THE SYNECOLOGICAL ANALYSES OF THE EDAPHIC BEETLES (COLEOPTERA) FROM THE MIXED FOREST (ELM, ASH AND FIELD MAPLE) FROM THE „CODRII TIGHECIULUI" LANDSCAPE RESERVE

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Abstract. This paper represents a faunistic and ecological study on the edaphic coleoptera from a mixed forest of the "Codrii Tigheciului" landscape reserve, accomplished during the vegetation period of 2004-2006. The coleopteran fauna from a forest of elm-tree (*Ulmus caprinifolia*) mixed with ash-tree (*Fraxinus excelsior*), sycamore (*Acer campestre*) and maple (*Acer platanoides*) was represented by 77 species from 37 genera and 7 families. The most well represented was the family Carabidae with 39 species from 16 genera, followed by family Staphylinidae with 15 species from 10 genera, then by the families Silphidae and Scarabaeidae with 9 species each from 4 and respectively 2 genera and the families Lucanidae and Tenebrionidae with 2 species from 2 genera each. The family Trogidae was represented by one species. Within the study the analysis of some analytical ecological indexes was realized, such as the abundance, the dominance, the stability and some synthetic indexes such as the index of ecological significance and the diversity index (the index of real diversity – H(S), the maximum diversity – H(S)max and the relative diversity (evenness).

Key words: edaphicolous beetles, synecological analyses, Codrii Tigheci Landscape Reserve

Rezumat: Analiza sinecologică a coleopterelor edafice (Coleoptera) din pădurea de amestec (ulm de câmp, frasin şi jugastru) din rezervaţia peisagistică „Codrii Tigheciului". Lucrarea de faţă este un studiu faunistic şi ecologic asupra coleopterelor edafice dintr-o pădure de amestec a rezervaţiei peisagistice "Codrii Tigheciului", realizat în perioada de vegetaţie a anilor 2004-2006. Fauna coleopterelor din pădurea de ulm de câmp (*Ulmus carpinifolia*) în amestec cu frasin (*Fraxinus excelsior*), jugastru (*Acer campestre*) şi arţar (*Acer platanoides*), a fost reprezentată prin 77 specii, ce aparţin la 37 genuri şi 7 familii. Cea mai bine reprezentată a fost Familia Carabidae cu 39 specii din 16 genuri, urmată de familia Staphylinidae cu 15 specii aparţinând la 10 genuri, apoi familiile Silphidae şi Scarabaeidae cu câte 9 specii fiecare şi respectiv 4 şi 2 genuri, şi familiile Lucanidae şi Tenebrionidae cu câte 2 specii din 2 genuri fiecare. Familia Trogidae a fost reprezentată printr-o singură specie. În cadrul studiului, a fost realizată analiza unor indici ecologici analitici precum: abundenţa, dominanţa, constanţa şi indici ecologici sintetici ca: indicile de semnificaţie ecologică şi indicii de diversitate (indicele de diversitate reală –H(S), diversitatea maximală –H(S)max şi diversitatea relativă (echitabilitatea).

Cuvinte cheie: coleoptere, analiză sinecologică, rezervaţia peisagistică Codrii Tigheciului

INTRODUCTION

Till 2003, information concerning the coleopterans' study from the "Codrii Tigheciului" landscape Reserve were quite beaked up. MILLER ED. and ZUBROVSKI N. (1917), MEDVEDEV S. and ŞAPIRO D (1957), had made an inventory of the beetle fauna of Basarabia. The authors cited a few new species for Moldova and specified several collecting sites situated near by that landscape reserve. This area was also investigated by Neculiseanu Z. concerning the Carabidae family - a complex taxonomic, zoogeographical, ecological and biological study, pointing out their importance in the ecosystems of the Republic of Moldova. During the period 2003-2006 I have studied the edaphicolous beetles of the landscape reserve from faunistic and ecological point of view.

The "Codrii Tigheci" landscape Reserve is situated in the central part of Tigheci hillock, where there are kept the most representative biocoenotic forest and forest-steppe associations, amenable at the present to a few centralized conservancy measurement and amelioration (Pic.2).

"Codrii Tigheci" is a reserve with multifunctional statute, where takes place different kind of activities like land clearing, sanitary outthought work, and tourists' activities with destructive effects on the forest ecosystem. Thereby, the human unreasonable interventions on the natural habitat, affect lots of species of the coleopterans.

Therefore, it is a very important problem to know the coleopterans diversity, the role which they have in maintaining the natural equilibrium.

This study presents the components and the diversity of edaphicolous coleopterans from one type of the forest of this landscape reserve. As well, it was made an analyse of a few ecological analitical indexes like: abundance, dominance, constancy and ecological synthetic indexes like: index of ecological significance, and diversity indexes (index of the real diversity –H(S), maximum diversity –H(S) max and relative diversity (evenness).

COLLECTING METHODS

For the collection of the entomological material I used pitfall traps, being collected the coleopterans which are active on the soil and those which live in the superficial stratum of the soil. This method was described in different scientific papers, A. CUDRIN (1966, 1971), M. LAMOTTE (1969), J. LE BERRE and M. ROTH (1996), V. ŞILENCOV (1982), O. KRYZHANOVSKIJ (1983), Gh. MOHAN and A. ARDELEAN (1993).

As pitfall traps I used glasses with different volume (700-1000 ml). Those glasses were ploughed under the soil till to the top level. Ten pitfall traps were set in that biotope during the vegetation period of the years 2004-2006. (O.

CRIJANOVSKIJ, 1983). The traps were placed in a right line (equal distance between them). Ten pitfall traps represented by glasses with different volume (700-1000 ml) were placed in right line (equal distance between them) in the mixed forest during the vegetation period of years 2004-2006). A concentrate solution of NaCl was used as a preserving liquid being a good conservator and prevents the maceration of the captured individuals. At the same time the presence of the preserving liquid excludes the cannibalism between the individuals, entrap and decrease the escape probability of the individuals (BÂZOVA, 1987).

METHODS USED FOR SCIENTIFIC WORKING OUT OF THE MATERIAL

For the working out of the collecting materials different ecological parameters were used such as: abundance, dominance, constancy, the ecological index of significance and the index of diversity (Simpson, Shannon, evenness), according to authors: Gh. STAN (1994), V. SIMIONESCU (1983), ANDREEV A. and IU. PESENCO (1982).

RESULTS AND DISCUSSIONS

From the mixed forest - field elm (*Ulmus carpinifolia*) with ash trees (*Fraxinus excelsior*), field maple (*Acer campestre*) and maple trees (*Acer platanoides*)- 77 species were collected.These species belong to 37 genera and 7 families.

The family Carabidae is the most representative with 39 species from16, genera followed by Staphylinidae family with 15 species from 10 genera; and the families Silphidae and Scarabaeidae with 9 species each, 4 and 2 genera respectively. The Lucanidae and Tenebrionidae families are represented by 2 species from 2 genera. The Trogidae family is represented by one species. (Fig.1).

Research investigations made in those 3 years demonstrate that the biggest number of coleopterans was collected in 2005 (1708 specimens), followed by the year 2006 (686 specimens) and the year 2004 (238 specimens).

The analyse after of the ecological indexes of the collected coleopteran species in the elm forest mixed with ash trees, field maples and maples, ascertains the following:

- the most abundant (A) are the species *Brachinus crepitans* (978 individuals) and *Silpha carinata* (760 individuals), these are also the eudominant species (D_5) – more than 10 %, 3 species are subdominant (D_3), 6 species are recedent (D_2), the rest of the species are subrecedent, each holding less than one percent from the species' total.

-the constance index (C) brought up into evidence 2 constant species (C_3) and one accessory species (C_2), the rest of the species are accidental;

- the most characteristic species for this forest type concerning the index of ecological significance (W), are *Brachinus crepitans* and *Silpha carinata* (W_5), 9 species are accessory (W_3 - W_2) and the rest of species are accidental (Tab. 1).

Table 1. The synecological analyse of coleopterans from field elm forest mixed with ash trees, field maple and maple trees in the years of 2004, 2005, 2006

Tabel 1. Analiza sinecologică a coleopterelor din pădurea de ulm de câmp în amestec cu frasin, jugastru şi arţar, în anii 2004, 2005, 2006

Nr.	Species list	A	D		C		W	
			%	Class	%	Class	%	Class
1	*Brachinus crepitans* (LINNAEUS, 1758)	978	37.16	D5	63.25	C3	23.50	W5
2	*Silpha carinata* HERBST, 1783	760	28.88	D5	70.48	C3	20.35	W5
3	*Ophonus rufibarbis* (FABRICIUS, 1792)	120	4.56	D3	27.71	C2	1.26	W3
4	*Nicrophorus fossor* ERICHSON, 1837	83	3.15	D3	12.05	C1	0.38	W2
5	*Nicrophorus vespillo* (LINNAEUS, 1758)	69	2.62	D3	7.83	C1	0.21	W2
6	*Onthophagus coenobita* (HERBST, 1783)	52	1.98	D2	12.05	C1	0.24	W2
7	*Harpalus tardus* (PANZER, 1797)	48	1.82	D2	18.67	C1	0.34	W2
8	*Onthophagus ovatus* (LINNAEUS, 1758)	48	1.82	D2	10.84	C1	0.20	W2
9	*Nicrophorus humator* OLIVIER, 1790	40	1.52	D2	12.05	C1	0.18	W2
10	*Nicrophorus vespilloides* HERBST, 1784	39	1.48	D2	10.84	C1	0.16	W2
11	*Anchomenus dorsale* (PONTOPPIDAN, 1763)	35	1.33	D2	13.86	C1	0.18	W2
12	*Ophonus schaubergerianus* PUEL, 1937	23	0.87	D1	8.43	C1	0.07	W1
13	*Aleochara curtula* (GOEZE, 1777)	23	0.87	D1	7.83	C1	0.07	W1
14	*Brachinus psophia* SERVILLE, 1821	20	0.76	D1	4.82	C1	0.04	W1
15	*Harpalus rufipes* (DE GEER, 1774)	19	0.72	D1	9.04	C1	0.07	W1
16	*Carabus convexus* FABRICIUS, 1775	19	0.72	D1	7.83	C1	0.06	W1
17	*Trox sabulosus* (LINNAEUS, 1758)	18	0.68	D1	7.83	C1	0.05	W1
18	*Harpalus flavicornis* DEJEAN, 1829	17	0.65	D1	6.02	C1	0.04	W1
19	*Ocypus nitens* (SCHRANK, 1781)	14	0.53	D1	6.63	C1	0.04	W1
20	*Amara aenea* (DE GEER, 1774)	14	0.53	D1	5.42	C1	0.03	W1

21	*Aphodius sticticus* PANZER, 1798	14	0.53	D1	4.82	C1	0.03	W1
22	*Philonthus succicola* THOMSON, 1860	10	0.38	D1	4.82	C1	0.02	W1
23	*Lucanus cervus* (LINNAEUS, 1758)	8	0.30	D1	4.22	C1	0.01	W1
24	*Stomis pumicatus* (DE GEER, 1774)	7	0.27	D1	4.22	C1	0.01	W1
25	*Carabus coriaceus* KRAATZ, 1877	7	0.27	D1	4.22	C1	0.01	W1
26	*Ontholestes haroldi* (EPPELSHEIM, 1884)	7	0.27	D1	3.61	C1	0.01	W1
27	*Philonthus tenuicornis* (MUL. & REY, 1853)	7	0.27	D1	3.01	C1	0.01	W1
28	*Pterostichus melas* (CREUTZER, 1799)	6	0.23	D1	3.01	C1	0.01	W1
29	*Aphodius melanostictus* SCHMIDT, 1840	6	0.23	D1	2.41	C1	0.01	W1
30	*Dorcus parallelopipedus* (LINNAEUS, 1758)	6	0.23	D1	2.41	C1	0.01	W1
31	*Brachinus explodens* DUFTSCHMID, 1812	6	0.23	D1	2.41	C1	0.01	W1
32	*Ontholestes tesselatus* (GEOFFROY, 1785)	6	0.23	D1	2.41	C1	0.01	W1
33	*Amara saphyrea* DEJEAN, 1828	5	0.19	D1	3.01	C1	0.01	W1
34	*Amara familiaris* (DUFTSCHMID, 1812)	5	0.19	D1	3.01	C1	0.01	W1
35	*Onthophagus taurus* SCHREBER, 1759	5	0.19	D1	2.41	C1	0.001	W1
36	*Pterostichus chamaelion* MOTS., 1865	5	0.19	D1	2.41	C1	0.001	W1
37	*Calathus distinguendus* CHAUDOIR, 1846	5	0.19	D1	0.60	C1	0.001	W1
38	*Amara plebeja* (GYLLENHAL, 1810)	4	0.15	D1	2.41	C1	0.001	W1
39	*Aphodius prodromus* (BRAHM, 1790)	4	0.15	D1	2.41	C1	0.001	W1
40	*Drusilla canaliculata* (FABRICIUS, 1787)	4	0.15	D1	2.41	C1	0.001	W1
41	*Aleochara lata* GRAVENHORST, 1802	4	0.15	D1	0.60	C1	0.001	W1
42	*Cylindronotus aeneus* (SCOPOLI, 1763)	3	0.11	D1	1.81	C1	0.001	W1
43	*Tasgius pedator* (GRAVENHORST, 1802)	3	0.11	D1	1.81	C1	0.001	W1
44	*Anotylus sculpturatus* GRAVENHORST, 1806	3	0.11	D1	1.20	C1	0.001	W1
45	*Amara communis* (PANZER, 1797)	3	0.11	D1	1.20	C1	0.001	W1
46	*Onthophagus vitulus* FABRICIUS, 1776	3	0.11	D1	1.20	C1	0.001	W1
47	*Panagaeus bipistulatus* (FABRICIUS, 1775)	3	0.11	D1	1.20	C1	0.001	W1
48	*Tanathophilus rugosus* (LINNAEUS, 1758)	3	0.11	D1	1.20	C1	0.001	W1
49	*Amara tricuspidata* DEJEAN, 1831	2	0.08	D1	1.20	C1	0.001	W1
50	*Amara similata* (GYLLENHAL, 1810)	2	0.08	D1	1.20	C1	0.001	W1
51	*Harpalus amplicollis* MENETRIES 1848	2	0.08	D1	0.60	C1	0.001	W1
52	*Onthophagus lemur* FABRICIUS, 1781	2	0.08	D1	1.20	C1	0.001	W1
53	*Platyderus rufus* (DUFTSCHMID, 1812)	2	0.08	D1	1.20	C1	0.001	W1
54	*Pterostichus leonisi* APFELBECK, 1904	2	0.08	D1	1.20	C1	0.001	W1
55	*Rugilus subtilis* ERICHSON, 1840	2	0.08	D1	1.20	C1	0.001	W1
56	*Silpha obscura* LINNAEUS, 1758	2	0.08	D1	1.20	C1	0.001	W1
57	*Tachyta nana* (GYLLENHAL, 1810)	2	0.08	D1	1.20	C1	0.001	W1
58	*Licinus silphoides* (ROSSI, 1790)	2	0.08	D1	0.60	C1	0.001	W1
59	*Leistus ferrugineus* (LINNAEUS, 1758)	2	0.08	D1	0.60	C1	0.001	W1
60	*Nicrophorus vestigator* HERSCH*., 1807*	2	0.08	D1	0.60	C1	0.001	W1
61	*Amara eurynota* (PANZER, 1797)	1	0.04	D1	0.60	C1	0.001	W1
62	*Badister bipustulatus* (FABRICIUS, 1787)	1	0.04	D1	0.60	C1	0.001	W1
63	*Calathus fuscipes* (GOEZE, 1777)	1	0.04	D1	0.60	C1	0.001	W1
64	*Calathus melanocephalus* (LINNAEUS, 1758)	1	0.04	D1	0.60	C1	0.001	W1
65	*Calosoma inquisitor* (LINNAEUS, 1758)	1	0.04	D1	0.60	C1	0.001	W1
66	*Calathus halensis* (SCHALLER, 1783)	1	0.04	D1	0.60	C1	0.001	W1
67	*Falagrioma thoracica* (STEPHENS, 1832)	1	0.04	D1	0.60	C1	0.001	W1
68	*Harpalus atratus* LATREILLE, 1804	1	0.04	D1	0.60	C1	0.001	W1
69	*Harpalus rubripes* (DUFTSCHMID, 1812)	1	0.04	D1	0.60	C1	0.001	W1
70	*Licinus depressus* (PAYKULL, 1790)	1	0.04	D1	0.60	C1	0.001	W1
71	*Mycetoporus nigricolis* STEPHENS, 1835	1	0.04	D1	0.60	C1	0.001	W1
72	*Onthophagus ruficapillus* BRULLE, 1832	1	0.04	D1	0.60	C1	0.001	W1
73	*Philonthus addendus* SHARP. 1867	1	0.04	D1	0.60	C1	0.001	W1
74	*Philonthus laminatus* (CREUTZER. 1799)	1	0.04	D1	0.60	C1	0.001	W1
75	*Phosphuga atrata* (LINNAEUS. 1758)	1	0.04	D1	0.60	C1	0.001	W1
76	*Pterostichus melanarius* (ILliger. 1798)	1	0.04	D1	0.60	C1	0.001	W1
77	*Scaphidema metalica* (FABRICIUS. 1792)	1	0.04	D1	0.60	C1	0.001	W1
		2632						

The specific diversity was calculated on the basis of the dominant coleopterans – the *Carabidae* family. The real index diversity –H(S). calculated for the elm forest mixed with ash trees and field maple. represents the value of 1.95; the maximum diversity –H(S)max. had the value of 5.15; relative diversity (evenness) - Hr had the value of 0.38%. This point of evernness estimation. through the report between real diversity –H(S) and maximum diversity –H(S) max. till present it is not used. on the reason that in nature the maximum diversity can not be never reached. Therefore. there was chosen other possibility to calculate the equitability. (ε). with the relation ε = S′/S. The evenness value calculated through the relation proposed by Lloyd and Ghelardi for the elm forest mixed with ash trees and field maple. is 0.12. up to the ideal community with the same numbers of the species. but with the individuals reasonableness distributed. were ε=1. The evenness value calculated by those two methods is different. Let's consider. that the second value (0.12). reflects the reality better. the analysed test is characterized by a low evenness in the distribution of individuals in the species.

From the total of 1.383 specimens of ground beetles - 70.71% belongs to one species only. The calculation demonstrates that the carabids diversity in the forest elm mixed with ash trees. represents only 0.12% in comparison with the ideal community from the same number of the species. only with the individuals equitable distributed. This inequitable signification. it is explained not by the instability of the biotope. because this biotope has been already existing for 47 years. but by the very intensive anthropic activity. There has been found near the villages Cociulia and Tigheci. the forest it is intensely explored for dry wood collections. medicinal plants. mushrooms. as well as for grazing by the domestic animals. as well as this biotope is affected by the irresponsible people who recreate themselves in the middle of the nature. and leave the big quantities of recycle. cut the trees. make fire and destroy. The climactic conditions also contribute to the evolution of coleopterans density.

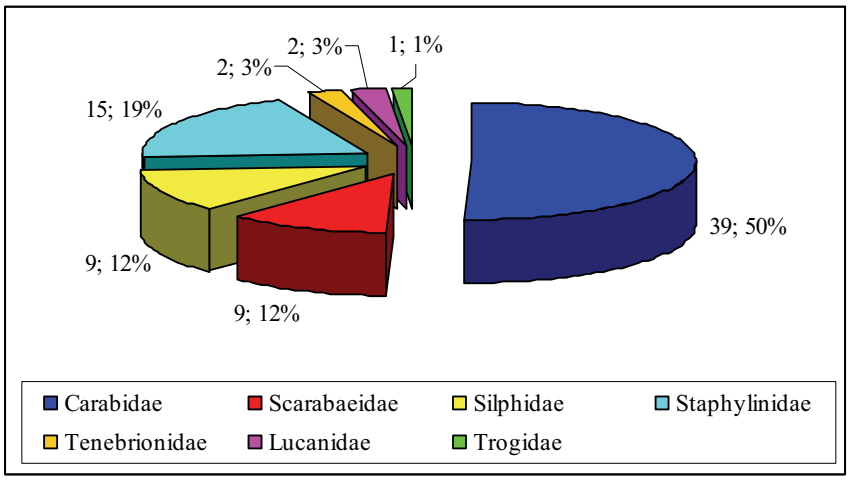

Figure 1. Ecological spectrum of the coleopterans families from the elm wood mixed with ash tree, field maple and maple tree collected in the years of 2004. 2005. 2006 using the pitfall traps

Figura 1. Spectru ecologic al familiilor de coleoptere din pădurea de ulm de câmp în amestec cu frasin, jugastru şi arţar, colectate în anii 2004, 2005, 2006 folosind-capcane de sol

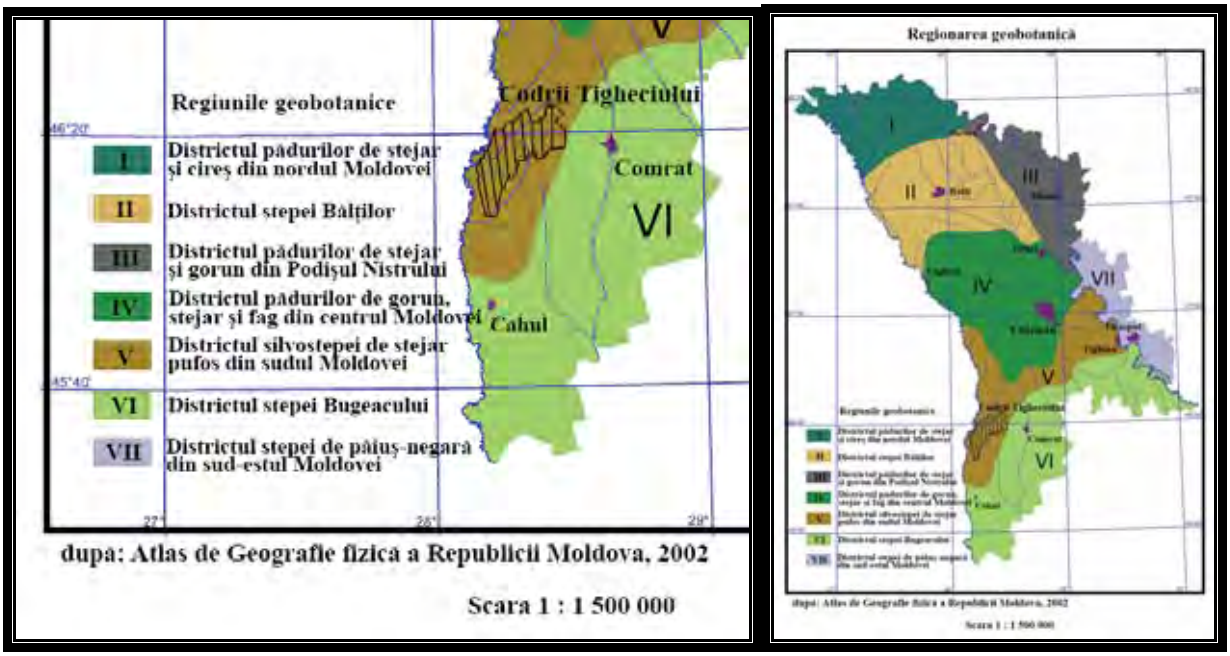

Figure 2. The geo botanic placement. district of the fluffy oak tree in the steppe in the South of Moldova. "Codrii Tigheciului" landscape reserve

Figura 2. Regionarea geobotanică. districtul silvostepei de stejar pufos din sudul Moldovei. rezervaţia peisagistică "Codrii Tigheciului"

CONCLUSIONS

The edaphic beetle fauna of the elm forest (*Ulmus carpinifolia*) mixed with ash tree (*Fraxinus excelsior*) field maple (*Acer campestre*) and maple (*Acer platanoides*) is represented by 77 species which belong to 37 genera and 7 families.

The family Carabidae was the most representative with 39 species from 16. genera followed by the family Staphylinidae with 15 species from 10 genera; families Silphidae and Scarabaeidae are represented by 9 species each and respectively 4 and 2 genera. Families Lucanidae and Tenebrionidae are represented by 2 species and 2 genera. The Trogidae *f*amily is represented by one specie.

The diversity real index –H(S). calculated for this forest. has the value of 1.95; maximum diversity –H(S)max. has the value of 5.15; relative diversity (evenness) - Hr 0.38%. The evenness value – ε. 0.12.

Of the total number of 1383 ground beetles specimens 70.71% belongs to the same species - *Brachinus crepitans*.

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