

Taxonomic diversity and the main ecological aspects of Carabidae (Coleptera) family in Piatra Craiului National Park, Romania

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Abstract

The paper presents the taxonomic diversity, numeric abundance and relative abundance of the epigeic carabid fauna in Piatra Craiului National Park, "La Table" area. Also there are references to the main ecological requirements of the identified species. We recorded 16 species, belonging to 7 genera and 7 tribes. The eudominant species are typically stenobiotic forest species: *Pterostichus unctulatus* (Duftschmidt, 1812) and *Carabus linnaei* Panzer, 1812. We have reported the presence of the South Carpathians endemic species *Carabus planicollis* Kuster, 1827.

Rezumat

Lucrarea de față prezintă diversitatea taxonomică precum și abundența numerică și relativă a speciilor de carabide epigeice din zona „La Table”, Parcul Național Piatra Craiului. De asemenea, se fac referiri și la principalele cerințe ecologice ale speciilor identificate. În studiul efectuat s-au înregistrat 16 specii de carabide, aparținând la 7 genuri și 7 triburi. Cu efective populaționale importante s-au remarcat două specii stenobionte tipic de pădure (*Pterostichus unctulatus* și *Carabus linnaei*). Cu importanță sozologică mare s-a identificat o singură specie *Carabus planicollis*, endemit sud-carpatic.

Keywords: ground beetle, Carabidae, Piatra Craiului National Park, diversity, ecology, Romania, relative abundance, main ecological requirements.

Introduction

Only a few studies on Carabidae family have been done in Piatra Craiului National Park: NAE & al. 2004, PURICE 2003 etc.

"La Table" area is situated in the South-East of Piatra Craiului mountain, on an altitude of 1453 meters. The slope where collections were made has a South-East exposition and an inclination of 35 degrees. The coordinates of the area (from GPS) are 45°31'07" North latitude, 25°25'30" East longitude.

On this slope is a healthy spruce forest (*Picea abies*), which offers a wide range of microhabitats for epigeic carabid beetles. The only species of tree identified is *Picea abies*, and in the shrub layer we identified *Picea abies*, *Sorbus aucuparia*, *Rubus sp.* etc. In the herbaceous layer was recorded *Carex sp.*, *Campanula sp.*, *Oxalis acetosella*, *Luzula sp.*, *Dryopteris sp.* and in the moss layer was recorded *Polytrichum commune*. This study aims to identify the carabid species that populate this area and making some consideration based on population effective, relative abundance and main ecological requirements.

Materials and methods

Standard Barber traps were used for sampling. Barber first applied this method of collection in 1931 with great results (PAULSON 2005). A trap is made from a plastic glass with a diameter of 10 cm, which is buried in the soil till the top (CHIMIŞLIU 2002). The traps were protected from the rain by a small roof suspended a few cm above the soil. For conservation was used a solution of ethylene-glycol and the traps have worked without a proper bait to attract insects. The conservation liquid it's about 1/3 from the glass height and prevents exit and alteration of the insects. This is not an absolute quantitative method because does not allow reporting to the unit area and does not cover all species in the biotope in a natural rate.

There were installed 9 traps (Fig.1) in two series: 16 June -16 July and 16 August – 16 September. In total it was 18 traps and worked 61 days. Species identifications were made according to: REITTER 1908; FREUDE & al. 1976; GÎDEI & POPESCU 2009; PANIN 1951; PANIN 1955; NIŢU 2006 etc.

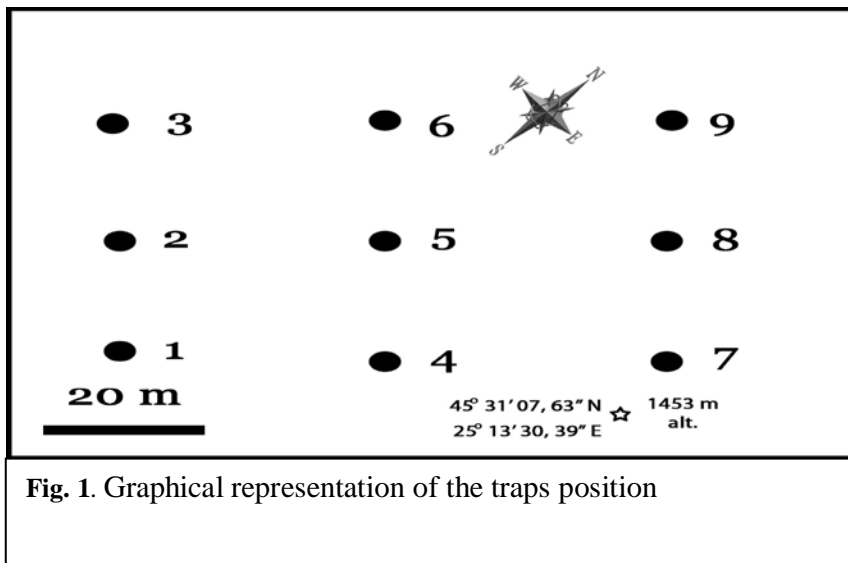


Fig. 1. Graphical representation of the traps position

For data analysis we considered the number of individuals, the number of species and their numerical and relative abundance.

Numerical abundance (NA)- is the ratio between the total number of individuals and total number of samples.

This relationship provides information on population size.

Relative abundance (RA)- this express the percentage of total number of individuals of a species reported to total number of individuals. Based on the results we can identified 5 classes of species: D1- Subrecedent species (below 1,1%), D2- Recedent species (1,1-2%), D3- Subdominant species (2,1-5%), D4- Dominant species (5,1-10%), D5- Eudominant species (over 10%).

Results and discussions

The species of Carabidae family collected in this research are represented in table 1. For the characterization of the carabid coenosis we used the following parameters: main ecological requirements (time of reproduction, preference for food, humidity, biotope and geographical area), number of individuals, numeric abundance and relative abundance. The table 1 data are according to literature: VARVARA 2004; VARVARA & ZUGRAVU 2004; VARVARA & ZUGRAVU 2006; VARVARA 2005; NIȚU 2003; NIȚU & al. 2008; GIDEI & POPESCU 2009; BABAN 2006; MATALIN 2008; NIEMELÄ & al. 1989; BOROS & al. 2005; etc. “La Table” area from Piatra Craiului National Park shows a typical fauna on Carabidae for a spruce forest litter. Scientific names are in accordance with [http:// www.faunaeur.org /index.php](http://www.faunaeur.org/index.php)

Table 1. Main ecological requirements, number of individuals, numeric abundance and relative abundance of the carabid species.

No	Species	BP	Ind. Nr.	NA	RA %	BS	ZD	FR	HP
1	<i>Bembidion lampros</i> (Herbst, 1784)	Eu	1	0,06	0.21	Sp	Pl	Z	M
2	<i>Calathus melanocephalus</i> (Linne, 1758)	Eu	31	1.72	6.64	Sp	Pl	P	M
3	<i>Calathus micropterus</i> (Duftschmidt, 1812)	F	1	0.06	0.21	A	ES	Z	M
4	<i>Carabus auronitens</i> Fabricius, 1792	F	1	0.06	0.21	Sp	E	Z	M
5	<i>Carabus coriaceus</i> Linne, 1758	F	9	0.50	1.93	A	E	Z	M
6	<i>Carabus linnaei</i> Panzer, 1812	F	77	4.28	16.49	S	E	Z	M
7	<i>Carabus planicollis</i> Kuster, 1827	F	1	0.06	0.21	S	SC	Z	M
8	<i>Carabus violaceus</i> Linne, 1758	Eu	13	0.72	2.78	S	E	Z	Mx
9	<i>Cychrus caraboides</i> (Linne, 1758)	F	11	0.61	2.36	Sp	E	Z	M
10	<i>Notiophilus biguttatus</i> (Fabricius, 1779)	Eu	19	1.06	4.07	Sp	ES	Z	M

11	<i>Pterostichus aethiops</i> (Panzer, 1796)	F	2	0.11	0.43	Sp	E	Z	M
12	<i>Pterostichus jurinei</i> (Panzer, 1803)	F	24	1.33	5.14	Sp	E	Z	M
13	<i>Pterostichus niger</i> (Schaller, 1783)	Eu	24	1.33	5.14	Pl	Pl	Z	M
14	<i>Pterostichus nigrita</i> (Paykull, 1790)	Eu	23	1.28	4.93	S	Pl	Z	H
15	<i>Pterostichus unctulatus</i> (Duftschmidt, 1812)	F	218	12.11	46.68	Sp	E	Z	M
16	<i>Trechus quadristriatus</i> (Schrank, 1781)	O	12	0.67	2.57	A	ES	Z	M
Total			467						

BP- Biotope preference; **BS-** Breeding season; **FR-** Food regime; **HP-** Humidity preference; **NA-** Numerical abundance; **Ind. Nr.-** Individuals number; **RA-** Relative abundance; **ZD-** Zoogeographical distribution;

Eu- Eurytopic; **F-** Forest; **O-** Open landscape; **Sp-** Spring; **S-** Summer; **A-** Autumnal; **E-** European; **Es-** Eurosiberian; **Pl-** Palearctic; **SC-** South-Carpathian; **P-** Pantophagous; **Z-** Zoophagous; **H-** Hygrophilous; **M-** Mesophilous; **Mx-** Mesoxerophilous.

BP- Preferință biotop; **BS-** Sezon împerechere; **FR-** Regimul de hrană; **HP-** Preferință umiditate; **NA-** Abundența numerică; **Ind. Nr.-** Număr indivizi; **RA-** Abundența relativă; **ZD-** Distribuția zoogeografică;

Eu- Euritop; **F-** Silvic; **O-** Zone deschise; **Sp-** Primăvară; **S-** Vară; **A-** Toamnă; **E-** European; **Es-** Eurosiberian; **Pl-** Palearctic; **SC-** Sud-Carpatic; **P-** Mixofag; **Z-** Zofag; **H-** Higrofil; **M-** Mesofil; **Mx-** Mesoxerofil.

Most species belong to *Pterostichus* and *Carabus* genera (10 species from 16). The most important numeric effective belong to *Pterostichus unctulatus* (Duftschmidt, 1812) (218), *Carabus linnaei* Panzer, 1812 (77), *Calathus melanocephalus* Linne, 1758 (31), *Pterostichus jurinei* (Panzer, 1803) (24), *Pterostichus niger* (Schaller, 1783) (24) etc.

In terms of relative abundance we have 2 eudominant species (13%) *Pterostichus unctulatus* (46,68) and *Carabus linnaei* (16,49), 3 dominant species (19%) *Calathus melanocephalus* (6,64), *Pterostichus jurinei* (5,14), *Pterostichus niger* (5,14), 5 subdominant species (31%) *Pterostichus nigrita* (Paykull, 1790) (4,93), *Notiophilus biguttatus* (Fabricius, 1779) (4,07), *Cychrus caraboides* (Linne, 1758), *Carabus violaceus* Linne, 1758 (2,78), *Trechus quadristriatus* (Schrank, 1781) (2,57), 1 recedent species (6%) *Carabus coriaceus* Linne, 1758 (1,93) and 5 subrecedent species (31%) (**Fig. 2**). The main populations are represented by 2 stenotopic forest species *Carabus*

linnaei and *Pterostichus unctulatus* (BOHAC & MATEJKA 2011).

From the total of species, 9 (56%) are typically for the forest, indicating a healthy ecosystem (*Calathus micropterus* (Duftschmidt, 1812), *Carabus auronitens* Fabricius, 1792, *Carabus coriaceus*, *Carabus linnaei*, *Carabus planicollis*, *Cychrus caraboides*, *Pterostichus aethiops* (Panzer, 1796), *Pterostichus unctulatus*, *Pterostichus jurinei*), 6 (38%) are eurytopic species and only 1 (6%) species typically for open landscape probably entering in the forest from the nearby clear cut areas (**Fig. 3**).

From total species, 8 (50%) are breeding in spring time, 4 (25%) in summer, 3 (19%) in autumn and only 1 (6%) has a plastic breeding time (**Fig. 4**). It is normal for forest

ecosystems that majority species have the reproduction season in spring when the conditions are favorable (VARVARA 2009).

The moisture and temperature have a big impact on the activity and distribution of the ground beetles (VARVARA 2004). Concerning the humidity, we have 14 (88%) species with mesophilous preferences, 1 (6%) species with mesoxerophilous preferences and 1 (6%) with hygrophilous preferences (Fig. 5). We found a normal mesophilous species dominance in this type of ecosystem.

Considering that ground beetles are in majority predators we expected to find predominantly zoophagous. The results are 15 (94%) species carnivores and only 1 (4%) species pantophagous (Fig. 6).

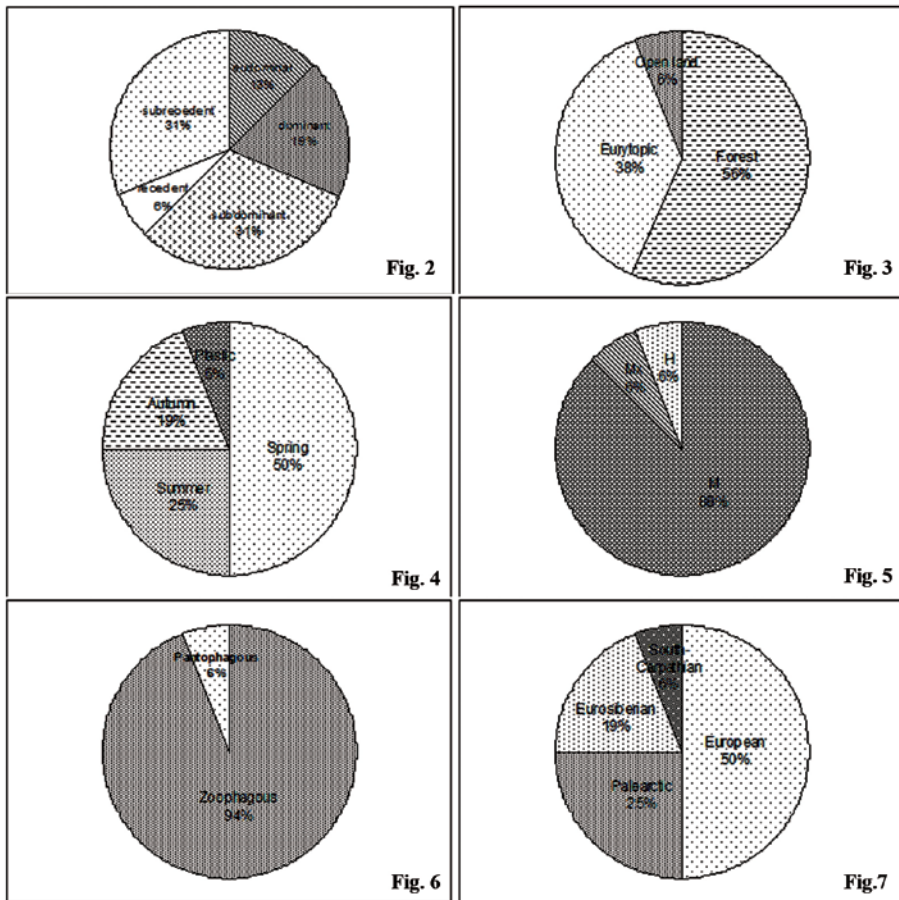


Fig. 2. Graphical percentage representation of the dominance classes of carabid species.

Fig. 3. Graphical percentage representation of the biotope preferences of the carabidspecies.

Fig. 4. Graphical percentage representation of the breeding season of the carabidspecies.

Fig. 5. Graphical percentage representation of the humidity preferences of thecarabid species. H- hygrophilous, M- mesophilous, Mx- mesoxerophilous

Fig. 6. Graphical percentage representation of the food regime of the carabidspecies.

Fig. 7. Graphical percentage representation of geographical distribution of carabidspecies.

As concerns of the geographic distribution of the species of carabids collected from the spruce forest we have: 8 (50%) European species, 4 (25%) Palearctic species, 3 (19%) Eurosiberian species and 1 (6%) South Carpathian endemic species (**Fig. 7**).

We identified only 1 species with special status *Carabus planicollis*- according to WWF (2001) is a South-Carpathian endemic species, critically endangered in the Carpathian chain (WWF & PAN 2003). This species is found in coniferous and deciduous forests (Affinity to CORINE Land Cover units and altitude= 3-High) and rarely in meadows (Affinity to CORINE Land Cover units and altitude= 1-Low). From this species we captured only 1 individual which means that is not a viable population in this area.

Conclusions

“La Table” area from Piatra Craiului National Park has a typically carabid fauna for a spruce forest (*Picea abies*).

The dominant genera are *Pterostichus* and *Carabus* with 5 species each.

The eudominant species are typically stenobiotical forest species (*Pterostichus unctulatus*, *Carabus linnaei*).

In terms of moisture preferences we have 88% mesophilous species.

From zoogeographical point of view there are 50% European species, 25% Palearctic species, 19% Eurosiberian species and 1% South-Carpathian endemic species.

The food regime of the species is 94% zoophagous.

Breeding time is in Spring for more than 50% of species, in Summer for more than 25% of species and in Autumn for more than 19% of species.

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