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CONTRIBUTIONS TO THE STUDY OF CARABIDS (CLEOPTERA, CARABIDAE) FROM THE GÂDINȚI FOREST, NEAMȚ COUNTY

BY

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Key words: Querco-petreae-Carpinetum, epigeic arthropods, structure, carabids, relative abundance, dominance, Shannon index, ecological preferences of carabids

The Gâdinți forest is located at 10 km away from the town of Roman. The material was collected from the Querco-petreae - Carpinetum vegetal association. To collect the epigeic invertebrates, 12 pitfalls were used in each of those three years 1991, 2000, 2001, from April to September . There were found five classes of invertebrates, eight orders of insects, 13 families of Coleoptera, 30 species of Carabidae. Particularly abundant are : Insecta, Coleoptera, Carabidae. Nine species of Carabidae are eudominant and dominant. The Shannon index ranged from 2. 60 to 3. 64, and echitability from 62 % to 82 % . The papers also contains tables concerrning the main ecological characteristics of carabids.

Introduction

Nature, ecosphere, biosphere are governed by natural, ecological and biological laws. The fundamental ecological law is the unity and interaction between organisms and environment.The main ecological unity is ecosystem. Ecosystem is the unity and interaction between biotope and biocoenosis

The Neamț County has an area of 5890 km^2, 2.5 % of the territory of Romania. The county is located in Moldova, in the eastern central part of Romania.

In correlation with the altitude within the county, the main forms of relief are:mountains (in the west part) , hills and Subcarpathian Depressions (center) and alluvional plain at the altitude of 169 m (east part of the county).

The general altitude of the relief ranges from 169 to 1907 m. The altitude of the hills is comprised between 300 and 445 m.

Climate is an important and necessary ecological factor with its two main components: temperature and precipitations.

In connection with the main forms of relief, there are two types of climate within the county: mountain climate in the west part of the county and continental climate of hills and plateau in the east part of the county.

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Temperature of the air

Depending on altitude and relief, the annual averages of temperature ranges from 2.0 to 6.5 Celsius degrees. In the town of Roman, annual average temperature is 8.3 Celsius degrees.

Precipitations

The amount of precipitations ranges with the forms of relief, that is , from 550 litres per square metres (in the east part) to 1000.0, in the mountain region. Some concrete values of temperature and precipitation in the east part are given in tables The data were taken from the Roman Meteorological Station.

Table 1. Average values of the air temperature at Roman

Years	May	June	July	August	September	October	Average
1991	12.0	18.0	20.2	18.2	14.7	9.3	15.4
2000	16.8	19.2	20.9	21.4	13.8	9.0	16.85
2001	15.4	17.7	22.7	21.4	15.2	10.9	17.22

Table 2. The amount of precipitations in the months of collecting the material, Roman

Years	May	June	July	August	September	October	Total amount
1991	182.8	87.7	171.6	161.6	90.3	43.4	737.4
2000	10.2	42.5	128.4	54.5	130.7	7.5	373.0
2001	48.2	101.9	135.6	37.8	125.0	49.5	498.0

Vegetation reflects the characteristics of the environmen. Depending on altitude, temperature, precipitations there are three main belts of vegetation within the county.The belt of deciduous forests, the belt of the fir tree forests and the subalpine belt.

The belt of deciduous forests covers the most part of the territory within the relief unity, The Moldavian Central Plateau.

Referring to the knowledge of the fauna in the perimeter of the Neamț county, Mândru and collaborators (1979) published the paper: Aspects of the fauna in the Ceahlău Massif. The authors cited species from the following taxa: Mollusca, Insecta (Odonata, Orthoptera,Lepidoptera, Coleoptera, Hymenoptera),Vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia).Varvara and Popescu (1999) published the paper: Contributions to the knowledge of populations of Carabidae from the Ceahlău Massif.

Contributions to the list of the species in the collections of the Roman Museum of Natural Sciences brought: Tărăbuță (1998) (Histeridae), Serafima Rodica, Apetrei Maria (1996) for the collection of the Museum of Natural Sciences from Piatra Neamț (Coccinellidae, Cerambycidae).

The purpose of this original paper is to bring contributions to the knowledge of the structure of epigeic fauna in a deciduous forest within the Neamț county, and

especially the fauna of Carabidae, based on a quantitative and standardized method of collecting.Within Moldova, Varvara (2002) made a sinthesis concerning the knowledge of carabids within deciduous forests (11 sites).In the Republic of Moldova, the species of carabids from all categories of ecosystems are well kown (Neculiseanu 2003, manuscript).

Material and Methods

The paper is based on the material collected for three years (1991, 2001, 2002) from the Gâdinți forest. The Gâdinți forest covers the Sâra Hill, located in the Moldavian Central Plateau, 10 kilometers away of the Roman town.The surface of the Gâdinți forest is about 10,000 hectares, being a component of the Roman forest County.The altitude of the Sâra Hill ranges from 180 to 430 m , most frequently aroud 250 and 300 m .

To collect the material a site was chosen in the Querco-petreae Carpinetum vegetal association, at the altitude of 200 metres, north-western exposure. Soil is brown-grey. The species of Querqus robur and Querqus petreae are predominant.These two species are found on sunny or partially sunny slopes. Other forest trees within the association are: Carpinus betulus,Tilia tomentosa, Acer pseudoplatanus.

To collect the material accurately an important element is the number of traps . Accordingly, 12 pitfalls were used. The height and the diameter of the pitfalls were: 11 and 7. 5 cm respectively. The pitfalls were set in three rows, each row having four pitfalls. The distance between the pitfalls and rows was 5 m. Each pitfall contained a 3 % formol solution to conserve the material captured.The setting of pitfalls was made on 20 th April (1991), and on 1rst April (2000,2001). The collecting were made bimonthly.

In 1991 the pitfalls functioned for 164 days and in 2000 and 2001 for 183 days. In 1991, 11 samples were extracted .In 2000 and 2001,12 samples were extracted.

In the working out and interpretation of the findings, we have used the following parameters: numbers (relative abundance), dominance, the index of similarity of communities (Sörensen), the Shannon index diversity (H), equitability.

For the calculation of the Shannon and Sörensen indeces we have used the programme, Multi-Variate Statistical Package.

Nomenclature of the carabidae species according to Freude, Harde and Lohse (1974).

Results and discussions

Taxonomic structure of the fauna of epigeic invertebrates

A general view on the numerical variation of taxa, the Shannon index and equitability at the level of the carabidae family is shown in table no. 3

Table 3. Numerical variation of taxa, individuals, the Shannon index, and equitability of epigeic invertebrates in the Querco-petreae -Carpinetum association, Gâdinți forest, Neamț County.

		1991	2000	2001	Total
1	**Classes of invertebrates**	**5**	**5**	**5**	**5**
2	Individuals	4770	1186	1123	4684
3	**% of total**	**63. 1**	**18. 4**	**18. 5**	**100.00**
4	**Orders of insects**	**4**	**8**	**6**	**8**
5	Individuals	2375	1186	1123	4684
6	**% of total**	**50. 7**	**25. 3**	**24. 0**	**100.00**
7	**Families of Coleoptera**	**11**	**9**	**7**	**13**
8	Individuals	1264	1125	1034	3423
	% of total	**36. 9**	**32. 9**	**30. 2**	**100.00**
9	**Species of Carabidae**	**22**	**18**	**18**	**30**
10	Individuals	547	932	854	2333
11	**% of total**	**23. 5**	**39. 9**	**36. 6**	**100.00**
12	Shannon index	3.64	2.60	3.32	
13	Equitability %	.82	62	80	

In the concrete ecological conditions of the Gâdinți deciduous forest (Querco-petreae-Carpinetum vegetal association (1991, 2000, 2001) within the epigeic fauna of invertebrates, there were identified: six classes of invertebrates, 8 orders of insects (with annual variation between 4 and 8), 13 families of Coleoptera (variation between 7- 11), 30 species of Carabidae (variation between 18- 22).

General percentages of capture of the material at the level of classes of invertebrates and orders of insects (2000, 2001) are similar or slightly different, but quite different compared to 1991 . For example, in 1991, the total material collected represented 63.1 % compared with 18.4 % (2001) and 18.5 % (2001).The cause of these differences is due, we think, to the total amount of precipitation fallen from May to October (table no 2). The total amount of precipitations fallen during these months was 737.4 litres per suare meter in comparison with 373.0 (2000) and 498.0 (2001) taking into consideration that humidity of soil is a main ecological factor for epigeic invertebrate fauna. The mesophilous invertebrates such as Gasteropoda, Isopoda, Arachnida and Miriapoda (table no 4) were significantly in bigger amount and percentages collected in 1991(table 4).

The variations of effectives of taxa (classes of invertebrates, orders of insects, families of Coleoptera) are shown in tables 4 - 6.

Table 4. Classes of invertebrates and their annual variation of individuals in the epigeic fauna of the Querco – petreae - Carpinetum association, Gâdinți forest, Neamț County

	Name of classes	1991		2000		2001		Total	
		No	%	No	%	No	%	No	%
1	Gasteropoda	50	1.0	16	1.1	18	1.3	84	1.1
2	Crustacea (Ord. Isopoda)	660	13.8	5	0.4	27	1.9	692	9.1
3	Arachnida	1200	25.2	102	7.3	119	8.5	1421	18.8
4	Miriapoda	485	10.2	85	6.1	109	7.8	679	9.0
5	Insecta	2905	49.8	1186	85.1	1123	80.5	4684	62.0
	Total classes	**5**		**5**		**5**		**5**	
	Total specimens	4770	100.00	1394	100.00	1396	100.00	7560	100.00

Table 5. Orders of insects and their numerical variation in the epigeic fauna of the Querco-petreae Carpinetum association, Gâdinți forest, Neamț County

	Name of orders	1991		2000		2001		Total	
		No	%	No	%	No	%	No	%
1	Orthoptera	-	-	5	0.4	4	0.4	9	0.2
2	Dermaptera	-	-	12	1.0	14	1.2	26	0.6
3	Heteroptera	22	0.9	2	0.2	7	0.6	31	0.7
4	Homoptera	-	-	2	0.2	-	-	2	0
5	Mecoptera	-	-	5	0.4	-		5	0.1
6	Hymenoptera	376	15.8	2	0.2	4	0.4	382	8.2
7	Coleoptera	1264	53.2	1125	94.8	1034	92.1	3423	73.0
8	Diptera	713	30.0	33	2.8	60	5.3	806	17.2
	No of orders	**4**		**8**		**6**		**8**	
	Total specimens	2375	99.90	1186	100.00	1123	100.00	4684	100.00

Table 6. Families of Coleoptera and their numerical variation of individuals in the epigeic fauna of the Querco-petreae Carpinetum association, Neamț County

	Name of families	1991		2000		2001		Total	
		No	%	No	%	No	%	No	%
1	Carabidae	547	43.3	932	82.8	854	82.6	2333	68.2
2	Histeridae	1	0.1	-	-	-	-	1	0
3	Catopidae	7	0.5	-	-	-	-	7	0.2
4	Silphidae	165	13.0	60	5.3	58	5.6	283	8.3
5	Staphylinidae	216	17.1	37	3.3	48	4.6	301	8.8
6	Lucanidae	2	0.2	-	-	-	-	2	0.1
7	Scarabaeidae	311	24.6	85	7.5	57	5.5	453	13.2
8	Cantharidae	0	0	1	0.1	-	-	1	0
9	Elateridae	0	0	2	0.2	4	0.4	6	0.2
10	Tenebrionidae	2	0.2	2	0.2	8	0.8	12	0.4
11	Cerambycidae	3	0.2	3	0.3	1	0.1	7	0.2
12	Chrysomelidae	5	0.4	-	-	-	-	5	0.1
13	Curculionidae	5	0.4	3	0.3	4	0.4	12	0.3
	No. of families	**11**		**9**		**8**		**13**	
	No of individuals	1264	100.00	1125	100.00	1034	100.00	3423	100.00

As to the order of Coleoptera, this was represented by 13 families, of which the individuals of seven families were collected in all those three years. (Carabidae, Silphidae, Staphylinidae, Scarabaeidae, Tenebrionidae, Cerambycidae,Curculionidae). The populations of the Silphidae, Staphylinidae and Scarabaeidae families were influenced by the variation of the soil humidity . This ecological conclusion results if it is compared the total number of individuals captured in those three years (table. 6). The families well represented in the vegetal association during those three years of collecting the material were: Carabidae (43.3 % - 83 %), Scarabaeidae (5.5 - 24. 6 %), Staphylinidae (3.3 –17 %). The other nine families had very few individuals.

From trophic point of view, the specimens of the epigeic families in those three years of collecting belong to the following groups: carnivores : Carabidae (87 % -94 %), Staphylinidae (most of the part) , Cantharidae; coprophags (Scarabaeidae), saprophags (Silphidae), phytophags (Elateridae, Lucanidae, Curculionidae, Tenebrionidae, Cerambycidae, Chrysomelidae.

Referring to the Silphidae family in table 7 is shown the number of species and the individuals, captured in 2000 and 2001. Seven species were identified.

Table 7. Species of Silphidae and their number of individuals in the Gâdinți forest, Neamț County

	Name of species	2000		2001		Total	
		No	%	No	%	No	%
1	Nicrophorus humator	14	20.6	-	-	14	11.1
2	Nicrophorus vespillo	10	14.7	13	22.4	23	18.3
3	Nicrophorus vespilloides	17	25.0	26	44.8	43	34.1
4	Nicrophorus fossor	10	14.7	-	-	10	7.9
5	Silpha carinata	11	16.2	16	27.6	27	21.4
6	Silpha obscura	6	8.8	-	-	6	4.8
7	Phosphuga atrata	-	-	3	5.2	3	2.4
	No.of species	**6**		**4**		**7**	
	No.of individuals	68	100.00	58	100.00	126	100.00

Nicrophorus vespillo, N.vespiloides and Silpha carinata were more commonly captured. And their populations are well represented in the vegetal association.

The coenosis of Carabidae in the Querco - petreae - Carpinetum association, Gâdinți forest, Neamț County

As a result of three years of collectings (May – September, 1991,2000,2001), 30 species of Carabidae were captured with annual variation between 18 and 23. (Table 8)

Table 8. Species of carabidae and their realative abundances in the Querco-petreae-Carpinetum association, Gâdinți forest, Roman

	Name of species	1991		2000		2001		Total	
		No	%	No	%	No	%	No	%
1	Carabus coriaceus	35	6.4	84	9.0	123	14.4	242	10.4
2	Carabus glabratus	6	1.1	39	4.2	18	2.1	63	2.7
3	Carabus cancellatus	70	12.8	25	2.7	124	14.5	219	9.4
4	Carabus ullrichi	22	4.0	2	0.2	12	1.4	36	1.5
5	Carabus arvensis	-	-	-	-	14	1.7	14	0.6
6	Carabus excellens	63	11.5	35	3.8	50	5.9	148	6.3
7	Carabus convexus	2	0.4	36	3.9	21	2.5	59	2.5
8	Cychrus semigranosus	-	-	3	0.3	14	1.6	17	0.7
9	Leistus piceus	-	-	4	0.4	-	-	4	0.2

	Name of species	1991		2000		2001		Total	
		No	%	No	%	No	%	No	%
10	Leistus rufomarginatus	1	0.2	-	-	3	0.3	4	0.2
11	Nebria brevicollis	-	-	4	0.4	-	-	4	0.2
12	Notiophilus palustris	7	1.3	-	-	-	-	7	0.3
13	Notiophilus biguttatus	1	0.2	-	-	-	-	1	0
14	Ophonus nitidulus	8	1.4	-	-	-	-	8	0.3
15	Harpalus rufipes	3	0.5	28	3.0	12	1.4	43	1.8
16	Harpalus latus	32	5.8	-	-	-	-	32	1.4
17	Pterostichus melanarius	-	-	6	0.6	3	0.3	9	0.4
18	Pterostichus melas	5	0.9	17	1.8	9	1.0	31	1.3
19	Pt.ovoideus	2	0.4	-	-	-	-	2	0.1
20	Pt.oblongopunctatus	19	3.5	-	-	-	-	19	0.8
21	Pterostichus niger	-	-	-	-	1	0.1	1	0
22	Stomis pumicatus	1	0.2	-	-	-	-	1	0
23	Platynus assimilis	1	0.2	-	-	-	-	1	0
24	Molops piceus	86	15.7	52	5.6	82	9.6	220	9.4
25	Abax parallelepipedus	37	6.8	59	6.3	64	7.5	160	6.9
26	Abax carinatus	1	0.2	16	1.7	30	3.5	47	2.0
27	Abax parallelus	34	6.2	13	1.4	50	5.9	97	4.2
28	Amara similata	78	14.3	-	-	-	-	78	3.3
29	Amara sp.	-	-	4	0.4	-	-	4	0.2
30	Aptinus bombarda	33	6.0	505	54.2	224	26.2	762	32.7
	No.of species	**23**		**18**		**18**		**30**	
	No.of individuals	547	100.00	932	99.90	854	99.90	2333	99.80

As it is known from nemerous observations made by us during the years in the deciduous forests of Moldavia, the Republic of Moldavia (Neculiseanu , 2003) and abroad in different countries of Europa, the carabidae family is a main and important component of the epigeic fauna of invertebrates.In our material from the Gâdinți forest, the general proportion of the Carabidae family was 68.2 % with annual variation between 43.3 and 82.8 %. It is observed that the percentages of Carabidae in 2000 and 2001 are practically equal and much different compared to the year 1991 (43.3 %) though in that year the amount of precipitation was higher.The higher amount of precipitation in 1991 favoured the number of the following taxa : Isopoda, Arachnida, Miriapoda, Silphidae, Staphylinidae, Scarabaeidae (Tables 4, 6).

According to their different ecological valences to environment, the number of individuals of different species of Carabidae is different. The eudominant and dominant species are well represented*: Carabus coriaceus, C.cancellatus, Molops piceus, Abax parallelepipedus, Aptinus bombarda*, which are forest, mesophilous and European species.

The forest associations of trees are correlated and determined by soil, altitude, temperature and precipitation. In the Querco-petreae –Carpinetum, the soil is brown- grey . In the Republic of Moldavia (Neculiseanu, 1997) found that 11 species of Carabidae are tipical for the forest brown soil. These species are: *Carabus coriaceus, C. convexus, C. cancelatus, C. ullrichi, Cychrus semigranosus , Calosoma inquisitor, Molops piceus, Abax parallelepipedus, A. carinatus, Cymindis macularis, Aptinus bombarda*. All these species were also found in the Querco – petreae – Carpinetum of Gâdinți (except, *Cymindis macularis*) and other deciduous forests of Moldova (Varvara, 2002). These species are also characteristic to the deciduous forests of the central and west European zones.

By their number of individuals, eudominant and dominant species play an important role in the epigeic fauna of carabids. The eudominant and dominant species are shown in table 9.

Table 9. Dominant and eudominant species of carabids in the Gâdinți forest

	Species	1991	2000	2001
1	Carabus coriaceus	D	D	ED
2	Carabus cancellatus	ED	-	ED
3	Carabus excellens	ED	-	D
4	Harpalus latus	D	-	-
5	Molops piceus	ED	D	D
6	Abax parallelepipedus	D	D	D
7	Abax parallelus	D	-	D
8	Amara similata	ED	-	-
9	Aptinus bombarda	D	ED	ED
	Total	**9**	**4**	**7**
	% total inividuals of general total	72.6	75.1	83.9

The percentage of the total number of individuals of dominant and eudominant species range from 72.6 % to 83.9 % .Three species presented ample variation of the number of individuals collected: *Carabus coriaceus ,Carabus cancellatus and Aptinus bombarda*.

The Shannon index

The value of this index varied between 2.62 (year 2000) and 3.64 (year 1991)

Table 10. Variation of relative abundances in the Querco- petreae -Carpinetum association in four forests

	Name of species	I	II	III	IV	V	VI
1	Calosoma inquisitor L.	45	2	-	-	-	-
2	Carabus coriaceus L.	240	39	67	35	84	123
3	Carabus glabratus	-	-	-	6	39	18
4	C.cancellatus Illig.	9	95	38	70	25	124
5	C.ullrichi Germ.	-	16	283	22	2	12
6	C.arvensis Herbst	-	31	-	-	-	14
7	C.excellens F.	15	99	172	63	35	50
8	C.convexus F.	41	-	-	2	36	21
9	C.scabriusculus Ol.	3	-	-	-	-	-
10	C.intricatus L.	-	4	1	-	-	-
11	C.violaceus L.	-	-	34	-	-	-
12	Cychrus semigranosus Pllrd.	-	1	-	-	3	14
13	Leistus piceus	-	-	-	-	4	-
14	Leistus rufomarginatus	-	-	-	1	-	3
15	Nebria brevicollis	-	-	-	-	4	-
16	Notiophilus palustris	-	-	-	7	-	-
17	Notiophilus biguttatus F.	-	2	-	1	-	-
18	Ophonus nitidulus	-	2	7	8	-	-
19	Ophonus sabulicola Pz.	4	-	-	-	-	-
20	Harpalus rufipes De Geer	125	-	14	3	28	12
21	H. griseus Pz.	2	-	-	-	-	-
22	H. dimidiatus Rossi	-	-	3	-	-	-
23	H.fuliginosus Duft.	-	-	4	-	-	-
24	H.atratus Latr.	1	2	-	-	-	-
25	H.rubripes Duft.	-	1	-	-	-	-
26	H.tardus Pz.	4	-	21	-	-	-
27	H.latus L.	-	1	22	32	-	-
28	Pterostichus melanarius Illig.	-	7	-	-	6	3
29	Pt. melas Creutz.	592	-	353	5	17	9
30	Pterostichus ovoideus	-	-	-	2	-	-
31	Pt.niger Schall.	-	2	-	-	-	1
32	Pt. oblongopunctatus F.	-	10	-	19	-	-
33	Pt. nigrita Pk.	1	1	-	-	-	-
34	Pt. anthracinus Illig.	1	-	-	-	-	-
35	Stomis pumicatus	-	-	-	1	-	-
36	Platynus assimilis Pk.	-	3	-	1	-	-
37	Molops piceus Pz.	-	25	8	86	52	82

	Name of species	I	II	III	IV	V	VI
38	Abax parallelepipedus Miller et Miterpacher	7	17	352	37	59	64
39	A.parallelus Duft.	266	45	-	34	13	50
40	A.carinatus Duft.	130	16	24	1	16	30
41	Anchomenus dorsalis	1	-	-	-	-	-
42	A.similata Gyll.	1	1	6	78	-	-
43	Amara ovata F.	13	-	1	-	-	-
44	Amara sp.	-	-	-	-	4	-
45	Brachinus explodens Duft.	-	-	7	-	-	-
46	Br. crepitans L.	-	-	8	-	-	-
47	Aptinus bombarda L.	-	140	-	33	505	224
	Total **genera**	**9**	**12**	**9**	**13**	**10**	**8**
	Total **species**	**20**	**24**	**20**	**23**	**18**	**18**
	Total individuals	1501	571	1425	547	932	855
	Shannon index	2.61	3.30	2.90	3.65	2.60	3.32
	Evenness %	60	72	67	80	*62*	79

I = Mârzeşti,1976; II = Bârnova, 1983 ;III = Sohodol, 1980; IV = Gâdinți, 1991 ; V = Gâdinți, 2000; VI = Gâdinți, 2001

In total, 47 species (Gama diversity) were found, with local variation between 18 and 25. (alfa diversity). Five species were found in all the years and localities. These species are: *Carabus coriaceus, C.cancellatus ,C.excellens, Abax parallelepipedus, Abax carinatus*. In addition, other three species were found in five localities: *Abax parallelus, Harpalus rufipes, Molops piceus*. The Shannon index and equitability are also variable, as a result of interaction of abiotic factors.

Table 11. Variation of the Sorenson,s coefficient in the Querco - petreae-Carpinetum association in four deciduous forests of Moldavia

	Sites,years	County	1	2	3	4	5	6
1	Mârzeşti,1976	Iaşi						
2	Bârnova, 1983	Iaşi	**35.56**					
3	Sohodol,1980	Bacău	40.0	48.9				
4	Gâdinți,1991	Neamț	41.86	**62.50**	51.16			
5	Gâdinți,2000	Neamț	47.37	46.51	47.37	63.41		
6	Gâdinți,2001	Neamț	47.37	51.16	47.37	63.41	**77.78**	

The Sörenson index was calculated on the basis of the species of Carabidae. The value of the Sörenson index may range from 0 to 100 within these two extreme values, there are three classes of resemblances. 1. **Small resemblance** (under 25 %),

2. **Average resemblance** (between 26- 75 %), 3. **High resemblance** (between 76 - 100 %).

As is observed from fig. No 1 within the Querco-petreae-Carpinetum association from four forests in Moldavia there is an average resemblance , ranging from 40 % to 77.7 % Altitude, exposure, precipitation may explain the differences in similitude. At Gâdinți, the similitude among years ranged from 63.44 to 77.7

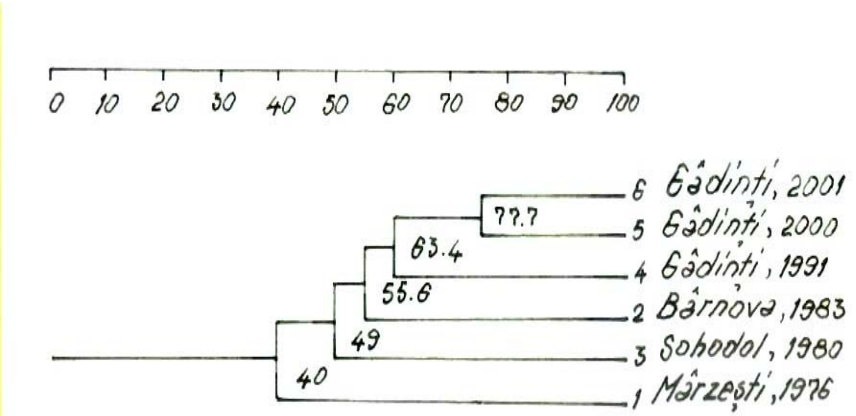

Fig. 1.Hierarhical dendrogram of similitude of the localities within the Querco-petreae-Carpinetm vegetal association

Ecological characteristics of the Carabidae species from the Gâdinți forest

To characterize the coenosis of carabids as regards the main ecological requirements we made table nr. 12 , on the basis of literature (cited in Varvara 2004, in press,Analele St ale Univ. Alex. I. Cuza, seria Biologie) and personal observations during the study of carabids in Moldova

Table 12. Main ecological characteristics of carabids in the Querco-petreae Carpinetum vegetal association in the Gâdinți forest, Roman

	Name of species	1	II	III	IV	V
1	Carabus coriaceus	A	M	F	Z	E
2	Carabus glabratus	A	Mh	F	Z	Es
3	Carabus cancellatus	Sp	M	F	Z	T
4	Carabus ullrichi	Sp	M	F	Z	CE
5	Carabua arvensis	Sp	M	F	Z	T

	Name of species	1	II	III	IV	V
6	Carabus excellens	Sp	Mx	F+St	Z	EstE
7	Carabus convexus	Sp	M	F	Z	Es
8	Cychrus semigranosus	A	Mh	F	Z	SestE
9	Leistus piceus	A	Mh	F	Z	E
10	L. rufomarginatus	A	Mh	F	Z	Ec
11	Nebria brevicollis	S	Mh	F	Z	Ec
12	Notiophilus palustris	Sp	M	F	Z	Wp
13	Notiophilus bigutattus	Sp	M	F	Z	Es
14	Ophonus nitidulus	A	M	F	P	Wp
15	Harpalus rufipes	A	Mx	Ols	P	Wp
16	Harpalus latus	A	M	F+St	P	T
17	Pt.melanarius	A	M	Eu	Z	Es
18	Pterostichus melas	Sp	Mx	F	Z	Ec
19	Pt.ovoideus	Sp	M,	F	Z	Ec
20	Pt.oblongopunctatus	Sp	Mh	F	Z	T
21	Pt.niger	Pl	Mh	Eu	Z	T
22	Stomis pumicatus	Sp	M	F	Z	E
23	Platynus assimilis	Sp	Mh	F	Z	T
24	Molops piceus	Sp	M	F	Z	E
25	A. parallelepipedus	Sp	M	F	Z	E
26	Abax carinatus	Sp	Mh	F	Z	E
27	Abax parallelus	A	M	F	Z	E
28	Amara similata	Sp	M	F+St	P	T
30	Aptinus bombarda	Sp	Mx	F	Z	CE

Legend: 1= Reproduction; II = Humidity; III = Habitat; IV = Food; V = Geogr.Distribution

Sp = Spring ; A = Autumn ; S = Summer; Pl = Plastic ; M = Mesophilous ; Mh = Mesohygrophilous ; Mx = Mesoxerophilous ; F = Forest ; Ols = Open landscape ;Eu = Euritopic ; Z = Zoophagous ; P = Pantophagous ; T = Transpalearctic ; Wp = West-Palearctic ; E = European ; Em = Euromediteranean ; Ec = Eurocaucasian ; Es = Eurosiberian; CE = Central European ; EstE = East-European ; SestE = South-east-European

On the basis of this general table,we summurised in separate tables the preferences of species for reproduction, moisture, habitat, food, geographical distribution and their variation within those three years (Tables 13 - 17)

Table 13. Types of reproduction of carabids in the Querco-petreae-Carpinetum vegetal association from the Gâdinți forest, Roman

	Reproduction type	1991		2000		2001	
		No	%	No	%	No	%
1	Spring	16	69.6	1	55.6	10	55.6
2	Autumnal	7	30.4	7	38.9	7	38.9
3	Summer	-	-	1	5.5	-	
4	Plastic	-	-	-	-	1	5.5
	Total	23	100.0	18	100.0	18	100.0

Table 14. Hygric preferences of carabids in the Querco-petreae-Carpinetum vegetal association from the Gâdinți forest, Roman

	Hygric preferences	1991		2000		2001	
		No	%	No	%	No	%
1	Mesophilous	14	60.9	9	50.0	9	50.0
2	Mesohygrophilous	5	21.7	5	27.8	5	27.8
3	Mesoxerophilous	4	17.4	4	22.2	4	22.2
	Total	23	100.0	18	100.0	18	100.0

Table 15. Habitat preferences of carabids in the Querco-petreae-Carpinetum vegetal association from the Gâdinți forest, Roman

	Habitat preference	1991		2000		2001	
		No	%	No	%	No	%
1	Forest	19	82.6	15	83.3	14	77.7
2	Forest + Steppe	3	13.0	1	5.6	1	5.6
3	Open landscape	1	4.4	1	5.6	1	5.6
4	Euritopic	-	-	1	5.6	2	11.1
	Total	23	100.0	18	100.0	18	100.0

Table 16. Trophic regime of carabids in the Querco-petreae-Carpinetum vegetal association from the Gâdinți forest, Roman

	Food regime	1991		2000		2001	
		No	%	No	%	No	%
1	Zoophags	20	87.0	16	88.9	17	94.4
2	Pantophags	3	13.0	2	11.1	1	5.6
	Total	23	100.0	18	100.0	18	100.0

Table 17. Geographical distribution of carabids in the Querco – petreae - Carpinetum vegetal association from the Gâdinți forest, Roman

	Zoogeogr.Regions	1991		2000		2001	
		No	%	No	%	No	%
1	Transpalearctic	5	21.7	1	5.8	3	
2	Westpalearctic	3	13.0	1	5.8	1	
3	European	6	26.1	6	35.3	5	
4	Central European	2	8.7	2	11.8	2	
5	East-European	1	4.4	1	5.8	1	
6	South-East-European	-	-	1	5.8	1	
7	Eurosiberian	3	13.0	3	17.7	3	
8	Eurocaucasian	3	13.0	2	11.8	2	
	Total	23	99.9	17		18	

Any species has necessary ecological requirements.Ecological requirements are the result of evolution ,adaptation and natural selection.

Under Gâdinți forest ecological conditions , the carabids has four reproduction types: In Spring, Summer ,Autumn and plastic.It predominates the spring reproduction species ranging from 55. 6 to 69. 6 %. As for the moisture requirements there are three groups: Mesophilous, mesohygrophilous and mesoxerophilous. As expected ecologically, the mesophilous group predominates, ranging from 50 to 60 .9 %.The preferences of species for habitat fall into four groups: forest, forest + steppe,open land scape, euritopic species.It predominates the forest species , ranging from 77.7 to 83.3 %. The food regime of the species is composed of zoophagous and pantophagous species.The zoophagous species range from 87.0 to 94.4 %.

From zoogeographical point of view, the species of carabids collected belong to eight groups. The European, central European, Euro-Siberian and Euro-Caucasian species are more constant.

Conclusions

The soil surface of the Gâdinți forest harbours quite numerous epigeic invertebrates. Under the conditions of the Querco – petreae - Carpinetum vegetal association, it consists of members of five classes, eight orders of insects, 13 families of Coleoptera, among which Carabidae predominante both as to the number of species and individuals.

Among Carabidae, *Carabus coriaceus, Molops piceus and Abax parallelepipedus* were dominant in all the years, but the dominance of other six species is variable. The Shannon index values ranged from 2.60 to 3.65, having normal limits of variation.

In the same manner as in other deciduous forests from Moldavia, the carabidae fauna from Gâdinți is predominanted by spring, mesophilous, forest, zoophagous, European species. The similitude degree among years ranged from 63.4 to 77.7.

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