COLEOPTERANS FAUNA (INSECTA: COLEOPTERA) OF THE CĂLIMANI NATIONAL PARK, ROMANIA

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Abstract. In period May - October 2013, a faunistic, biogeographic and eco-geographic study was made on coleopterans fauna from the Călimani National Park, from eight types of habitats: riparian areas, forest edge, mixed habitat between forest edge and riparian areas, forest, wet meadows, swamp, alpine shrubs and mountain-subalpine meadows, located on altitudes between 796 m and 1800 m. In total, 132 coleopterans species were identified, grouped in 20 families. Dominant as number of individuals and species were the families: Carabidae, Cerambycidae, Curculionidae and Chrysomelidae. Taking account of the zoogeographical characterization, the coleopteran fauna from the Călimani National Park consists of 13 chorotypes. 81% of all species are represented in the following order: European-Siberian species (28.79%), European-Asian ones (16.67%), Palearctic (14.39%), European (12.12%) and West Palearctic (9.09%). The eco-geographical structure of the coleopterans fauna from the Călimani National Park is dominated by the arboreal species (approximately 80%) preferring moist forests and meadows. The eremian and oreal species have equal shares, 9.85% each. Jaccard index values have shown the existence of small similarities between the populations of coleopterans of the eight habitat types investigated. From the conservative point of view, two species, *Rosalia alpina* (Linnaeus, 1758) and *Carabus variolosus* Fabricius, 1787, are protected at national and international level and the other two species, *Peltis grossa* (Linnaeus, 1758) and *Meloe rugosus* Marsham, 1802, are considered rare for the Romanian fauna.

Keywords: coleopterans, Călimani National Park, Romania.

Rezumat. Fauna de coleoptere (Insecta: Coleoptera) din Parcul Naţional Călimani, România. În perioada mai - octombrie 2013, a fost realizat un studiu faunistic, zoogeografic şi ecogeografic asupra faunei de coleoptere din Parcul Naţional Călimani, în opt tipuri de habitate: zonă ripariană, lizieră de pădure, habitat mixt între lizieră de pădure şi zonă ripariană, pădure, pajişte umedă, mlaştină, tufăriş alpin şi pajişte montan-subalpină, situate la altitudini cuprinse între 796 m şi 1800 m. În total au fost identificate 132 de specii de coleoptere, grupate în 20 de familii. Dominante, ca număr de indivizi şi specii, au fost familiile: Carabidae, Cerambycidae, Curculionidae şi Chrysomelidae. Din punct de vedere zoogeografic, fauna de coleoptere din Parcul Naţional Călimani a fost încadrată în 13 corotipuri. 81% dintre coleopterele identificate au fost grupate astfel: specii european-siberiene (28,79%), european-asiatice (16,67%), palearctice (14,39%), europene (12,12%) şi vest palearctice (9,09%). Structura eco-geografică a faunei de coleoptere din Parcul Naţional Călimani a fost dominată de speciile arboreale (aproximativ 80%), care preferă pădurile şi pajiştile umede. Speciile eremiale şi oreale au fost egal reprezentate, 9,85% fiecare. Valorile indicelui Jaccard au arătat existenţa unor similarităţi mici între populaţiile de coleoptere din cele 8 tipuri de habitate investigate. Din punct de vedere conservativ două specii: *Rosalia alpina* (Linnaeus, 1758) şi *Carabus variolosus* Fabricius, 1787, sunt protejate la nivel naţional şi international, iar alte două specii: *Peltis grossa* (Linnaeus, 1758) şi *Meloe rugosus* Marsham, 1802, sunt considerate rare pentru fauna României.

Cuvinte cheie: coleoptere, Parcul Naţional Călimani, România.

INTRODUCTION

The article may be included in the category of the papers generically called lists of species, research that aims to supplement the existing data on the diversity of fauna from a particular region. Our methods of collecting were focused primarily on obtaining qualitative data, in order to complete the data regarding the coleopterans fauna of the Călimani National Park.

The Călimani National Park was established in 2000, having the aim to protect the biodiversity of the flora and fauna as well as the geological and landscapes diversity. In accordance with the Urgent Decree no. 57/2007 concerning the regime of natural protected areas, conservation of natural habitats, flora and fauna, the Călimani National Park corresponds to the category II of the International Union for Conservation of Nature.

The Călimani National Park is located in the Călimani Mountains and includes the largest volcanic crater in Romania (now inactive). The main element of the Călimani Mountains is represented by the caldera located in the north of the mountain, with a diameter of about 10 km, formed through a collapse process, followed by erosion that have shaped the current form of the massif. The horseshoe shape of the massif is made up of ridges, with altitudes of about 2,000 m, which is the edge of the old caldera (Fig. 1). The Călimani National Park covers part of the massive Călimani from the Eastern Carpathians, between 47°1'49.17" - 47°14'51.70" N and 25°0'19.92" - 25°19'47.11" E, with an area of 24,555.6 ha.

From the administrative point of view, this protected area is located on the territory of four counties: Suceava, Mureş, Harghita and Bistriţa Năsăud, comprising the top area of Călimani massif, delimited to the east by Păltiniş, Drăgoiasa, Bilbor and Secu depressions, to the north by Dorna depression and the Bârgăului Mountains, to the south by the Mureş Gorges and to the west by the piedmont hills of Călimani, which make the transition to the eastern part of Transylvania Plateau (according to the Management Plan of the Călimani National Park, 2008).

The study has been made in a cold and moderately dry, "Călimani-Rarău" type climate, with annual average temperatures of 2.4-4.0 ^{0}C and precipitation of 579-1,653 mm, with a multi annual average of 1,022 mm (BÂNDIU & DONIŢĂ, 1988; CENUŞĂ, 1992).

In the park area, the dominant habitats are spruce forests, rarely with admixed fir (43%) or the mixed spruce, fir, beech forest (14%), locally with admixing of *Acer pseudoplatanus* L., *Acer platanoides* L., *Tilia cordata* Mill. and *Fraxinus excelsior* L. Very important in terms of conservation are the habitats edified by: *Pinus mugo* Turra (7%) and *Rhododendron kotschyi* Simonkai syn. *Rh. myrtifolium* (5%). Other habitats characteristic to the Călimani National Park can be added: subalpine and alpine meadows, shrubs with *Alnus viridis* (Chaix.) D. C., *Juniperus sibirica* Burgsdorff shrubs, spruce forests with *Pinus cembra* L., riparian areas, mobile scree and cliff area. These cover a surface between 5% and less than 1%.

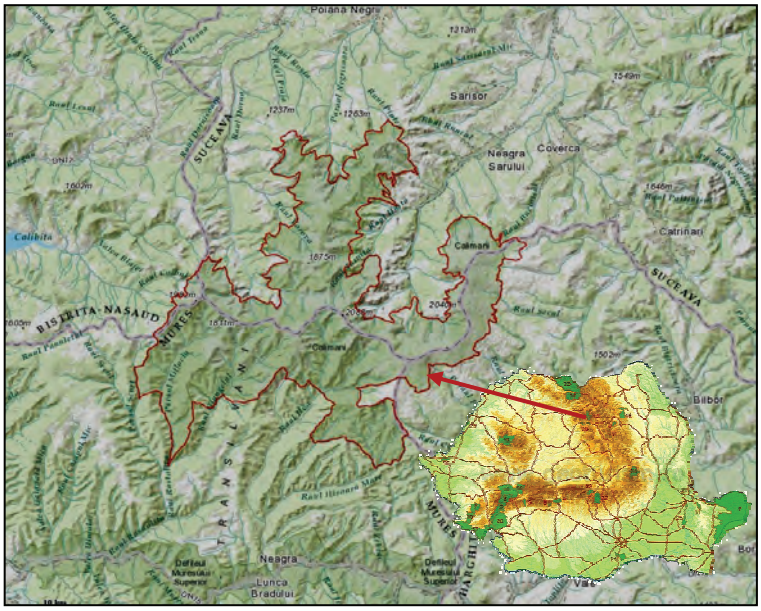

Figure 1. Location of the Călimani National Park (adapted after http://bio.geoportal-mediu.ro and http://www.skyscrapercity.com).

The first data from the literature included the entire range of the Carpathian Mountains or areas with two or more mountains, with references to the Călimani Mountains. General lists of beetles reported species from Transylvania fauna, as well as data from the Călimani Mountains or from the adjacent areas (FRIVALDSZKY, 1880; SIEDLITZ, 1891; KUTHY, 1896; FLECK, 1904, 1905; HOLDHAUS & DEUBEL, 1910; PETRI, 1912). In the same context, there can be mentioned the faunal lists with coleopterans from Moldova (ŞTEFĂNESCU, 1885; HORMUZACHI, 1888, 1901, 1904; MONTANDON, 1908). In these lists, there are mentioned coleopterans collected from the neighbour areas of the Călimani Mountains. These data allowed some extrapolations related to the coleopterans fauna from Călimani massive.

After 1912, coleopterans, in the Călimani Mountains and surrounding areas, were studied sporadically by: PANIN, 1955; VARVARA, 2005; NIŢU, 2006, the Carabids were specially studied; by PANIN, 1957, Scarabaeids; by PANIN & SĂVULESCU, 1961; SERAFIM, 2006, 2010; SERAFIM & MAICAN, 2011, Cerambycids; by RUICĂNESCU, 2002, Buprestids; by RANG et al., 2005, Elaterids; by BÁLINT, 2011, Chrysomelids; by ZERCHE, 2007; PUTHZ, 2008; STAN, 2012, Staphylinids; by STAN, 2013, for the stag beetles (Lucanidae). In the Management Plan of the Călimani National Park, there are mentioned only 36 species of beetles from 7 families, the majority belonging to the family Carabidae (Annex no. 8).

MATERIALS AND METHODS

The coleopterans species were collected from May to October 2013 in 65 transects (length 200-500 m, width 50 m), using pitfall traps, mowing by entomological net or manually, directly on the substrate: on the soil, on and under rocks and logs, on the herbaceous vegetation, the shrubs, on the bark of trees. For saproxylic species, in areas with dead wood (fallen or standing trees, wood stacks), there were investigated the adequate micro-refuges, through removing the bark on the trunks of dry trees and on logs.

We used both wet (with 4% formalin) and dray pitfall traps, in ratio to 2/3. The wet traps were emptied monthly, while the dry traps daily. Five traps were installed in every 10 wooded or selvage locations, in a line, at 1-meter distances to each other (Table 1).

Table 1. The types of the investigated habitats in the Călimani National Park.

No.	Habitat	No. of the transect	Sum of the transects from each habitat	Altitude (m)	No. of the group of the pitfall traps	Altitude (m)
1	R	T6*, T11, T13, T14, T15, T16, T35	7	796-1400 m	B5, B7, B9	1004, 993, 796
2	F-ed	T19, T43, T45, T46, T47	5	902-1615 m		
3	F-ed + R	T7, T21, T23, T28, T36, T39, T40, T44, T49, T50, T52, T53, T55, T60, T61, T63, T65	17	913-1,490 m	B1	1400
4	F	T5, T9, T10, T17, T18, T20, T22, T24, T25, T26, T27*, T29*, T31*, T32, T34*, T37*, T38, T41, T51, T54, T56*, T57, T58, T59*, T62*, T64*	26	930-1,650 m	B2, B4*, B6*, B10	1197, 1014, 1129, 1066
5	WM	T4	1	1,100-1,200 m		
6	AS	T3	1	1,600-1,750 m		
7	MSM	T2, T8, T12, T33, T42, T48	6	1,101-1,800		
8	Sw	T1, T30	2	968-1,197	B3, B8	1197, 968

Legend: R – Riparian, **F-ed** – Forest edge, **F-ed + R** – Forest edge + Riparian, **F** – Forest, **WM** – Wet Meadows, **AS** – Alpine shrubs, **MSM** – Mountain-Subalpine Meadows, **Sw** – Swamp; * – mixed forest, spruce and beech; **T** – transect; **B** – Barber (pitfall traps).

Eight habitat types were investigated: riparian (R), forest edge (F-ed), forest edge + riparian (F-ed + R), forest (F), wet meadows (WM), swamp (Sw), alpine shrubs (AS), mainly composed from *Pinus mugo* and *Rhododendron kotschyi* and mountain-subalpine meadows (MSM). The transects were established at various altitudes (between 796 meters and 1.800 meters), as well as the traps, noted from B1 to B10 (located between 796 meters and 1.400 meters) (Table 1).

The coleopterans classification was adopted after BOUCHARD et al., 2011. The zoogeographical characterization of species was based on their natural distribution only, using the data from Fauna Europaea, Coleoptera Poloniae and from the literature. The classification of chorotypes was made taking account of the researches made by VIGNA-TAGLIANTI et al., 1999 and GORODKOV, 1984. We have not considered their introduction into other areas.

RESULTS AND DISCUSSIONS

We collected 852 individuals belonging to 132 species and 20 families (Table 2).

The major part of the individuals is represented by Carabidae family (24.53%), followed by: Cerambycidae (19.48%), Curculionidae (16.43%), Chrysomelidae (9.27%), Geotrupidae (8.10%) and Staphylinidae (5.63%). The other families did not exceed 4% (Fig. 2).

In terms of species, the following families were the richest: Carabidae (23.48%), Cerambycidae (17.42%) and Curculionidae (12.88%) followed by: Chrysomelidae (9.85%), Scarabaeidae (8.33%) and Staphylinidae (5.30%). The rank of the first four families but the qualitative representation of Scarabaeidae was higher. Other families were represented by less than 5% of the species (Fig. 2).

Table 2. List of species recorded in the Călimani National Park.

No.	Taxa	Transect/traps	Sum (No. sp.)	Zoogeographic	Eco-geographic
	Order COLEOPTERA				
	Family CARABIDAE Latreille, 1802				
	Subfamily Nebriinae Laporte, 1834				
1	***Notiophilus biguttatus*** (Fabricius, 1779)	T26	**1**	WPal.**	Ar.
	Subfamily Cicindelinae Latreille, 1802				
2	***Cicindela sylvicola*** Dejean, 1822	T35	**1**	Eu.	Ar.
	Subfamily Carabinae Latreille, 1802				
3	***Carabus arcensis*** Herbst, 1784*	T3, T8, B4	**3**	Eu.-Sib.	Ar.
4	***Carabus auronitens escheri*** Palliardi, 1825*	T7, T26, T27, T32, T40, T54, B2, B5, B7	**17**	Carpath.	Ar.
5	***Carabus cancellatus*** Illiger, 1798*	T7, T32, T41, T61, B2, B3, B5, B7, B10	**11**	Eu.-Sib.	Ar
6	***Carabus coriaceus*** Linnaeus, 1758	B1, B2, B4, B5	**9**	Eu.	Ar.
7	***Carabus glabratus*** Paykull, 1790	T2, T8, B2, B3, B4	**10**	Eu.-Sib.	Or.
8	***Carabus granulatus*** Linnaeus, 1758	B5, B6	**3**	Eu.-As.**	Ar
9	***Carabus linnei*** Panzer, 1813*	T3, T31, B3, B4, B5, B7	**34**	Cent.-East Eu.	Ar
10	***Carabus obsoletus*** Sturm, 1815*	B4	**1**	Carpath.	Or.
11	***Carabus variolosus*** Fabricius, 1787	T30, B5	**4**	Cent.-Southeast Eu.	Ar.
12	***Carabus violaceus*** Linnaeus, 1758*	T3, T43, T52, B2, B4, B5, B7	**8**	Eu.-Sib.	Ar.
13	***Cychrus caraboides*** (Linnaeus, 1758)	T28, T51, B1, B2, B4, B5	**9**	Eu.	Ar.
14	***Cychrus semigranosus*** Palliardi, 1825	T57	**1**	Southeast. Eu.	Ar.
	Subfamily Trechinae Bonelli, 1810				
15	***Bembidion deletum*** Audinet-Serville, 1821	T20, T30, T38, T39, T50, B2, B3, B8	**12**	WPal.	Ar.
16	***Bembidion lampros*** (Herbst, 1784)	T14, B5, B9	**3**	Pal.**	Ar.
17	***Bembidion striatum*** (Fabricius, 1792)	T16, T49, T50	**3**	WPal.	Er.
18	***Bembidion tibiale*** (Duftschmid, 1812)	T39, T40	**2**	Eu.-Ca.	Ar.
19	***Bembidion varicolor*** Fabricius,1803	T63, T65	**2**	Eu.-Ca.	Ar.
20	***Trechus pulchellus*** Putzeys, 1846	B4, B10	**5**	Cent.-East Eu.	Ar.
	Subfamily Harpalinae Bonelli, 1810				
21	***Agonum sexpunctatum*** (Linnaeus, 1758)	T30, T39, T40, T53, B8	**10**	Eu.-As.	Ar.
22	***Poecilus cupreus*** (Linnaeus, 1758)	T7, T13	**2**	Eu.-As.	Ar.
23	***Pterostichus anthracinus*** (Illiger, 1798)	T14	**1**	Eu.-Sib.	Ar.
24	***Pterostichus foveolatus*** (Duftschmid, 1812)	T9, B6	**3**	Carpath.	Ar.
25	***Pterostichus jurinei*** (Panzer, 1805)	T7, T39, T40, T43, T44, B6	**8**	Eu.	Or.
26	***Pterostichus melanarius*** (Illiger, 1798)	B5	**1**	Eu.-Sib.**	Ar.

27	***Pterostichus niger*** (Schaller, 1783)	B1, B4, B5, B6, B9	**25**	Eu.-As.**	Ar.
28	***Pterostichus nigrita*** (Paykull, 1790)	B3	**1**	Pal.	Ar.
29	***Pterostichus oblongopunctatus*** (Fabricius, 1787)	B1, B4, B6, B10	**9**	Eu.-As.	Ar.
30	***Pterostichus pilosus*** (Host, 1789)	T39, T40	**3**	Cent.-Eu.	Ar.
31	***Pterostichus unctulatus*** (Duftschmid, 1812)	B2, B4, B6, B10	**7**	Eu.	Ar.
	Family DYTISCIDAE Leach, 1815				
	Subfamily Agabinae Thomson, 1867				
32	***Agabus guttatus*** (Paykull, 1798)	T14	**2**	WPal.	Ar.
	Family LEIODIDAE Fleming, 1821				
	Subfamily Cholevinae Kirby, 1837				
33	***Catops tristis*** (Panzer, 1793)	B4	**5**	Eu.	Ar.
	Family SILPHIDAE Latreille, 1806				
	Subfamily Silphinae Latreille, 1806				
34	***Phosphuga atrata*** (Linnaeus, 1758)	T7, T48, T51, T61, B5	**6**	Eu.-As.	Ar.
	Subfamily Nicrophorinae Kirby, 1837				
35	***Nicrophorus vespillo*** Linnaeus, 1758	B1	**1**	Eu.-As.**	Er.
	Family STAPHYLINIDAE Latreille, 1802				
	Subfamily Tachyporinae Macleay, 1825				
36	***Bolitobius cingulatus*** Mannerheim, 1831	T18	**1**	Eu.-As.**	Ar.
37	***Tachinus pallipes*** (Gravenhorst, 1806)	B1, B2, B3, B5	**6**	Eu.-Sib.**	Ar.
	Subfamily Steninae				
38	***Stenus obscuripes*** Ganglbauer, 1896*	B4	**1**	Carpath.	Ar.
	Subfamily Staphylininae Latreille, 1802				
39	***Philonthus decorus*** (Gravenhorst, 1802)	B4, B5	**7**	Eu.-Sib.	Ar.
40	***Quedius plagiatus*** Mannerheim, 1843	B2, B5	**5**	Eu.-Sib.**	Ar.
41	***Ocypus macrocephalus*** (Gravenhorst, 1802)*	B3, B4, B5	**26**	Cent.-Eu.	Ar.
42	***Ocypus picipennis*** Fabricius, 1793*	T43, B1	**2**	Eu.-As.	Ar.
	Family GEOTRUPIDAE Latreille, 1802				
	Subfamily Geotrupinae Latreille, 1802				
43	***Anoplotrupes stercorosus*** (Hartmann, 1791)	T7, T8, T15, T17, T22, T23, T27, T28, T42, T54, T56, B1, B2, B3, B4, B5, B7,B8	**67**	Eu.-Sib.	Ar.
44	***Trypocopris vernalis*** (Linnaeus, 1758)	T42	**2**	Eu.-Ca.	Er.
	Family SCARABAEIDAE Latreille, 1802				
	Subfamily Aphodiinae Leach, 1815				
45	***Acrossus depressus*** (Kugelann 1792)	T7	**1**	Eu.-As.**	Ar.
46	***Acrossus luridus*** (Fabricius, 1775)	T7	**3**	Pal.**	Er.
47	***Acrossus rufipes*** (Linnaeus, 1758)	T7	**1**	Pal.**	Ar.
48	***Agolius abdominalis*** (Bonelli 1812)*	T42	**1**	Eu.	Or.
49	***Coprimorphus scrutator*** (Herbst, 1789)	T42	**2**	Eu.-Ca.	Er.
50	***Teuchestes fossor*** (Linnaeus, 1758)	T7	**1**	Pal.**	Ar.
	Subfamily Scarabaeinae Latreille, 1802				
51	***Onthophagus fracticornis*** (Preyssler, 1790)	T50, T55	**3**	WPal.	Er.
52	***Onthophagus ovatus*** (Linnaeus, 1767)	T2, T7, T42, B1, B4	**8**	Eu.-CAs.	Er.
53	***Onthophagus vacca*** Linnaeus, 1767	T26	**2**	WPal.	Er.
	Subfamily Cetoniinae Leach, 1815				
54	***Oxythyrea funesta*** Poda, 1761	T1, T15, T21, T28	**4**	WPal.	Er.
55	***Trichius fasciatus*** (Linnaeus, 1758)	T15, T16, T21, T23, T26, T28, T49, T50	**13**	Eu.-Sib.	Ar.
	Family BUPRESTIDAE Leach, 1815				
	Subfamily Buprestinae Leach, 1815				
56	***Anthaxia quadripunctata*** (Linnaeus, 1758)	T6, T11, T13, T16	**6**	Pal.	Ar.
57	***Dicerca alni*** (Fischer von Waldheim, 1824)	T34	**1**	WPal.	Er.
	Subfamily Agrilinae Laporte, 1835				
58	***Agrilus viridis*** (Linnaeus, 1758)	T13, T14, T16, T21	**8**	Pal.	Ar.
	Family BYRRHIDAE Latreille, 1804				
	Subfamily Byrrhinae Latreille, 1804				
59	***Byrrhus pilula*** (Linnaeus, 1758)*	T22	**2**	Eu.-As.**	Ar.
	Family ELATERIDAE Leach, 1815				
	Subfamily Dendrometrinae Gistel, 1848				
60	***Athous subfuscus*** (O.F. Müller, 1764)	T14, T50, T53	**3**	Eu.-Sib.	Ar.

61	***Ctenicera cuprea*** (Fabricius, 1781)	T4, T14, T27, T33, T52	**6**	Eu.-Sib.	Ar.
62	***Hemicrepidius niger*** (Linnaeus, 1758)	T7	**1**	Eu.-As.**	Ar.
63	***Selatosomus aeneus*** (Linnaeus, 1758)	T2, T8, T13, T16, T28, T49	**6**	Eu.-Sib.	Ar.
	Subfamily Elaterinae Leach, 1815				
64	***Agriotes pilosellus*** (Schönherr, 1817)	T13, T14, T16	**4**	Eu.-Sib.	Ar.
65	***Ampedus nigrinus*** (Herbst, 1784)	T14	**1**	Eu.-As.**	Ar.
	Family LYCIDAE Laporte, 1836				
	Subfamily Dictyopterinae Houlbert, 1922				
66	***Pyropterus nigroruber*** (Degeer, 1774)	T7	**1**	Eu.-Sib.	Ar.
	Subfamily Lycinae Laporte, 1836				
67	***Lygistopterus sanguineus*** (Linnaeus 1758)	T7	**1**	Pal.	Ar.
	Family CANTHARIDAE Imhoff, 1856				
	Subfamily Cantharinae Imhoff, 1856				
68	***Cantharis nigricans*** (O. F. Müller, 1776)	T6, T13, T16	**4**	Eu.-As.**	Ar.
69	***Rhagonycha fulva*** (Scopoli, 1763)	T16, T21	**3**	Pal.**	Ar.
	Family TROGOSITIDAE Latreille, 1802				
	Subfamily Peltinae Latreille, 1806				
70	***Peltis grossa*** (Linnaeus 1758)	T19	**1**	Eu.-Sib.	Ar.
	Family CLERIDAE Latreille, 1802				
	Subfamily Clerinae Latreille, 1802				
71	***Thanasimus formicarius*** (Linnaeus, 1758)	T1, T29	**2**	Pal.**	Ar.
72	***Trichodes apiaries*** (Linnaeus, 1758)	T4, T15, T16, T26, T28	**11**	Pal.	Ar.
	Family COCCINELLIDAE Latreille, 1807				
	Subfamily Coccinellinae Latreille, 1807				
73	***Calvia quatuordecimguttata*** (Linnaeus, 1758)	T26	**1**	Hol.	Ar.
74	***Coccinella septempunctata*** Linnaeus, 1758)	T13, T16, T21	**6**	Pal.**	Ar.
75	***Hippodamia variegata*** (Goeze, 1777)	T44	**2**	Pal.**	Ar.
76	***Propylea quatuordecimpunctata*** (Linnaeus, 1758)	T16, T21	**2**	Pal.**	Ar.
	Family TENEBRIONIDAE Latreille, 1802				
	Subfamily Lagriinae Latreille, 1825				
77	***Lagria hirta*** (Linnaeus, 1758)	T13, T16, T22, T23, T26, T28, T38, T50, T60	14	Pal.	Ar.
	Family MELOIDAE Gyllenhal, 1810				
	Subfamily Meloinae Gyllenhal, 1810				
78	***Meloe rugosus*** Marsham, 1802	T8	**1**	Eu.-As.	Ar.
79	***Meloe violaceus*** Marsham, 1802	T8	**1**	Pal.	Ar.
	Family CERAMBYCIDAE Latreille, 1802				
	Subfamily Lepturinae Latreille, 1802				
80	***Anastrangalia dubia*** (Scopoli, 1763)	T13, T14, T15, T16, T21, T26, T28	**15**	WPal.	Or.
81	***Evodinus clathratus*** (Fabricius, 1792)	T8, T22	**3**	Eu.	Or.
82	***Gaurotes virginea*** (Linnaeus,1758)	T13, T14, T15, T21, T22, T23, T26, T38, T49, T53	**33**	Eu.-Sib.	Or.
83	***Judolia sexmaculata*** (Linnaeus 1758)	T13, T21, T26	**4**	Eu.-Sib.**	Ar.
84	***Lepturobosca virens*** (Linnaeus, 1758)	T7, T14, T28	**10**	Eu.-Sib.	Or.
85	***Oxymirus cursor*** Linnaeus 1758	T20	**1**	Eu-Sib.	Ar.
86	***Pachyta quadrimaculata*** (Linnaeus, 1758)	T1, T15, T21, T32, T55	**9**	Eu.-Sib.	Or.
87	***Pachytodes cerambyciformis*** (Schrank, 1781)	T14, T15, T16, T23, T26, T28, T34	**14**	Eu.-Ca.	Ar.
88	***Paracorymbia maculicornis*** (De Geer, 1775)	T16, T26, T56, T62	**5**	Eu.	Ar.
89	***Pidonia lurida*** (Fabricius, 1792)	T17	**1**	Eu.	Ar.
90	***Pseudovadonia livida*** (Fabricius, 1776)	T13, T15, T16, T21, T26	**8**	Eu.-As.	Er.
91	***Rhagium inquisitor*** (Linnaeus, 1758)	T20, T27	**2**	Pal.**	Or.
92	***Rutpela maculata*** (Poda, 1761)	T13, T14, T21, T26	**5**	Eu.-Cent. As	Er.
93	***Stictoleptura rubra*** (Linnaeus,1758)	T13, T15, T23, T26, T28, T32, T51, T54	**24**	WPal.**	Ar.
94	***Stictoleptura scutellata*** (Fabricius, 1781)	T14, T15, T26	**10**	WPal.	Ar.
	Subfamily Cerambycinae Latreille, 1802				
95	***Callidium violaceum*** (Linnaeus, 1758)	T1	**1**	Eu.-Sib.**	Ar.
96	***Cyrtoclytus capra*** (Germar, 1824)	T15, T16	**2**	Eu.-Sib.	Ar.
97	***Rosalia alpina*** (Linnaeus, 1758)	T6, T27	**2**	Eu.-Ca.	Ar.
	Subfamily Lamiinae Latreille, 1825				
98	***Agapanthia villosoviridescens*** (De Geer, 1775)	T21, T23	**2**	Eu.-Sib.	Er.
99	***Pogonocherus fasciculatus*** (Degeer, 1775)	T6, T11, T22	**3**	Eu.-Sib.	Ar.

100	***Monochamus sartor*** (Fabricius, 1787)	T6, T11, T15	**5**	Eu.	Ar.
101	***Monochamus sutor*** (Linnaeus, 1758)	T1, T8, T11, T22	**4**	Eu.-Sib.	Ar.
102	***Tetropium castaneum*** (Linnaeus, 1758)	T19, T27	**3**	Eu.-Sib.	Or.
	Family CHRYSOMELIDAE Latreille, 1802				
	Subfamily Chrysomelinae Latreille, 1802				
103	***Chrysolina carpathica*** (Fuss, 1856)*	T3	**1**	Cent.-Southeast Eu.	Or.
104	***Chrysolina coerulans*** (Scriba, 1791)	T6, T16, T21, T28, T36	**8**	Eu.-CAs.	Ar.
105	***Chrysolina fastuosa*** (Scopoli, 1763)	T13, T21, T23, T26, T49, T52, T63	**19**	Eu.-Sib.**	Ar.
106	***Chrysolina graminis*** (Linnaeus, 1758)	T15, T21	**2**	Eu.-As.	Ar.
107	***Chrysolina herbacea*** (Duftschmid, 1825)	T11, T13, T14, T15, T16, T21, T23, T36, T52	**18**	Eu.-CAs.	Ar.
108	***Chrysolina polita*** (Linnaeus, 1758)	T4, T11	**2**	Eu.-As.	Ar.
109	***Chrysolina varians*** (Schaller, 1783)	T23, T28	**2**	WPal.**	Ar.
110	***Gastrophysa viridula*** (De Geer, 1775)	T7, T28,	**3**	Eu.-As.	Ar.
	Subfamily Galerucinae Latreille, 1802				
111	***Agelastica alni*** (Linnaeus, 1758)	T6, T11, T13, T14, T15, T16, T26, T28	**11**	Eu.-As.**	Ar.
112	***Batophila rubi*** (Paykull, 1799)	T14, T16, T23, T28, T53	**7**	Eu.-Sib.	Ar.
113	***Derocrepis rufipes*** (Linnaeus 1761)	T15, T16	**3**	Eu.-Sib.	Ar.
114	***Lochmaea caprea*** (Linnaeus, 1758)	T49	**2**	Eu.-As.**	Ar.
115	***Luperus viridipennis*** Germar, 1824	T4	**1**	Eu.-CAs.	Or.
	Family CURCULIONIDAE Latreille, 1802				
	Subfamily Cossoninae Schönherr, 1825				
116	***Rhyncolus ater*** (Linnaeus, 1758)	B3, B5	**2**	Eu.-Sib.	Ar.
	Subfamily Entiminae Schönherr, 1823				
117	***Otiorhynchus equestris*** (Richter 1820)	B4, B5	**3**	Eu.-Sib.	Ar.
118	***Otiorhynchus coecus*** (Fabricius, 1775)	T8, T13, T16, T23, T32, T55, B4	**10**	Eu.	Ar.
119	***Otiorhynchus pauxillus*** Rosenhauer, 1847	B1	**2**	Eu.	Ar.
120	***Otiorhynchus scaber*** (Linnaeus, 1758)	B4, B5	**8**	Eu.**	Ar.
121	***Phyllobius argentatus*** (Linnaeus, 1758)	T7	**1**	Eu.-Sib.	Ar.
122	***Phyllobius viridicollis*** (Fabricius, 1792)	T43	**2**	Eu.-Sib.	Ar.
123	***Polydrusus formosus*** (Mayer 1779)	T7	**1**	Eu.-Sib.**	Ar.
	Subfamily Molytinae Schönherr, 1823				
124	***Hylobius abietis*** (Linnaeus, 1758)	T17, T20, T22, T27, T54, T65, B4, B5	**17**	Eu.-As.	Ar.
125	***Liparus glabrirostris*** (Küster, 1849)	T13, T15, T16, T23, T28, T35	**13**	Eu.	Ar.
126	***Plinthus tischeri*** Germar 1824	B1, B2, B4, B5	**6**	Cent.-Eu.	Ar.
	Subfamily Scolytinae Latreille, 1804				
127	***Cryphalus abietis*** (Ratzeburg, 1837)	T18, T19, T24, T45	**5**	Pal.	Ar.
128	***Dryocoetes autographus*** (Ratzeburg, 1837)	T18, T24, T29, T58, T59	**11**	Hol.	Ar.
129	***Hylastes cunicularius*** Erichson, 1836	T12, T29, T58, B3	**5**	Pal.	Ar.
130	***Ips amitinus*** (Eichhoff, 1872)	T18, T25, T29, T45, T46, T47	**16**	Eu.	Ar.
131	***Ips typographus*** (Linnaeus, 1758)	T5, T9, T10, T12, T18, T19, T24, T29, T37, T45, T47, T59	**26**	Eu.-Sib.	Ar.
132	***Pityogenes chalcographus*** (Linnaeus, 1761)	T12,T18, T19, T24, T25, T37, T47	**12**	Eu.-Sib.	Ar.

Legend: * – species present in the management plan; ** – introduced species in Nearctic region; Hol – Holarctic, Pal – Palearctic, Eu.-As. – European-Asian, WPal. – West Palearctic, Eu.-Sib. – European-Siberian, Eu.-CAs. – European-Central Asian, Eu.-Ca. – European-Caucasian, Eu. – European, Cent.-Southeast Eu. – Central- Southeast European, Cent.-Eu. – Central- European, Cent.-East Eu. – Central- East European, Southeast Eu. – Southeast European, Carpath. – Carpathian; Ar. – Arboreal, Er. – Eremian, Or. – Oreal, Ub. – Ubiquitous.

Most species (60.61%) were found in the contact zone between forest and riparian habitat (F-ed+R), followed by those from the riparian (R) habitats and forest edge (F-ed) (46.97% and 40.91%, respectively). The forest habitat (F) and the mountain-subalpine meadows (MSM) were poorer in species (28.03% and 10.61%, respectively). In swamp (Sw), wet meadows (WM**)** and alpine shrubs (AS), there were recorded, less than 10% of the species (Fig. 3). The differences reflected various conditions (exposition, humidity, temperature, altitude and vegetation) in each habitat, as well as the intensity of sampling, that was lower in mountain-subalpine meadows habitat, swamp, wet meadows and alpine shrubs.

The coleopteran fauna of the Călimani National Park consists of 13 chorotypes represented in the following order: European-Siberian species (28.79%), European-Asian ones (16.67%), Palearctic (14.39%), European (12.12%) and West Palearctic (9.09%). The species of these five chorotypes represent 81% of all species. Other chorotypes were represented by less than 5% (Fig. 4). Among the 132 species, 32 species (24%) are originally Palearctic, but have been introduced to Nearctic.

The above data show that the coleopteran fauna of the Călimani National Park is dominated by widely spread species. The percentage of the European-Siberian, European-Asian, Palearctic and West Palearctic species was 68.94%. This

indicates the occurrence, in the perimeter of the park, of a high number of species with medium or wide ecological valence that are relatively common, with low specificity for particular habitats.

The eco-geographical structure of the coleopteran fauna of the Călimani National Park is dominated by the arboreal species (approximately 80%), preferring moist forests and meadows. They spread, during forest expansion, from the arboreal refuges, during the damp period of the post-glacial (RUICĂNESCU, 1997).

The eremian and oreal species have equal shares, 9.85% each (Fig. 5). The small number of oreal species can be explained by the low sampling intensity in the alpine and sub-alpine habitats, but also by biodiversity decline with increasing altitude.

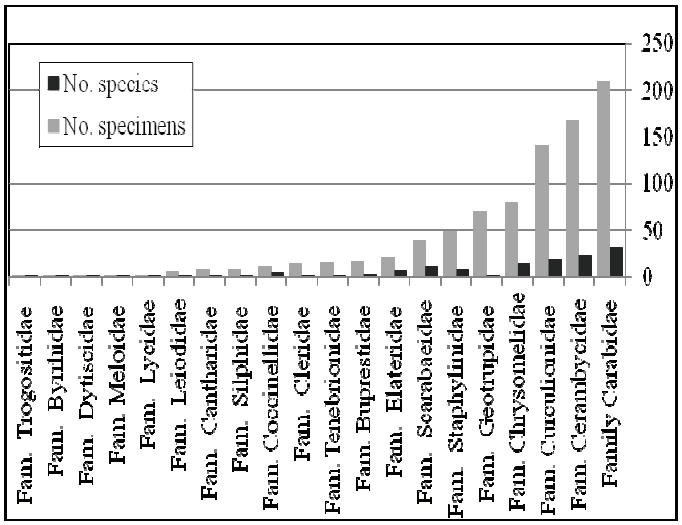

Figure 2. Distribution of species and individuals among families.

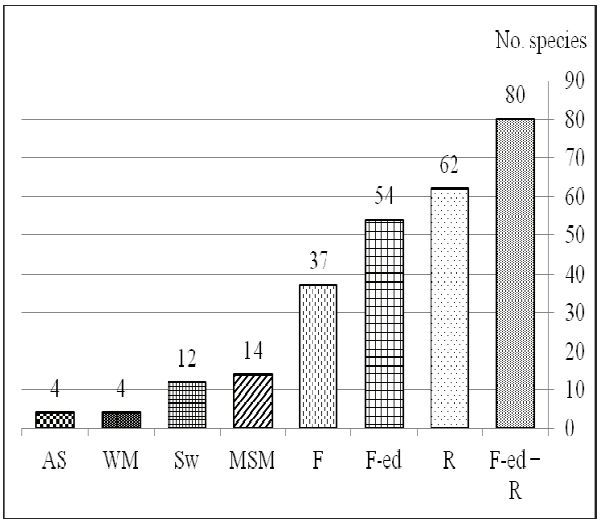

Figure 3. Distribution of species among 8 habitat types in the Călimani National Park (**AS –** Alpine shrubs, **WM –** Wet Meadows, **Sw –** Swamp, **MSM –** Mountain-Subalpine Meadows, **F –** Forest, **F-ed –** Forest edge, **R –** Riparian, **F – ed + R –** Forest edge + Riparian).

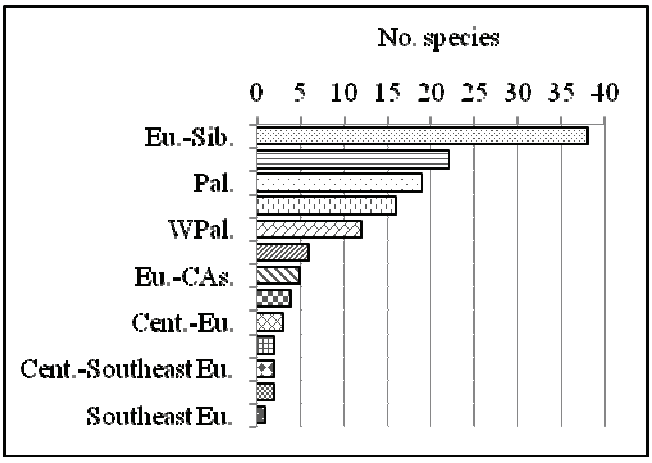

Figure 4. Distribution of the identified species on zoogeographical groups (Hol – Holarctic, Pal – Palearctic, Eu.-As. – European-Asian, WPal. – West Palearctic, Eu.-Sib. – European-Siberian, Eu.-CAs. – European-Central Asian, Eu.-Ca. – European-Caucasian, Eu. – European, Cent.-Southeast Eu. – Central-Southeast European, Cent.-Eu. – Central-European, Cent.-East Eu. – Central- East European, Southeast Eu. – Southeast European, Carpath. – Carpathian).

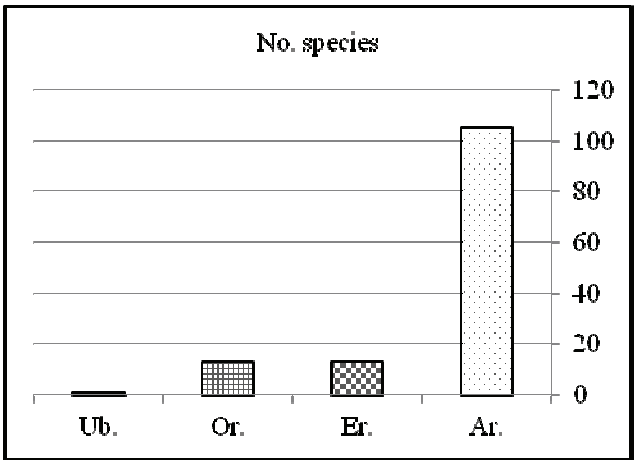

Figure 5. Distribution of the identified species on eco-geographical groups
(Ar. – Arboreal, Er. – Eremian, Or. – Oreal, Ub. – Ubiquitous).

The similarity between coleopteran populations from the investigated habitats was made using the Jaccard index (Fig. 6). Low values of the similarity index, less than 50%, were obtained for all groups. The wet grassland showed high faunal differences in comparison with the other habitats. A smaller difference was obtained between

coleopteran populations from forests, riparian areas and the combination of the two habitats. The highest values of similarity were obtained between riparian areas and mixed habitat of riparian - forest edge (42.31%). This similarity was expected, since the riparian habitat is situated close to the forest (mixed or spruce); it shows that the characteristic riparian species (hygrophilic beetles that inhabit only wet river banks) are unable to induce drastic faunal differences, if we make a comparison with the surrounding forest (NIȚU et al., 2008). A low gradient of the similarity among studied habitats was obtained, which increased from open areas toward the semi-open and closed habitats.

Since the family Carabidae was best represented (taking into account the species diversity and the numerical abundance) we tried to establish the similarity index between the structure of the carabids populations and the altitude of the investigated pitfall traps (quantitative method).

The Jaccard cluster analysis revealed three differentiated groups, primarily in terms of habitat and secondary depending on altitude (Fig. 7).

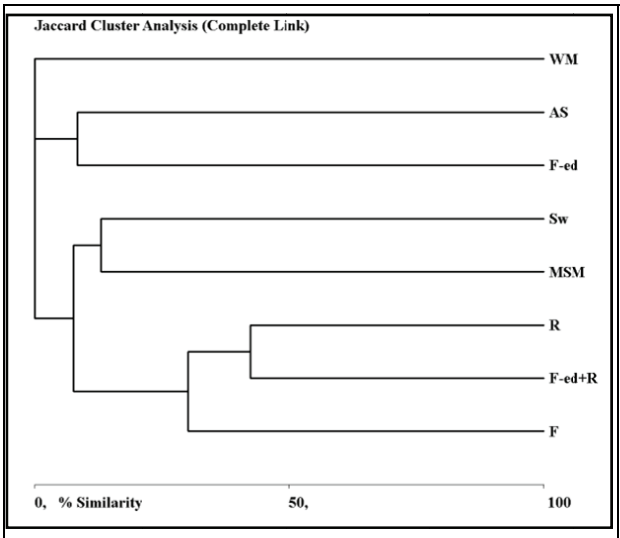

Figure 6. Dendrogram of clustering of habitat depending on coleopterans fauna of the Călimani National Park.

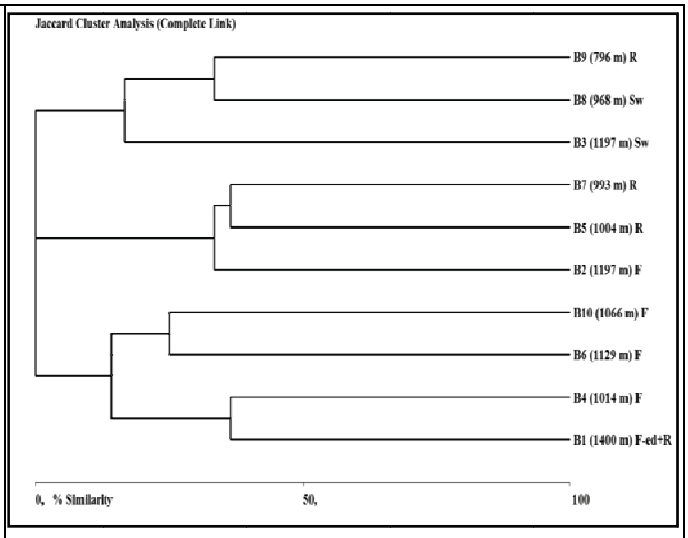

Figure 7. Dendrogram of clustering of altitudinal pitfall traps samples in the Călimani National Park.

The first group consists of carabids present in moist locations, as swamps and riparian wetlands areas, marsh (*Bembidion* species). The second group includes common species for *Alnus* riparian areas and few pine forests located on the valleys (*Carabus cancellatus*, *C. violaceus* and *C. auronitens*). The third group includes common species for forest ecosystems (coniferous and mixed) and for forest edge plus riparian, as carabids from the genera *Pterostichus* and *Carabus*. Our data shows a weak differentiation of the carabids fauna, taking into account the altitudinal gradient. The research method and the low difference between altitudes of the collection points have not allowed an accurate comparison with other studies done in the neighbouring mountain massifs, as Rodnei Massif (NIȚU et al., 2008).

From the conservative point of view, we found two species protected by the European and national legislation, *Carabus variolosus* Fabricius, 1787 and *Rosalia alpina* (Linnaeus, 1758). Both species are listed in Annex II and Annex IV of EU Council regulation 92/43/EEC, revised in Annex I of Resolution 6 (1998) of the Bern Convention and in the national legislation 57/20.06.2007.

Carabus variolosus is a semi-aquatic woodland carabid beetle, distributed up to 1,500 m, restricted to the fringes of streams and to areas of high soil moisture, features that show a slight preference for sparse tree vegetation, with small open areas and less acidic soil. The species indicates the undisturbed wet areas in the zone ranging from the beech-oak to Norway spruce forests.

Rosalia alpina is classified as a priority species and enjoys protection Europe-wide. In Romania, its population is in decline due to the destruction or fragmentation of the initial area due to timber exploitation during the mating period. Thus, the females lay eggs on timber that is rapidly hailed from the stands. Thus the larvae cannot finish their development. Both species disappeared or became extremely rare in western European countries.

Among the rare coleopterans of the Romanian fauna, we can also mention *Peltis grossa* (Linnaeus 1758), which is a relict of virgin forest and *Meloe rugosus* Marsham, 1802, which develops in the nest of solitary bees of the genera *Halictus*, *Andrena* and *Nomada*. In Europe, their populations are in decline, due to the destruction of their natural habitats.

CONCLUSIONS

In eight types of habitats of the Călimani National Park, 132 species of 20 coleopterans families were recorded, in the period May - October, 2013. Two species, *Rosalia alpine* (Linnaeus, 1758) and *Carabus variolosus* Fabricius, 1787, are protected at national and international level and the other two species, *Peltis grossa* (Linnaeus, 1758) and *Meloe rugosus* Marsham, 1802, are considered rare for the Romanian fauna.

Taking into account the geographical distribution, the species with large areas, as European-Siberian, European-Asian, Palearctic and West Palearctic, predominated in the studied material. They represent nearly 69% of the recorded species. Most of them originated from the arboreal refuges, as shown by the dominance of arboreal elements, representing almost 80% of recorded species.

The values of the Jaccard similarity index, smaller than 50%, reflect a low similarity of the coleopteran fauna from the eight studied habitats types, indicating a high heterogeneity of the investigated coleopteran populations and of the environmental conditions of the habitats. The same situation was observed in the case of the cluster analysis performed for the carabids fauna from the 10 locations (sampling sites), where pitfall traps was placed. For this reason, the carabids fauna did not reveal an exact ordering of the 10 sample stationeries in correlation with the altitudinal gradient.

Considering the size of the investigated area and the number of the studied habitats, the 132 species recorded in the Călimani National Park represent only a small part of the local coleopteran fauna. For this reason we consider this study as a preliminary one that must be continued.

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