), separated from a marshy area which substitutes the "watershed" (Negrea & Negrea, 1999): Fountain of Lisandru Vlăduț in the west and Fountain of Cacaleților in the east. These form two rivulets with a length of about 800-1000 meters each; they are close to their front sections then they have a divergent path, defining between them an area of about 90,000 m^2 and then they reunite for shedding the Neajlov River (Fig. 1).

At present (2012), the surface of reserve decreased to about 5 ha, because of the expansion of crops and grazing. It was grubbed up "riverside coppice-looking jungle" (Negrea & Negrea, 1999), which covered the complex of springs and rivulets collectors down to the shedding in the Neajlov River.

For the catching of ground beetles were established three collecting stations (Fig. 1):

Station 1 (SR1) was located near the rivulet Lisandru Vlăduț, in open area, with herbaceous vegetation and shrub layer poorly individualized, represented by the isolated specimens: *Rosa canina* (Linnaeus, 1753), *Crataegus monogyna* (Jacq., 1775) and *Euonymus europaeus* (Linnaeus, 1753).

Station 2 (SR2) was set in the proximity of the rivulet Cacaleților, at the edge of a selvage formed of very young specimens by: *Salix* sp. and *Alnus glutinosa* (Linnaeus, 1754), accompanied by *Cornus sanguinea* (Linnaeus, 1753).

Station 3 (SR3) was placed in an area with a tree vegetation, formed of young specimens by *Alnus glutinosa* (Linnaeus, 1754), localized around a spring.

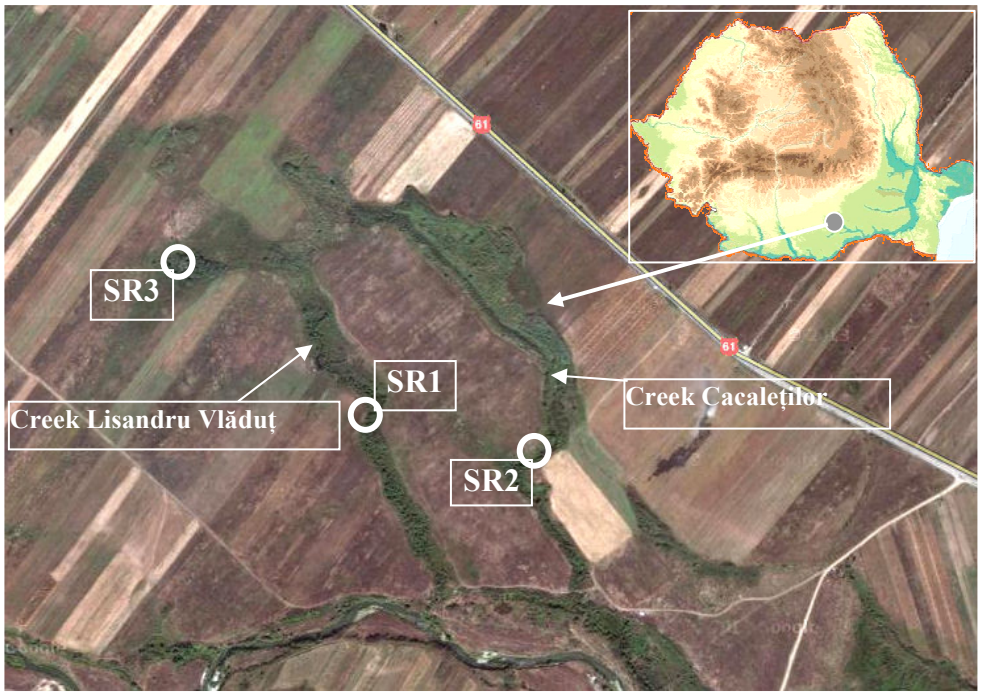


Figure 1 - Locating the wetland complex Izvoru/Corbii Ciungi and of collecting stations (http://maps.google.ro).

The capture the ground beetles was done using wet pitfall traps (interception traps), used for collecting the invertebrates active at ground level. There were used plastic tumblers (buried in the ground), with a capacity of 500 cm^3, opening diameter of 9 cm, the height of 12 cm, and opening surface area of 63.58 cm^2. In each trap were placed 150 cm^3 formaldehyde solutions (4%), approximately 1/3 of the vessel volume. To stop captured animals to leave the trap, through climbing on the sides of the bowl, for each trap a funnel was used, obtained by cutting the top of a plastic bottle. The funnel was introduced with the small opening downwards in the plastic beaker, forming a barrier for the animals

which try to leave the trap. To prevent the access of rainwater and impurities, at approximately 6 cm above the trap, a small sheet metal roof was set, with square shaped and dimensions 14 x 14 cm. There were installed in each station 5 pitfalls, set in line, 5 m distant one from another, perpendicular to the thread/surface water; the first trap was installed very close to the water limit. The material was monthly collected, from April to December (2012). These pitfalls have operated in the field 255 days.

RESULTS AND DISCUSSIONS

After the collection, sorting and determination of the biological material 502 exemplars grouped in 62 de species were obtained (Tab. 1). The ground beetles represented 47.26% from the total amount of collected beetles and 39.24% from the total amount of identified species.

The most exemplars belonged to the species *Pterostichus (Cophosus) cylindricus* (Herbst, 1785), almost 15.93% from the total amount of the captured individuals; it was followed by these species: *Limodromus (Platynus) assimilis* (Paykull, 1790), 12.54% and *Carabus coriaceus* (Linnaeus, 1758) with 11.95%.

Table 1 - The list of the ground beetles species collected in the Nature Reserve Spring from Corbii Ciungi (Dâmbovița), including data about: the number of collected exemplars from each species, the geographical spreading and the preferences regarding the humidity (Hum.), the type of habitat (Hab.) and food.

No.	Taxon	SR1	SR2	SR3	Sum	Spread	Hum.	Hab.	Food
	Ord. COLEOPTERA								
	Fam. Carabidae								
1	***Abax parallelus*** (Duftschmid, 1812)			3	**3**	E	Mh	F	Z
2	***Acupalpus flavicollis*** (Sturm, 1825)		1		**1**	P	H	Ols	Z
3	***Agonum marginatum*** (Linnaeus, 1758)			2	**2**	WP	Mx	Ols	Z
4	***Agonum viduum*** (Panzer, 1797)	1			**1**	ES	Mh	Ols, Rip	Z
5	***Agonum viridicupreum*** (Goeze, 1777)	1			**1**	WP	H	Ols, Rip	Z
6	***Amara aenea*** (DeGeer, 1774)		1		**1**	TP	M	Ols	Ph
7	***Amara aulica*** (Panzer, 1797)			1	**1**	WP	M	Cr	O

Continues.

Table 1 - Continuation.

No.	Taxon	SR1	SR2	SR3	Sum	Spread	Hum.	Hab.	Food
8	***Amara communis*** (Panzer, 1797)	4	1		**5**	TP	Eh	Eu	Ph
9	***Amara convexior*** Stephens, 1828	1	1		**2**	ES	M	F	O
10	***Amara eurynota*** (Panzer, 1797)	1	1		**2**	WP	Mh	Eu	Ph
11	***Amara familiaris*** (Duftschmid, 1812)	2	1		**3**	TP	Mx	Eu	Ph
12	***Amara montivaga*** (Sturm, 1825)		1		**1**	WP	Mx	Ols	Ph
13	***Amara ovata*** (Fabricius, 1792)		3		**3**	TP	M	F	O
14	***Anchomenus dorsalis*** (Pontoppidan, 1763)	2			**2**	WP	M	Ols	Z
15	***Anisodactylus binotatus*** (Fabricius 1787)		1		**1**	WP	M	St	O
16	***Asaphidion flavipes*** (Linnaeus, 1761)			2	**2**	WP	H	F	Z
17	***Badister bullatus*** (Schrank, 1798)		1	1	**2**	TP	Mh	Eu	Z
18	***Bembidion lampros*** (Herbst, 1784)	2	1		**3**	H	Mh	Eu	Z
19	***Brachinus crepitans*** (Linnaeus, 1758)	6	2		**8**	WP	Mx	F, St	Z
20	***Brachinus explodens*** Duftschmid, 1812	2	2		**4**	WP	Mx	F, St	Z
21	***Calathus ambiguus*** (Paykull, 1790)	1			**1**	P	Mx	F	Z
22	***Calathus erratus*** (C. R. Sahlberg, 1827)	4		1	**5**	P	Mx	Eu	Z
23	***Calathus fuscipes*** (Goeze, 1777)		1		**1**	WP	M	Eu	Z
24	***Calathus melanocephalus*** (Linnaeus, 1758)	3			**3**	WP	M	Eu	Z
25	***Callistus lunatus*** (Fabricius, 1775)	1	1		**2**	WP	X	Ols	Z
26	***Carabus cancellatus*** Illiger, 1798		1		**1**	P	M	F, Cro	Z

Continues.

Table 1- Continuation.

No.	Taxon	SR1	SR2	SR3	Sum	Spread	Hum.	Hab.	Food
27	***Carabus convexus*** Fabricius, 1775		1		**1**	ES	M	F	Z
28	***Carabus coriaceus*** (Linnaeus, 1758)	21	31	8	**60**	E	M	F	Z
29	***Carabus scabriusculus*** Olivier, 1795	2			**2**	E	M	St, Cro	Z
30	***Carabus ullrichi*** Germar, 1824	1		1	**2**	CE	M	F	Z
31	***Chlaenius festivus*** (Panzer, 1796)			2	**2**	SWP	Mh	Ols	Z
32	***Chlaenius nigricornis*** (Fabricius, 1787)		1	1	**2**	WP	H	Ols, Rip	Z
33	***Chlaenius tristis*** (Schaller, 1783)			1	**1**	ES	H	Ols, Rip	Z
34	***Drypta dentata*** (Rossi, 1790)	1			**1**	SWP	H	F, Rip	Z
35	***Harpalus calceatus*** (Duftschmid, 1812)	1			**1**	P	Mx	St	O
36	***Harpalus froelichi*** Sturm, 1818		1		**1**	ES	Mx	Ols	O
37	***Harpalus*** *(Pseudoophonus)* ***griseus*** (Panzer, 1796)	2	8		**10**	TP	Mx	Ols	O
38	***Harpalus rubripes*** (Duftschmid, 1812)	1			**1**	WP	Mx	Ols	O
39	***Leistus ferrugineus*** (Linnaeus, 1758)	1			**1**	TP	Mh	F, Rip	Z
40	***Limodromus*** *(Platynus)* ***assimilis*** (Paykull, 1790)			63	**63**	P	H	F, Rip	Z
41	***Nebria brevicollis*** (Fabricius, 1792)	2			**2**	E	Mh	F	Z
42	***Notiophilus palustris*** (Duftschmid, 1812)			1	**1**	ES	H	F, Rip	Z
43	***Oodes gracilis*** A. Villa & G.B. Villa, 1833			7	**7**	E	H	F, Rip	Z
44	***Oodes helopioides*** (Fabricius, 1792)			38	**38**	WP	H	F, Rip	Z
45	***Ophonus*** *(Metophonus)* ***azureus*** (Fabricius, 1775)		3		**3**	WP	M	St, Cr	Ph

Continues.

Table 1 - Continuation.

No.	Taxon	SR1	SR2	SR3	Sum	Spread	Hum.	Hab.	Food
46	***Ophonus nitidulus*** Stephens, 1828		2		**2**	WP	M	F	O
47	***Ophonus*** *(Metophonus)* ***puncticeps*** Stephens 1828		1		**1**	WP	M	Cr	Ph
48	***Ophonus rufibarbis*** (Fabricius, 1792)	1			**1**	TP	M	Eu	Ph
49	***Ophonus sabulicola*** (Panzer, 1796)	2			**2**	ES	M	St, Cr	Ph
50	***Paranchus albipes*** (Fabricius, 1796)			3	**3**	WP	H	Rip	Z
51	***Poecilus cupreus*** (Linnaeus, 1758)		6		**6**	WP	M	Eu	Z
52	***Pseudoophonus*** *(Harpalus)* ***rufipes*** (De Geer, 1774)		6		**6**	WP	Mx	Ols	O
53	***Pterostichus*** *(Pseudomaseus)* ***anthracinus*** (Illiger, 1798)	2	1	7	**10**	ES	H	St, F, Rip	Z
54	***Pterostichus*** *(Cophosus)* ***cylindricus*** (Herbst, 1785)	22	56	2	**80**	CEE	H	F, Rip	Z
55	***Pterostichus hungaricus*** Dejean, 1828	1			**1**	EE	M	F	Z
56	***Pterostichus melanarius*** (Bonelli, 1810)		3	17	**20**	ES	M	Eu	Z
57	***Pterostichus minor*** (Gyllenhal, 1827)			29	**29**	ES	H	F	Z
58	***Pterostichus niger*** (Schaller, 1783)	5	23	43	**71**	TP	M	Eu	Z
59	***Pterostichus nigrita*** (Paykul, 1790)		3		**3**	P	H	St, F, Rip	Z
60	***Pterostichus vernalis*** (Panzer 1796)	1	2	1	**4**	TP	H	Rip	Z
61	***Stomis pumicatus*** (Panzer, 1795)		1	1	**2**	E	M	F	Z
62	***Trechus quadristriatus*** (Schrank, 1781)		1		**1**	WP	M	Ols	Z
	Total (specimens)	**97**	**170**	**235**	**502**				
	No. species	**30**	**34**	**23**					

Legend: CE – Central-European, CEE – Central-East-European, E – European, EE – East-European, ES – European-Siberian, H – Holarctic, P – Palearctic, SWP – Southwest Palearctic, TP – Trans-Palearctic, WP – West-Palearctic; Eh – Euryhigrophilous, H – Hygrophilous, M – Mesophilous, Mh – Mesohygrophilous, Mx – Mesoxerophilous, X – Xerophilous; Cr – Crops, Eu – Eurytopic, F – Forest, Ols – Open landscape, Rip – Riparious, St – Steppe; O – Omnivorous, Ph – Phytophagous, Z – Zoophagous.

Regarding the fauna, out of the 62 ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi, can be considered relatively scarce: *Amara (Curtonotus) aulica* (Panzer, 1797), *Brachinus crepitans* (Linnaeus, 1758), *Brachinus explodens* Duftschmid, 1812, *Callistus lunatus* (Fabricius, 1775), *Carabus convexus* Fabricius, 1775 and *Carabus scabriusculus* Olivier, 1795. They are species in decline, which are included in the category of species near threatened or vulnerable in many European countries; *Oodes gracilis* A. Villa & G.B. Villa, 1833 and *Oodes helopioides* (Fabricius, 1792), two characteristic species for the eutrophic wet areas, which as a result of their habitats restrained are considered near threatened or vulnerable in many European countries.

The differences regarding the fauna of the three collecting stations were highlighted using the similarity index Jaccard, which takes into consideration the presence/absence of the ground beetles species (Fig. 2). The obtained data indicated that the similarity of the three habitats was little. The values varied between 18.73%, for SR3 – SR1, SR2 and 27.83%, for SR1 – SR2.

The small values (under 30%) of the similarity index Jaccard, shows that there is a low similarity of the ground beetles associations from the three studied habitats. This fact reflects the high heterogeneity of the researched area, from a structural point of view. This feature is a result of the anthropic activities (agriculture, grazing) which determined the fragmentation, the diminution and even the disappearing of the original riparian habitats.

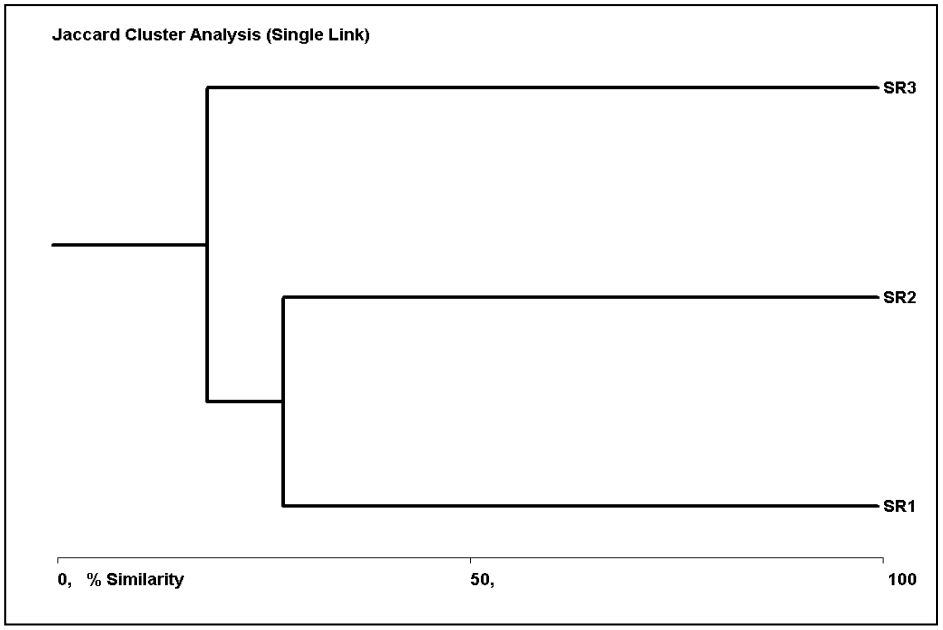


Figure 2 - The similarity of the ground beetles fauna in the three stations from the Nature Reserve Spring from Corbii Ciungi.

In concordance to their geographical spreading the 62 ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi, were grouped in 10 zoogeographical categories. From the point of view of the weight of each identified zoogeographic categories, we noticed the presence of a big number of West-Palearctic species (37.10%). They were followed by the European-Siberian species and the Trans-Palearctic ones (16.13% each). The Palearctic species (11.29%) and the European ones (9.68%), represented almost 10%. The rest of the zoogeographic elements represented less than 5% (Fig. 3). This hierarchy changes if the analysis is performed for each station. In this case, for all the stations, the West-Palearctic species are the best represented, but for the SR1 and SR2 was observed an increase of the number of Trans-Palearctic species (23.33% - SR1 and 23.53% - SR2) and a decrease of the European-Siberian species (13.33% - SR1 and 14.71% - SR2). In the SR3 an increasing of the weight of the European-Siberian (21.74%) and European (17.39%) species was noticed; contrary the number of the Trans-Palearctic species (13.04%) decreases. For the SR3 it was noticed an increasing of the number of species that prefer a colder and wetter clime, i.e. the European-Siberian species.

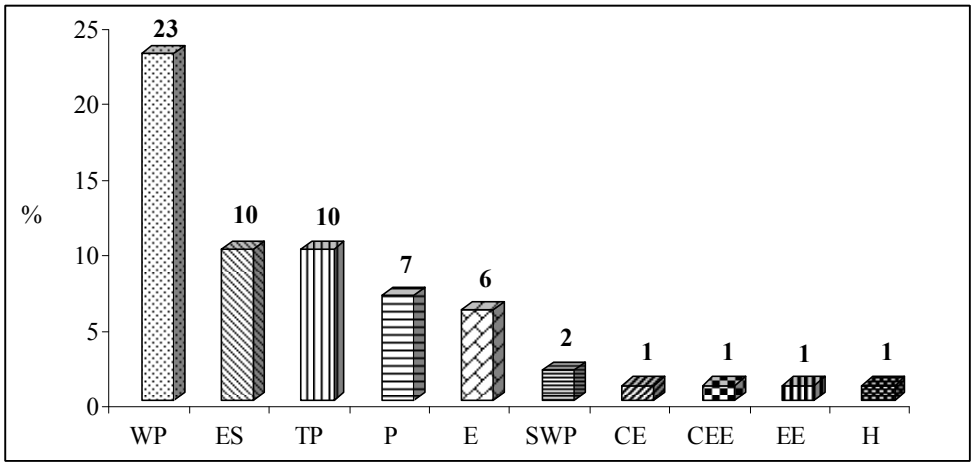


Figure 3 - The weight of the zoogeographic categories depending on the number of species from each category (CE – Central-European, CEE – Central-East-European, E – European, EE – East-European, ES – European-Siberian, H – Holarctic, P – Palearctic, SWP – Southwest Palearctic, TP – Trans-Palearctic, WP – West-Palearctic).

From the point of view of the preference for the humidity, the most ground beetles species (38.71%) identified in the Nature Reserve Spring from Corbii Ciungi were mesophilous (Fig. 4). Also well represented were the hygrophilous species (25.81%) and the mesoxerophilous ones (19.35%), followed by the mesohygrophilous ones (12.90%). The weight of the xerophilous species and the euryhigrophilous ones was small (1.61%, each one). Important differences in the three stations were observed. The hierarchy for SR1 and SR2 is similar to the general one. A big number of the following species was recorded: mesophilous

(SR1 - 33.33%, SR2 - 47.06%), mesoxerophilous (SR1 - 26.67%, SR2 - 20.59%), hygrophilous (SR1 - 16.67%, SR2 - 17.65%) and mesohygrophilous (SR1 - 16.67%, SR2 - 8.82%). For SR3 we found a significant increase of the number of hygrophilous species (52.17%), followed by mesophilous species (26.09%) and mesohygrophilous species (13.04%). Missing from this station the species euryhigrophilous and xerophilous.

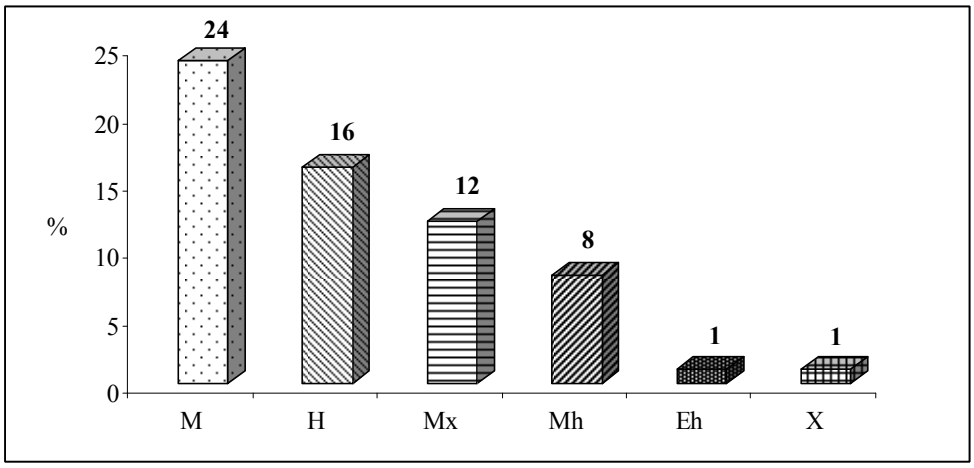


Figure 4 - The grouping of the ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi depending on their preference for humidity (Eh – euryhigrophilous, H – hygrophilous, M – mesophilous, Mh – mesohygrophilous, Mx – mesoxerophilous, X – xerophilous).

The grouping of the ground beetles species depending on their preference for a certain type of habitat highlighted the existence of a relative equilibrium of the weight of the species which prefer the forestall areas (20.97%) and those who prefer the open areas (19.35%) and the eurytopic ones (19.35%). Well represented were the riparian species (F, Rip + Ols, Rip + Rip), 20.97% of the total amount of the identified ground beetles species (Fig. 5).

In the SR1 and SR2 the most of the ground beetles species were eurytopic species (SR1 - 26.67%, SR2 - 26.47%). In SR1 they were followed by the forestall species (20.00%) and by those which prefer the open areas (SR1 - 13.33%). In the SR2 the hierarchy was inversed: the species which prefer the open areas were more numerous (23.53%) by comparison to the forestall ones (17.65%). In the SR3 we noticed the existence of a big number of species exclusively forestall (26.09%). The species met in the forests and in the agricultural areas can be added (F, Cr – 21.74%); they represent together 47.83%. The weight of the eurytopic species was 17.39%, while the ones which prefer the open areas diminished to 8.70%. Regarding the riparian species the values varied between 4.71% (SR2) and 23.33% (SR1); in SR3 their weighting was 21.74%).

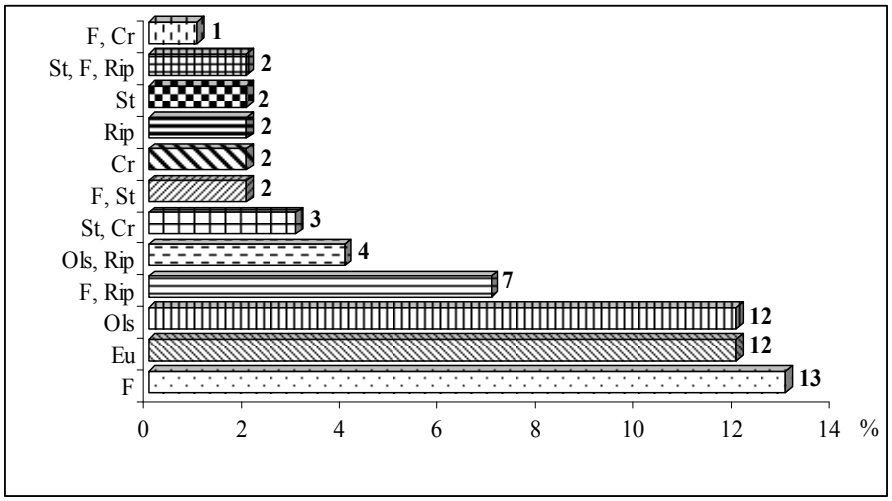


Figure 5 - The grouping of the ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi depending on their preference for a certain type of habitat (Cr – agricultural cultures, Eu – eurytopic, F – forest, Ols – open areas, Rip – riparian, St – steppe).

The analyzing of the trophic preferences highlighted a clear dominance of the zoophagous species. These ones represented 69.35%. The omnivorous and the phytophagous were almost even, 16.13%, and 14.52% respectively (Fig. 6). This hierarchy was the same for each station. The only noticeable difference was observed in SR3, where the phytophagous species were absent, while the zoophagous ones represented 95.65%. The species from the genera *Amara* and *Ophonus* were absent in SR3, while they were frequent in the agricultural cultures and in the open, ruderal and degraded areas.

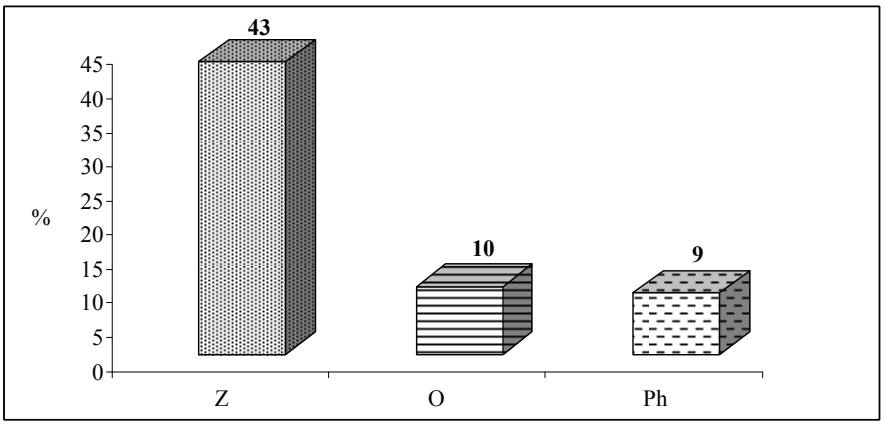


Figure 6 - The grouping of the ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi depending on their preference for a certain type of food (O – omnivorous, Ph – phytophagous, Z – zoophagous).

The quantitative ratios of the ground beetles species were quantified through the relative abundance. We considered that is recommended that values of this ecologic index to be calculated for each station and also cumulated for all collecting stations (Tab. 2).

Table 2 - The values of the relative abundance (Ar %) for the ground beetles species identified in the Nature Reserve Spring from Corbii Ciungi (there were written in the table the species whose the relative abundance values, cumulated for all collecting stations, were higher or equal 1%) .

No.	Taxon	Ar%			
		SR1	SR2	SR3	Total
1	*Pterostichus (Cophosus) cylindricus* (Herbst, 1785)	22.68	32.94	0.85	**15.94**
2	*Pterostichus niger* (Schaller, 1783)	5.15	13.53	18.30	**14.14**
3	*Limodromus (Platynus) assimilis* (Paykull, 1790)	-	-	26.81	**12.55**
4	*Carabus coriaceus* (Linnaeus, 1758)	21.65	18.24	3.40	**11.95**
5	*Oodes helopioides* (Fabricius, 1792)	-	-	16.17	**7.57**
6	*Pterostichus minor* (Gyllenhal, 1827)	-	-	12.34	**5.78**
7	*Pterostichus melanarius* (Bonelli, 1810)	-	1.76	7.23	**3.98**
8	*Harpalus (Pseudoophonus) griseus* (Panzer, 1796)	2.06	4.71	-	**1.99**
9	*Pterostichus (Pseudomaseus) anthracinus* (Illiger, 1798)	2.06	0.59	2.98	**1.99**
10	*Brachinus crepitans* (Linnaeus, 1758)	6.19	1.18	-	**1.59**
11	*Oodes gracilis* A. Villa & G.B. Villa, 1833	-	-	2.98	**1.39**
12	*Poecilus cupreus* (Linnaeus, 1758)	-	3.53	-	**1.20**
13	*Pseudoophonus (Harpalus) rufipes* (De Geer, 1774)	-	3.53	-	**1.20**
14	*Amara communis* (Panzer, 1797)	4.12	0.59	-	**1.00**
15	*Calathus erratus* (C. R. Sahlberg, 1827)	4.12	-	0.43	**1.00**

The values of the relative abundance calculated for each species for all collecting stations indicated that four species, i.e. *Pterostichus (Cophosus) cylindricus* (Herbst, 1785), *Pterostichus niger* (Schaller, 1783), *Limodromus (Platynus) assimilis* (Paykull, 1790) and *Carabus coriaceus* (Linnaeus, 1758) were eudominant species. They were followed by two dominant species: *Oodes helopioides* (Fabricius, 1792) and *Pterostichus minor* (Gyllenhal, 1827) and a subdominant one, *Pterostichus melanarius* (Bonelli, 1810). The rest of the ground beetles species were recedent (6 species) and subrecedent species (49 species).

Eudominante species in SR1: *Pterostichus (Cophosus) cylindricus* (Herbst, 1785) and *Carabus coriaceus* (Linnaeus, 1758), followed by *Brachinus crepitans* (Linnaeus, 1758) and *Pterostichus niger* (Schaller, 1783), as dominant species and *Amara communis* (Panzer, 1797) and *Calathus erratus* (C. R. Sahlberg, 1827) as

subdominant species. *Harpalus (Pseudoophonus) griseus* (Panzer, 1796) and *Pterostichus (Pseudomaseus) anthracinus* (Illiger, 1798) were recedente species (Fig. 7).

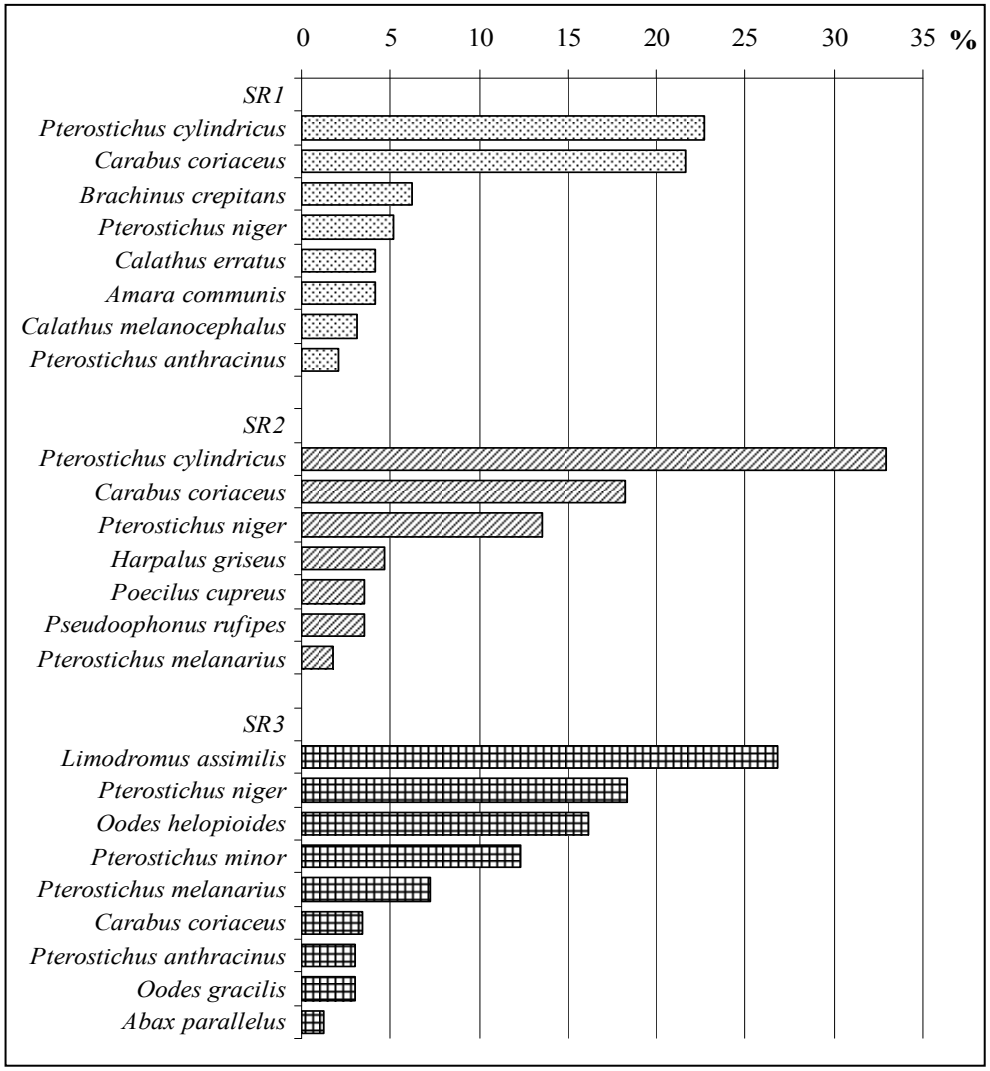


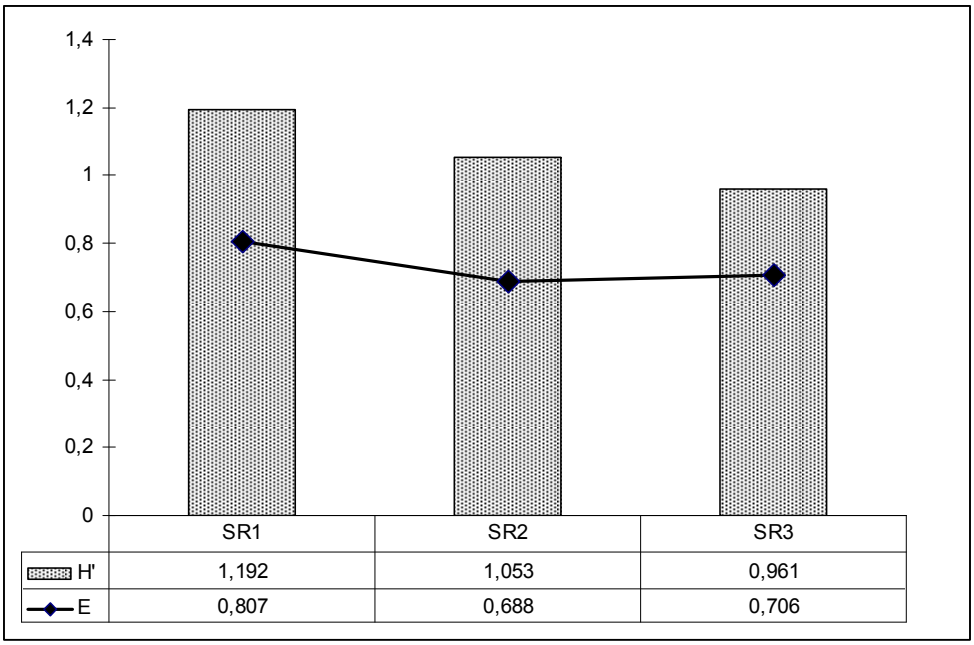
Figure 7 - The scale of the values of the relative abundance for the ground beetles species for which the index was bigger than 1% or equal.

Three species were eudominante in SR2: *Pterostichus (Cophosus) cylindricus* (Herbst, 1785), *Carabus coriaceus* (Linnaeus, 1758) and *Pterostichus niger* (Schaller, 1783). In this station the dominant species were absent. *Harpalus (Pseudoophonus) griseus* (Panzer, 1796), *Poecilus cupreus* (Linnaeus, 1758) and *Pseudoophonus (Harpalus) rufipes* (De Geer, 1774) represented subdominant species.

Four eudominante species were recorded in SR3: *Limodromus (Platynus) assimilis* (Paykull, 1790), *Pterostichus niger* (Schaller, 1783), *Oodes helopioides* (Fabricius, 1792) and *Pterostichus minor* (Gyllenhal, 1827); one dominant species, *Pterostichus melanarius* (Bonelli, 1810) and three subdominant species: *Carabus coriaceus* (Linnaeus, 1758), *Pterostichus (Pseudomaseus) anthracinus* (Illiger, 1798) and *Oodes gracilis* A. Villa & G.B. Villa, 1833.

The presented data offer information about the exercising of the dominance for the ground beetles fauna in these three stations for the species whose index was bigger than 1% or equal. In SR3 the hierarchy of the values of the relative abundance and implicit of the dominance was less "abrupt" by comparison to a SR1 and SR2. This fact indicates the existence of a more heterogeneous habitat from a structural point of view in this station.

The hierarchy of the collecting stations depending on the diversity and equitability values was done using the Shannon index. If we take in consideration, generally, the values of this index vary between 1.5 and 3.5 (Varvara & Zugravu, 2006), results that in all three stations the Shannon index had small values (Fig. 8).



	SR1	SR2	SR3
H'	1,192	1,053	0,961
E	0,807	0,688	0,706

Figure 8 - The values of the diversity (H') and the equitability (E) for the ground beetles fauna, in the three stations from the Nature Reserve Spring from Corbii Ciungi.

The smallest values of the diversity were calculated for SR3, while the highest for SR1. Though in SR2 there were identified the biggest number of ground beetles species, the value of the Shannon index was smaller than in SR1, because for SR2 the lowest value of equitability was calculated. This fact shows an unbalanced distribution of the number of individuals captured for the number of

identified species. The dominant species are absent in this station because the value of the relative abundance decreases sharply from over 10% to less than 5%. This type of dominance is specific for the relatively even habitats, where for one or two species, well adapted to the respective environment, have a big abundance. In this case *Pterostichus (Cophosus) cylindricus* (Herbst, 1785) was the species which dominated the ground beetles association in this station. A similar situation was recorded in SR1, but here we talk about the co-dominance of two species, *Pterostichus (Cophosus) cylindricus* (Herbst, 1785) and *Carabus coriaceus* (Linnaeus, 1758).

CONCLUSIONS

Regarding the fauna, the study has as a result the identification of 62 ground beetles species, double by comparison to the previous study performed in 2005-2007. The following species are considered to be rare for the Romanian fauna, a fact that increases the value of the reserve from the viewpoint of the fauna: *Amara (Curtonotus) aulica* (Panzer, 1797), *Brachinus crepitans* (Linnaeus, 1758), *Brachinus explodens* Duftschmid, 1812, *Callistus lunatus* (Fabricius, 1775), *Carabus convexus* Fabricius, 1775, *Carabus scabriusculus* Olivier, 1795, *Oodes gracilis* A. Villa & G.B. Villa, 1833 and *Oodes helopioides* (Fabricius, 1792).

From a conservative viewpoint we remarked the ground beetles association from the station SR3, which differs from the others through the following features: the specific component, the zoogeographical structure, the preference of the species for some of the characteristic feature of the habitat (type, humidity values) and the weight of the trophic categories. This association characterizes a type of habitat that resembles the most with original riparian habitats of the reservation. From this viewpoint such a habitat can be considered a regeneration centre that must be protected.

The small biodiversity and equitability values, as well as the way the domination exercising show the existence of some ground beetles associations characteristic foe the pioneer or degraded habitats, an obvious situation especially in the SR1 and SR2.

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