

FAUNAL RESEARCHES ON THE INVERTEBRATES (COLEOPTERA, ORTHOPTERA, COLLEMBOLA AND ARANEAE) IN THE RODNEI MOUNTAINS BIOSPHERE RESERVE

EUGEN NITZU*, IONUȚ POPA*, AUGUSTIN NAE*, CLAUDIU IUȘAN**

Abstract. The faunal lists of cave, epigaeic and soil species of Araneae (73 species), Collembola (61 species), Orthoptera (35 epigaeic species) and Coleoptera (127 species) collected in the years 2005 and 2006 from the Rodnei Mountains Biosphere Reservation are presented. Among these, eight species: *Rugathodes bellicosus* (Araneae, Theridiidae), *Glyphesis servulus* (Araneae, Linyphiidae), *Incestophantes frigidus* (Araneae, Linyphiidae), *Gnaphosa badia* (Araneae, Gnaphosidae), *Eusphalerum pallens* (Coleoptera, Staphylinidae), *Cryptophagus corticinus* (Coleoptera, Cryptophagidae), *Otiorrhynchus scaber* (Coleoptera, Curculionidae) *Thamnurgus varipes* (Coleoptera, Scolytidae) – are for the first time recorded for the Romanian fauna. The presence of other species in the Romanian fauna is confirmed and new data on the local distribution of some rare or protected species are given.

For the Pietrosul Mare Scientific Reserve (the core area of the Biosphere Reservation) the quantitative and qualitative sampling from all altitudinal biotic zones were carried out with the aim to observe the altitudinal gradient in the faunal structure. A brief zoogeographic analysis is presented.

Key words: The Rodnei Mountains, Biosphere Reservation, Araneae, Collembola, Orthoptera, Coleoptera, new faunal and zoogeographic data.

1. INTRODUCTION

The Rodna Mountains National Park is situated in the northern part of the Eastern Carpathians, extending between 47°25'54"–47°37'28" N. Latitude and 24°31'30"–25°01'30" E. Longitude (Fig. 1).

The Rodna Mountains National Park has a total surface of 47,000 ha, being legally protected by the Order of Minister (OM) No. 7/1990 and Law No. 5/2000. In 1979, in Paris, The International Council of Coordination of the MAB-UNESCO Program decided to include the Pietrosul Rodnei Natural Reserve (3,300 ha) in the international network of Biosphere Reservations. The included area was subsequently extended at 44,000 ha (www.unesco.org). According to the internal administrative mapping, within the park are delimited a series of *scientific reserves* (Pietrosul Mare – 3,300 ha; Pietra Rea – 309 ha; Bila-Lala – 1,646.9 ha; Corongis – 592.4 ha) and *natural reserves* included in the special conservation area.

The Pietrosul Rodnei area (the most intensive studied area by our team), constituted as a scientific reserve by the Journal of the Ministers Council No. 1149/1932,

presents a surface of 183 ha of alpine meadows surrounding the Pietrosul Mare Peak (from a total surface of 1,770 ha, 53% is covered by forests and 47% by alpine meadows).

No integrated studies on the soil and subterranean invertebrates following the altitudinal gradient in faunal and zoogeographic structure have been carried out in the area up to now.

1.1. GENERAL CHARACTERISATION OF THE STUDIED AREA

The geological substratum of the Rodnei Mountains consists of crystalline schists, in the perimeter of scientific reservation prevailing the green schists of Rebra. The crystalline limestone is the best represented in the Piatra Rea Massif. The crystalline and sedimentary limestones are both present but weakly represented in comparison with the crystalline schists. The crystalline limestones intersperse with crystalline schists in areas of Piatra Rea, Turnu Roșu (North of Pietrosul Mare), in the saddle between the Repedeș Peak and Negoiasa, the Corongis Peak, Capul Beiușului and the Laptele Mic Peak, sometimes generating exokarstic forms like karrens (in the walls and cliffs at Izvorul Cailor, Piatra Rea) or dolines (on Bistricioara Valley, the Gărtălău Peak).

According to the documentation of the Pietrosul Rodnei Natural Park, the endokarst is represented by 80 caves and potholes among which remarkable are: Peștera Cobășel (570 m.) (R. Peștera = E. Cave), Grota Zânelor (4,269 m.), Peștera Baia lui Schneider (791.5 m.), Peștera Izvorul Albastru al Izei (2,500 m), P. Iza (365 m), Avenul cu Scară (117 m), Av. Podu Pietrei Rele (208 m) (ro. aven = eng. pothole). At the south-western limit of the park is situated the karstic complex Tăușoare – Zalion (18 km) – Peștera Tăușoare being in the same time the deepest cave from Romania (– 470 m in depth).

The vegetation, following an altitudinal gradient, could be included in 4 biotic zones, significant different by those presented by MANI, 1968 (following Pax) in the chapter 9. “*The ecological characters and biotic zonation of the Carpathians*”.

1. lower forest zone – premontane beech forests;
2. upper forest-zone, from the upper limit of the Fagus-forest including mixed forests (spruce, fir and beech) at the lower montane level, to the forest line (spruce forest), and pre-subalpine spruce forests;
3. subalpine zone, from the upper limit of the forest to the upper limit of Juniper tree associations with *Rhododendron* and *Pinus mugo*;
4. alpine zone – with alpine meadows with *Nardus*, lacking the shrub vegetation formation.

According to COLDEA (1990), 1123 species of phanerogames were identified in the park area. From phytogeographical viewpoint these are 36.7% eurasian

elements, 12.7% boreo-montane elements, 8.1% Central-European elements, 4.6% Mediterranean elements and 1.4% continental elements. For the Pietrosu Mare only, 650 species and 46 vegetal associations were identified.

The invertebrate fauna of the Rodnei Mountains was studied since last century but just fragmentarely. First catalog including data on the Coleoptera from the Rodnei Mountais was published by K. PETRI (1912). E. CSIKI (1946, 1951) made new and valuable contributions to the knowledge of coleopteran fauna of this area. The genus *Duvalius* was studied by R. JEANNEL (1927). Other punctual studies were carried out by MAICAN S. (2004) (some data on the Crysomelidae species), SERAFIM, R. (1997) (Coccinelidae and Cerambycidae). The spiders were very little studied in this area, some data being presented in Fauna R.S.R. (I. FUHN, F. NICULESCU BURLACU, 1971). Few data on Collembolan fauna were presented by RADVANSKI, J.M. et coll. (2006).

Our study represents the first contribution to the knowledege of the soil and subterranean fauna of Coleoptera, Orthoptera, Collembola and Araneae of the Rodnei Mountains Biosphere Reservation, carried out as an integrate research in order to observe the altitudinal gradient and differences in faunal and zoogeographic composition of this area.

2. MATERIAL AND METHODS

In the years 2005 and 2006 we collected fauna from caves and soil using qualitative and quantitative sampling methods.

For subterranean fauna we investigated the caves from the area Dealul Popii (P. Speranței, P. lui Mihai, P. Rece, P. Strâmtă, Grota Baia lui Schneider), Pestera Cobășel and Peștera Izvorul Tăușoarelor (Fig. 1). The fauna was collected with tweezers, exhaustor and using Barber traps.

The soil fauna was sampled from alpine, subalpine, upper and lower forest zones. For each type of habitat, fauna was collected using quantitative and qualitative samples. The quantitative sampling was made only in the Pietrosul Mare Massif (the core area of the Biosphere Reservation). For quantitative sampling we have delimited sampling areas of 100 square meters. In each sampling area 9 sapling units (Barber traps with olfactory attractant and ethyl alcohol as conservant) were placed. The number of sampling areas was chosen considering the total surface of each zone and the occurrence of peculiar microhabitas. Two sampling areas were placed in the alpine zone (each of them in different microhabitats), one in subalipe zone, two in upper spruce forest zone (one of them in a riparian-sylvan microhabitat), one in the spruce forest area with high productivity, and one in the area of the lower forest zone (mixed forest) – in total 7 sampling areas. The traps have been verified and emptied at an interval of four days each.

The collected material was identified by following specialists:

Dr. EUGEN NITZU – Ord. Coleoptera
IUȘAN CLAUDIU – Ord. Orthoptera
AUGUSTIN NAE – Ord. Araneae
IONUT POPA – Cls. Collembola

3. RESULTS AND DISCUSSIONS

3.1. CAVES AND THE CAVE FAUNA

Dealul Popii (1230 m. elevation) is situated at 1.5 Km. West from Valea Vinului (the unique locality included in park). Seven caves developed in crystalline limestones by Devonian-Carbonifere origin are known for this area: Peștera Speranței, Peștera lui Mihai, Peștera Rece, Peștea Strâmtă, Peștera cu Puț, Grota Baia lui Schneider, Peștera Râsului, most of them being descendent caves.

Peștera Baia lui Schneider

The cave is situated on the Dealul Popii hill, up to the Valea Vinului village (Fig. 1:2). It has a total development of 570 m and –30 m denivelation. The most frequent speleotemes are the parietal formations (coralytes) generated by the condensing water. The parietal crust and stalagmitic dome situated at the intersection between the central drift (gallery) and *Diaclazei* gallery are generated by the trickling water. The carbonatic crusts are frequent on the superior level of the *Diaclazei* gallery. The cave is characterised by the abundant aragonite formations. The mining exploitation in the cave for extraction of a silver-gold oxyde was stopped in XIXth century. The cave is now protected as speleological reservation (Law No. 5/2000). The first detailed mapping of the cave was carried out by C. GORAN and O. BUSUIOCEANU (1973) (in BLEAHU et coll., 1976).

Climatic parameters (08.03.2005): Relative humidity – 67.16% at the entrance, 81.3% inside; temperature – 20.9°C at the entrance, 5.1°C inside.

Fauna

Cls. Arachnida

Ord. Araneae

Fam. Tetragnathidae

Meta menardi (Latreille, 1804) TF

Cls. Collembola

Ord. Poduromorpha

Fam. Onychiuridae
Deuteraphorura silvaria (Stach, 1954)
Ord. Entomobryomorpha
Fam. Tomoceridae
Plutomurus unidentatus Börner, 1932
Pogonognathellus flavescens

Cls. Insecta
Ord. Coleoptera
Fam. Staphylinidae
Quedius mesomelinus Marsham, 1802

Other collected invertebrates (undetermined): Acari, Diplura, Trichoptera, Diptera.

Peștera lui Mihai (1027/2)

The descending cave has a total development of 70 meters and presents a 12 m deep pothole at approx. 10 m to the entrance. The large galleries resulted after the polyphasic modeling of diaclasses by water.

Climatic parameters (08.03.2005): Relative humidity – 67.10% at the entrance, 81% inside; temperature – 21°C at the entrance, 9°C inside.

Fauna

Cls. Arachnida
Ord. Araneae
Fam. Linyphiidae
Lepthyphantes sp.
Fam. Tetragnathidae
Meta menardi (Latreille, 1804) TF
Fam. Clubionidae
Clubiona sp.

Ord. Lepidoptera
Fam. Nymphalidae
Inachis io STF (at the vestibular level)

Cls. Collembola
Ord. Poduromorpha
Fam. Onychiuridae
Deuteraphorura silvaria (Stach, 1954)
Kalaphorura tuberculata (Moniez, 1840)
Fam. Neanuridae
Thaumanura carolii (Stach, 1920)

Ord. Entomobryomorpha
Fam. Tomoceridae
Plutomurus unidentatus Börner, 1932

Other collected invertebrates (undetermined) Acari, Diptera

Peștera Speranței (1027/6)

The cave (cca. 70 m development) has a descending principal gallery (a slope of approx. 45°) ramified at approx. 15 m distance from the entrance in small and labirintic galleries.

Climatic parameters (08.03.2005): Relative humidity – 67.12% at the entrance, 83.2% inside; temperature – 20°C at the entrance, 9°C inside.

Fauna

Cls. Arachnida

Araneae

Fam. Linyphiidae
Micrargus herbigradus (Blackwall, 1854) STF
Fam. Tetragnathidae
Meta menardi (Latreille, 1804) TF
Fam. Clubionidae
Clubiona sp. (one immature)

Cls. Collembola

Ord. Poduromorpha
Fam. Onychiuridae
Deuteraphorura silvaria (Stach, 1954)

Ord. Entomobryomorpha
Fam. Tomoceridae
Plutomurus unidentatus Börner, 1932

Other collected invertebrates (undetermined) Gasteropoda, Pseudoscorpiones, Trichoptera, Diptera.

Peștera Strâmtă and Peștera Rece

Two small, descending caves with narrow galleries. The fauna is poorly represented. Only the troglomorphic spider *Meta menardi* (Latreille, 1804) was found.

Peștera Cobășel

Situated on the left versant of the Cobășel valley (GPS coordinates: 47°29'21" N, 24°52'48" E, 800 m elevation), the cave has 489 m development and –23 m/+10

denivelation. It is developed in crystalline limestone and could be considered as a model for caves generated by the infiltration of water. Such caves, formed in phreatic conditions, have frequent crystallisations of corallitic type. Climatic parameters (06.21.2006): Relative humidity – 83.8%; temperature – 8.6°C.

Fauna

Cls. Arachnida

Ord. Araneae

Fam. Tetragnatidae

Metellina segmentata (Clerck, 1757) (06.21.2006)

Fam. Clubionidae

Clubiona sp. (08.03.2005)

Cls. Collembola

Ord. Poduromorpha

Fam. Onychiuridae

Protaphorura fimata (Gisin, 1952) (08.03.2005)

Protaphorura armata (Tullb., 1869) (06.21.2006)

Ord. Entomobryomorpha

Fam. Tomoceridae

Plutomurus unidentatus Börner, 1932 (08.03.2005, 06.21.2006)

Cls. Insecta

Ord. Coleoptera

Fam. Carabidae

Duvalius (Duvalidius) proceroides Jeannel, 1926 (exoskeletal fragments)

Fam. Leiodidae

Catops tristis Panzer, 1794

Other collected invertebrates (undetermined): Pseudoscorpiones, Acari.

Peștera Izvorul Tăușoarelor

Peștera Izvorul Tăușoarelor is situated on the Tăușoare spring, a left affluent of the Gersa Valley. The cave morphology is exclusively tectonic. Discovered in the year 1915 by the teacher Leon Bârte, the cave has a development of over 16 km, and –470 m denivelation, being the deepest cave from the Oriental Carpathians. It contains a very rare mineral – the mirabilit ($\text{Na}_2\text{SO}_4 \times 10 \text{H}_2\text{O}$) and also flowerlike selenite crystals (adonites). The fauna is poor considering the impressive dimensions of the cave. Still, one endemic troglobiont diplopod (*Romanosoma bârtei* Ceuca, 1967) was found and described from here. Some bones of *Ursus spelaeus* were also found. The cave is declared speleological reservation (Law No. 5/2000).

Fauna

Cls. Arachnida

Ord. Araneae

Fam. Linyphiidae.

Porrhomma sp. – troglobiont (a blind, unpigmented imature)

Taranucnus bihari Fage, 1931

Collembola

Ord. Poduromorpha

Fam. Onychiuridae

Deuteraphorura silvaria (Stach, 1954)

Protaphorura armata (Tullb., 1869)

Ord. Entomobryomorpha

Fam. Tomoceridae

Plutomurus unidentatus Börner, 1932

Fam. Isotomidae

Desoria violacea Tullb., 1876

Cls. Insecta

Ord. Coleoptera

Fam. Carabidae

Trechus latus Putzeys, 1847, 1 male – TX.

Duvailus (Duvailiopsis) pilosellus Miller, 1868 (exoscheletic fragments)

Fam. Staphylinidae

Quedius mesomelinus Marsham, 1802

Other observed species (undetermined): Gasteropoda, Acari, Opiliones, Trichoptera, Diptera.

3.2. THE SOIL/EPIGAEIC FAUNA

The soil and epigaeic fauna belonging to four representative taxonomic groups of invertebrates (Coleoptera, Orthoptera, Collembola and Araneae) was collected in the months of June and August. The analysis of the quantitative samples, statistical results and their interpretation for the Pietrosul Mare area (the core unit of Biosphere reserve) will be presented in a future paper. This work is dedicated to the faunal and zoogeographic analysis for larger types of habitats and investigated areas only.

The sampling periods have been chosen with the purpose to catch the periods of activity in the imago stage for the largest number of species. During the sampling period the values of temperature, relative humidity and dwelling point were recorded.

We collected fauna from 6 different areas of the Rodnei Mountains National Park. Two areas situated in the lowest zone of beech forests, along river valleys (Valea Secii, Valea Cobășel), one in the lowest part of the spruce forest area (Valea Măriilor), two in subalpine-upper limit of the spruce forest area, along springs and river valleys (Izvorul Cimpoiș, Cascada Cailor), and one in the core unit – the area Pietrosul Mare al Rodnei, where we carried out quantitative sampling following the altitudinal gradient from the alpine meadows to the mixed forest of beech and spruce (Fig. 1).

The species of Araneae, Collembola and Coleoptera (qualitative sampled in the first five stations) are presented below (Table 1). At these we add the list of the soil species sampled in the Pietrosul Mare Scientific Reservation (the core area of investigations) (Annex I) on altitudinal gradient/zone, with reference to their distribution.

Table 1

Araneae, Collembola and Coleoptera qualitative sampled in five sites from the Rodnei Mountains Biosphere Reservation (Cosm. – Cosmopolitan; Nearct. – Nearctic; Hol. – Holarctic; Pal. – Palaearctic; Euro. – European; Cauc. – Caucasian; Carp. – Carpathian; Centr. – Central, E – Eastern, W – Western; Sib. – Siberian)

Species/site and habitat	Izvorul Cimpoiș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
CLS. ARACHNIDA Ord. Araneae (Det. Nae A.)						
Fam. Segestriidae <i>Segestria senoculata</i> (Linnaeus, 1758)				+ (soil)		Palaearctic
Fam. Theridiidae <i>Rugathodes bellicosus</i> (Simon, 1873)				+	+ (grassy lands)	Euro.
<i>Theridion varians</i> Hahn, 1833				+	+ (grassy lands)	Hol.
Fam. Linyphiidae						
<i>Erigone dentipalpis</i> (Wider, 1834)	+ (soil)					Hol.
<i>Lepthyphantes obscurus</i> (Blackwall, 1841)				+ (soil)		Pal.
<i>Maso sundevalli</i> (Westring, 1851)				+ (soil)		Hol.
<i>Meioneta fuscipalpa</i> (C.L. Koch, 1836)	+ (soil)					Pal.
<i>Neriere emphana</i> (Walckenaer, 1842)					+ (high)	Pal.

Species/site and habitat	Izvorul Cimpoeș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
					vegetation)	
<i>Neriere montana</i> (Clerck, 1757)					+ (high vegetation)	Hol.
<i>Neriere peltata</i> (Wider, 1834)				+	+ (high vegetation)	Pal.
<i>Neriere radiata</i> (Walckenaer, 1842)					+ (high vegetation)	Hol.
<i>Oedotorax apicatus</i> (Blackwall, 1850)				+	(soil)	Pal.
<i>Oedotorax retusus</i> (Westring, 1851)	+					Pal.
<i>Porrhomma convexum</i> (Westring, 1851)	+					Pal.
<i>Tenuiphantes tenuis</i> (Blackwall, 1852)				+	(soil)	Euro-Med.
Fam. Tetragnatidae <i>Metellina menzei</i> (Blackwall, 1869)				+	+ (high vegetation)	W. Pal.
<i>Tetragnatha montana</i> Simon, 1874					+ (high vegetation)	Pal.
<i>Tetragnatha pinicola</i> L. Koch, 1862					+ (high vegetation)	Pal.
Fam. Araneidae <i>Araniella alpica</i> (L. Koch, 1869)				+	(shrubs)	W. Pal.
<i>Araneus diadematus</i> Clerck, 1757					+ (plants)	Hol.
<i>Gibbaranea gibbosa</i> (Walckenaer, 1802)				+	(plants)	W. Pal.
Fam. Lycosidae <i>Pardosa amentata</i> (Clerck, 1757)				+	(soil and grasy lands)	Euro. (incl. Russia)
<i>Pardosa lugubris</i> (Walckenaer, 1802)				+	(soil and grasy lands)	Pal.
<i>Pirata hygrophilus</i> Thorell, 1872				+	(soil)	Pal.
<i>Pirata knorri</i> (Scopoli, 1763)				+	+	Pal.

Species/site and habitat	Izvorul Cimpoeș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
Fam. Agelenidae <i>Tegenaria silvestris</i> L. Koch, 1872			+			Euro. (incl. Russia)
Fam. Clubionidae <i>Clubiona diversa</i> O.P.-Cambridge, 1873					+	Pal. (soil)
Fam. Amaurobiidae <i>Callobius claustrarius</i> (Hahn, 1833)						Pal.
<i>Coelotes atropos</i> (Walckenaer, 1830)					+	Euro. (soil)
<i>Coelotes terrestris</i> (Wider, 1834)					+	Pal. (soil)
Fam. Thomisidae <i>Xysticus luctuosus</i> (Blackwall, 1836)					+	Hol. (plants)
Fam. Salticidae <i>Carrhotus xanthogramma</i> (Latreille, 1819)						Pal. (plants)
<i>Evarcha falcata</i> (Clerck, 1757)					+	Pal. (plants)
<i>Sitticus rupicola</i> (C. L. Koch, 1837)					+	Hol. (plants)
CLS. COLLEMBOLA <i>/Det. Popa I.)</i>						
Ord. Entomobryomorpha (soil species)						
Fam. Cyphoderidae <i>Cyphoderus albinus</i> Nicolet, 1842						Cosm. (soil)
Fam. Entomobryidae <i>Orchesella flavescens</i> (Bourlet, 1839)					+	Pal.
<i>Lepidocyrtus cyaneus</i> (Tullb., 1871)					+	Euro+ Nearct
<i>Lepidocyrtus lanuginosus</i> Gmelin, 1788					+	Hol.
<i>Lepidocyrtus lignorum</i> Fabricius, 1781					+	Cosm.
<i>Entomobrya muscorum</i> (Nicolet, 1841)					+	Cosm.

Species/site and habitat	Izvorul Cimpoiș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
Fam. Tomoceridae						
<i>Tomocerus minor</i> (Lubbock, 1862)				+	+	Cosm.
<i>Pogonognathellus flavescens</i> (Tullb., 1871)	+			+	+	Cosm.
Fam. Isotomidae						Cosm.
<i>Isotomurus palustris</i> (Muller, 1776)	+					
<i>Hydroisotoma schaefferi</i> Krausbauer, 1898	+					Euro.+ Nearct
<i>Isotoma sp</i> – (1 imature)	+					–
Ord. Poduromorpha (soil species)						
Fam. Onychiuridae						
<i>Onychiuroides subgranulosus</i> (Gama, 1964)					+	S-E. Euro.
<i>Tetodontophora bielanensis</i> (Waga, 1842)		+				Centr.-E. Euro.
Fam. Neanuridae						
<i>Morulina verrucosa</i> (Borner, 1903)					+	Euro.
<i>Deutonura plena</i> (Stach, 1951)					+	N.-Carp.
<i>Thaumanura carolii</i> (Stach, 1920)					+	Euro-Medit.
Ord. Symphypleona (soil species)						
Fam. Dicyrtomidae						
<i>Dicyrtoma fusca</i> (Lubbock, 1873)				+		Euro-Medit. (Not in Sinai pen.)
CLS. INSECTA						
Ord. Coleoptera (Det. Nitzu E.)						
Fam. Carabidae						
<i>Carabus variolosus</i> Fabricius, 1758				+		
<i>Carabus glabratus</i> Paykull, 1790					+	Centr.-E. Euro.

Species/site and habitat	Izvorul Cimpoeș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
<i>Carabus cancellatus tuberculatus</i> Dejean 1826					+	Ssp. End. N. Carp.
<i>Bembidion (Trepanes) articulatum</i> (Panzer)		+				Pal.
<i>Bembidion (Bembidionetolitzkya) geniculatum</i> Heer, 1837	+			+		Euro. (mountains)
<i>Bembidion (Bembidionetolitzkya) paracomplanatum</i> Nitzu, 1995	+					Carp.
<i>Bembidion (Bembidionetolitzkya) varicolor</i> (Fabricius, 1803)		+				Euro-Cauc.
<i>Bembidion (Bembidionetolitzkya) tibiale</i> (Duftschmid, 1812)				+		Euro-Cauc.
<i>Bembidion (Peryphus) cruciatum bualei</i> J. du Val, 1852		+				Euro.
<i>Bembidion (Peryphanes) dalmatinum</i> Dejean, 1831		+				S-E. Euro.-Asia Minor-Cauc.
<i>Paranchus albipes</i> (Fabricius, 1796) (= <i>Platymus ruficornis</i> Goeze, 1777)		+				Hol.
<i>Patrobis roubali</i> Maran, 1933	+					Ro. Carp.
Fam. Dytiscidae <i>Agabus guttatus</i> (Paykull 1798)				+	(ponds)	Pal.
Fam. Staphylinidae <i>Staphylinus erythropterus</i> L.					+	W-Pal.
(Scaphidiinae) <i>Scaphidium quadrimaculatum</i> Olivier 1790				+		W-Pal.

Species/site and habitat	Izvorul Cimpoeș 08.05.2005 riparian	Cascada Cailor – 08.05.2005 riparian	Valea Măriilor 08.08.2005	Valea Cobasel 06.21.2006 riparian-sylvan	Valea Secii 21.06.2006 riparian-sylvan	Distribution
Fam. Elateridae <i>Cidnopus pilosus</i> (Leske 1785)				+		Pal.
<i>Oedostethus quadripustulatus</i> (Fabricius, 1792)				+		Pal.
Fam. Lucanidae <i>Platycerus caraboides</i> (Linnaeus 1758)				+		W-Pal.
Fam. Tenebrionidae <i>Stenomax lanipes</i> (Linnaeus, 1771)					+	Euro.
Fam. Chrysomelidae						
<i>Timarcha (Timarcha) rugulosa</i> Herrich-Schaeffer 1838				+		Carp.
<i>Chrysolina (Heliostola) carpathica</i> (Fuss 1856)					+ (flowers)	E- Euro.
Fam. Anthribidae <i>Platystomos albinus</i> (Linnaeus 1758)				+		W-Pal.
Fam. Cerambycidae <i>Oxymirus cursor</i> Linnaeus 1758			+		+ (xylophagous)	Pal.
<i>Pseudogaurotina excellens</i> (Brancsik 1874)					+ (xylophagous)	E.- Euro.
<i>Monochamus sartor</i> (Fabricius, 1787)			+ (xylophagous)			Euro- Sib.

To this table, presenting the results of some qualitative samples from different five habitats from the Rodnei Mountains National Park, we add the list of soil species sampled (qualitative and quantitative) in all altitudinal zones (alpine, subalpine and montane) of the Pietrosul Mare Scientific Reserve (Annex I) and the

list of epigaeic Orthoptera (leg. et det. Claudiu Iușan) with reference on their general distributions and ecological preferences (Annex II).

From the total species of invertebrates (127 Coleoptera, 61 Collembola, 73 Araneae, 35 Orthoptera) identified by us in the Rodnei Mountains Biosphere Reservation, most of them have been found only in the Pietrosul Mare Scientific reservation (102 Coleoptera, 45 Collembola, 39 Araneae and 5 Orthoptera). This is the consequence, on the one hand, of the intensive collecting campaign only in the core area of the research (Pietrosul Mare), and on the other hand, of the natural differences between the habitats from the Pietrosul Mare and the other investigated habitats (the sub-alpine Cimpoiș spring, the riparian habitat near to a waterfall – Cascada Cailor, riparian-sylvan habitats in beech forests – in Valea Secii, Valea Cobășel). Nevertheless, we consider that the presented lists of species from all investigated sites (other than Pietrosul Mare core area) could be useful in covering the lack of information about the present invertebrate diversity in this important Biosphere reservation. For instance, a series of species like *Paranichus albipes*, *Scaphidium quadripunctatum*, etc. are considered absent or unknown for the Romanian fauna in the European faunal database (Fauna Europaea Web Service (2004) Fauna Europaea version 1.1, available online at <http://www.faunaeur.org>) despite their citations for the Romanian fauna since the last century (*Paranichus albipes* was cited by K. PETRI, 1912, E. CSIKI, 1946 as *Agonum ruficorne* Goeze) or, for other species like *Pseudogaurotina excellens*, strictly protected in Europe we had only some old or insufficient data concerning their local distribution. For other species like *Patrobis roubali*, (Coleoptera, Carabidae) – known up to now only in the Meridional Carpathians, *Folsomia spinosa*, *Xenylla maritima* (Collembola) – known up to present only for Dobrogea, our study enlarge the knowledge on their local distribution. Finally, *Rugathodes bellicosus* (Araneae, Theridiidae), *Glyphesis servulus* (Araneae, Linyphiidae), *Incestophantes frigidus* (Araneae, Linyphiidae), *Gnaphosa badia* (Araneae, Gnaphosidae), *Eusphalerum pallens* (Coleoptera, Staphylinidae), *Cryptophagus corticinus* (Coleoptera, Cryptophagidae), *Otiorrhynchus scaber* (Coleoptera, Curculionidae) *Thammurgus varipes* (Coleoptera, Scolytidae) – are for the **first time recorded for the Romanian fauna**.

For the Pietrosul Mare area (our core area of investigations) the accumulated data allow us to present a brief faunal and zoogeographic analysis (a statistical analysis will be presented by us in a future paper).

The occurrence of species per sampled area related to altitude, relative humidity (RH) and temperature recorded values is presented in Fig. 2. The placement of sampling areas on biotic zones, altitudes and the captured species is presented in Annex I.

The graphical representation (Fig. 2) of the faunal distribution indicates a similar trend in occurrence for the coleoptera and collembolan species (most of them hygrophilous and/or umbraticolous). In the lower limit of the sub-alpine zone

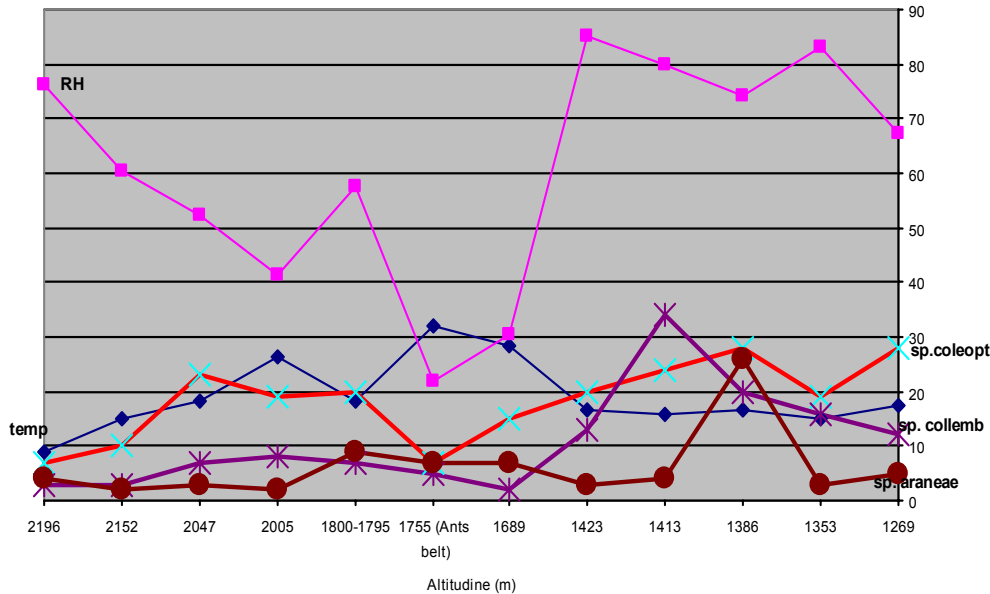


Fig. 2. – Repartition of species number per altitudinal gradient related to the temperature and relative humidity (RH) recorded values in the sampling period.

The graphical representation (Fig. 2) of the faunal distribution indicates a similar trend in occurrence for the coleoptera and collembolan species (most of them hygrophilous and/or umbraticolous). In the lower limit of the sub-alpine zone (between 1775–1989 m elevation), characterised by the lowest values of relative humidity and highest recorded values of temperature (xero-thermic habitat with sun-bathed stones), a semnificative decreasing in number of species of coleoptera followed by a similar trend of the collembolan species could be observed. In the same time, in this xero-thermic subalpine area, the spiders occurrence has a low ascendent trend. It is worth noticing that in this xero-thermic habitat the ant species are prevalent, lying as an „ant-belt” between alpine-superior subalpine zone and superior limit of forest.

The largest number of collembolan species was recorded in the spruce forest area with low productivity (at 1413 m elevation), which is the richest in vegetable debris and dead wood (Fig. 2, Annex I, Fig. 3). It is followed by the graphical peaks of coleoptera and spider species at the level of the spruce forest area with high productivity (1,386 m elevation), which is characterised by a litter with a vegetal layer consisting of *Oxalys* and *Luzula* species, and poorer in dead wood (Fig. 4). The most balanced area in ratio species between the Coleoptera, Collembola and Araneae is the spruce forest area with high productivity (1,386 m elevation, 16.7°C, 74% RH).

Fig. 3. – Litter detail in the old spruce forest with low productivity (1413 m elevation) – the richest habitat in Collembolan species.



Fig. 4. – Old spruce forest with high productivity (litter with vegetal layer consisting of *Oxalis* and *Luzula*. (1386 m) – the most balanced area in faunal composition.

For the Pietrosul Mare Scientific Reservation, the zoogeographic analysis indicates that the Araneae and Collembola are represented by a large number of widespread species (56% palaeartic species of Araneae, 30% cosmopolite species of Collembola) and the Orthoptera and Coleoptera are represented by species with more confined ranges (Fig. 4), the European elements being well represented for the all investigated taxonomic groups. The percent of endemic species (Carpathian endemites) has a significant variation between the studied taxonomic groups: 0% for Araneae and 1% for Collembola, to 25% for Coleoptera (from a total of 103 species) and 29% for Orthoptera (from a total of 14 species). As for the Coleoptera, the Carpathian endemites are prevalent in the alpine-subalpine zones (above the “ant-belt”) (Annex I).

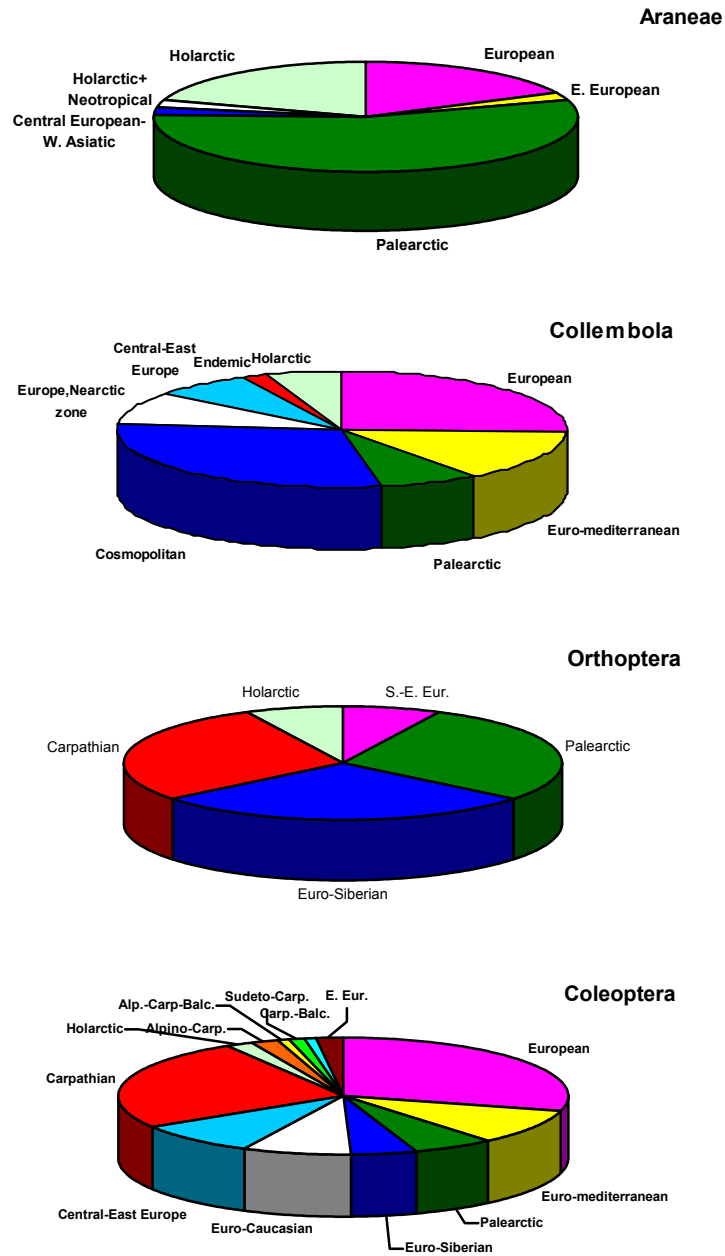


Fig. 5. – Percentage of zoogeographical elements for each investigated taxonomic group in the Pietrosul Rodnei Scientific Reservation (for species details see Annexes I–III).

4. CONCLUSIONS

With the main purpose to cover the informational gaps on the invertebrate fauna of the Rodnei Mountains Biosphere Reserve, our studies carried out in the years 2005 and 2006 led to the identification of 296 species of epigaeic, soil and subterranean species (73 Araneae, 61 Collembola, 35 Orthoptera and 127 Coleoptera) from six different epigaeic sites and seven caves. *Paranichus albipes*, *Scaphidium quadripunctatum* (Coleoptera), *Sminthurus viridis*, *Ceratophysella engadinensis*, *Hypogastrura socialis*, *Dicyrtomina ornata*, *Pseudachorutes parvulus*, *Allacma fusca*, *Heteraphorura carpatica*, *Plutomurus carpaticus*, *Choreutinula inermis*, *Folsomia spinosa*, *Onychiuroides pseudogranulosus*, *Hypogastrura sahlbergi*, *Protaphorura fimata*, *Protaphorura armata*, *Isotomurus palliceps*, *Deutonura plena*, *Willowsia buskii*, *Plutomurus unidentatus*, *Deuteraphorura silvaria*, *Hydroisotoma schaefferi* (Collembola) – considered absent or unknown for the Romanian fauna in the European faunal database (Fauna Europaea Web Service (2004), or catalogues (BOUSQUET, Y., 2003) were reconfirmed for the Romanian fauna – particularly for this Biosphere reservation. For *Pseudogaurotina excellens*, strictly protected in Europe, new data on its local distribution is given. For other species like *Patrobis roubali*, (Coleoptera, Carabidae) known at present only in the Meridional Carpathians, *Folsomia spinosa*, *Xenylla maritima* (Collembola) known up to now only for Dobrogea (GRUIA, M., 2000), our study enlarge the knowledge on their local distribution. Finally, *Rugathodes bellicosus* (Araneae, Theridiidae), *Glyphesis servulus* (Araneae, Linyphiidae), *Incestophantes frigidus* (Araneae, Linyphiidae), *Gnaphosa badia* (Araneae, Gnaphosidae), *Eusphalerum pallens* (Coleoptera, Staphylinidae), *Cryptophagus corticinus* (Coleoptera, Cryptophagidae), *Otiorrhynchus scaber* (Coleoptera, Curculionidae) *Thamnurgus varipes* (Coleoptera, Scolytidae) – are for the first time recorded for the Romanian fauna.

The systematic sampling of fauna in all altitudinal biotic zones of the Pietrosul Mare Scientific Reservation led to the observation of an altitudinal gradient in the faunal structure and species diversity, and underlined the high degree of endemism of the alpine-sub alpine zones for the Coleoptera followed by Orthoptera.

Our study represents the first contribution to the knowledge of the soil and subterranean fauna of Coleoptera, Orthoptera, Collembola and Araneae of the Rodnei Mountains Biosphere Reservation, carried out as an integrate research in order to observe the altitudinal gradient and differences in faunal and zoogeographic composition of this area.

ACKNOWLEDGEMENTS. The researches were carried out with the logistic and financial support of Darwin Initiative project “Youth participation in protected area management in Rodna Mountains, Romania” and CEEX-NATFORMAN Grant.

REFERENCES

- BOUSQUET, Y., in *Catalogue of Palaearctic Coleoptera*, I, Löbl & A. Smetana eds, Apollo Books, 819 p., 2003.
- COLDEA, G., *Muntii Rodnei. Studiu geobotanic*, Ed. Academiei, 1990.
- CSICKI, E., *Die Käferfauna des Karpaten-Beckens*, 798 p., Budapest, 1946.
- CSICKI, E., *Die Käferfauna des Radner Gebirges*. Acta Biol. **2**, 119–169, 1951.
- FAUNA EUROPAEA WEB SERVICE Fauna Europaea version 1.1, available online at <http://www.faunaeur.org>, 2004.
- FUHN, E., I., NICULESCU-BURLACU, FLORIANA, *Fauna Republicii Socialiste România, Arachnida, Fam. Lycosidae*, V (3), 256 p., 1971.
- GORAN, C., BUSUIOCEANU, O., in BLEAHU M., DECU, V., NEGREA, ȘT., PLEȘA, C., POVARĂ, I., VIEHMANN, I., *Peșteri din România*, p. 397., Ed. Științifică și Enciclopedică, 1976.
- GRUIA, MAGDALENA, *Collembola of the karstic system of Romania*, Memoires de Biospeologie, Tome XXVII, p. 53–60, 2000.
- JEANNEL, R., *Monographie des Trechinae. Monographie comparée et distribution géographique d'un groupe de Coléoptères* L'Abeille, Paris, Journal d'Entomologie, **33**, 1–592, 1927.
- JEANNEL, R., *Monographie des Trechinae. Monographie comparée et distribution géographique d'un groupe de Coléoptères. Les Trechini cavernicoles*. L'Abeille, Paris, Journal d'Entomologie, **35**, 1–808, 1928.
- MAICAN, SANDA, *Contributions to the knowledge of the Chrysomelid fauna (Coleoptera, Chrysomelidae) from Romanian Carpathians*. Acta Zoologica Universitatis Comenianae, **46** (2), 107–114, 2004.
- MANI, M., S., *Ecology and Biogeography of High Altitude Insects*. Series entomologica, vol. **4**, 527 p., Dr. W. Junk N.V. Publishers – The Hague, 1968.
- PETRI, K., *Siebenbürgens Käferfauna auf Grund ihrer Erforschung bis zum Jahre 1911*, Hermanstadt, 375, 1912.
- PETRI, K., *Ergänzungen und Berichtigungen zur Käferfauna Siebengürgens 1912*, Verhandlungen und Mitteilungen des Siebenbürgischen Vereins für Naturwiissenschaften zu Hermanstadt, LXXV–LXXVI, 165–206, 1925–1926.
- RADWAŃSKI J.M., FIERA C. & W.M. WEINER, A new species of *Protaphorura* Absolon, 1901 (Collembola: Onychiuridae: Onychiurinae) from Romania and a redescription of *Protaphorura glebata* (Gisin, 1952), *Annales zoologici* vol. **56**(3): 449–455, 2006.
- SERAFIM, R., Contributions to the knowledge of the distribution of Coccinellidae and Cerambycidae (Coleoptera) in Maramures Depression and Rodnei Mounatins, Romania. Travaux du Museum National d'Histoire Naturelle "Grigore Antipa", **37**: 95–115, 1997.

*"Emil Racovitza" Speleological Institute
 Calea 13 Septembrie nr. 13, Sect. 5, Bucharest, RO-050711
 **The National Park "Munții Rodnei" Administration
 Str. Principală nr. 1445, 427245 Rodna, jud. Bistrița Năsăud, Roumania

ANNEX I. A. The Species occurrence per altitude in the "Pietrosul Mare" Scientific Reserve
(core area of the Rodnei Mountains Biosphere Reserve)

ORD. ARANEAE (Det. Augustin NAE)

Species and distribution	Alpine zone				Sub alpine zone			Montane zone				
	2196	2152	2047	2005	1800-1795	1755*	1689	1423 (Ripisylv.)	1413	1393-1386	1353	1269
Fam. Segestridae 1. <i>Segestria senoculata</i> (Linnaeus, 1758) Pal.										+		
Fam. Theridiidae 2. <i>Robertus lividus</i> (Blackwall, 1834) Hol.										+		
3. <i>Steatoda bipunctata</i> (Linnaeus, 1758) Hol.										+		
Fam. Linyphiidae 4. <i>Anguliphantes monticola</i> (Kulczynski, 1882) Eur.												+
5. <i>Ceratinella major</i> Kulczynski, 1894 Pal.					+		+					
6. <i>Diplocephalus latifrons</i> (O.P.-Cambridge, 1872) Eur.								+				+
7. <i>Diplocephalus permixtus</i> (O.P.-Cambridge, 1871) Pal.								+				

Species and distribution	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripsislv.)	1413	1393–1386	1353	1269
8. <i>Diplocephalus picinus</i> (Blackwall, 1841) Pal.										+		
9. <i>Glyphesis servulus</i> (Simon, 1881) Eur.				+								
10. <i>Incestophantes frigidus</i> (Simon, 1884) Eur.						+						
11. <i>Leptyphanites leprosus</i> (Ohlert, 1865) Hol.										+		
12. <i>Megaleptyphanites nebulosus</i> (Sundevall, 1830) Hol.										+		
13. <i>Meioneta saxatilis</i> (Blackwall, 1844) Eur.										+		
14. <i>Micrargus herbigradus</i> (Blackwall, 1854) Pal.									+	+		
15. <i>Nerienne peltata</i> (Wider, 1834) Pal.												+
16. <i>Poecilonea variegata</i> (Blackwall, 1841) Hol.	+				+				+			
17. <i>Porrhomma pallidum</i> Jackson, 1913 Pal.										+		

Species and distribution	Alpine zone					Sub alpine zone				Montane zone				
	2196	2152	2047	2005		1800-1795	1755*	1689	1423 (Ripisy/v.)	1413	1393-1386	1353	1269	
18. <i>Tapinocyba biscissa</i> (O.P. - Cambridge, 1873) Pal.									+					
19. <i>Taranucmus bihari</i> Fage, 1931 E. Eur.											+		+	
20. <i>Tenuiphantes alacris</i> (Blackwall, 1853) Pal.								+			+		+	
• Fam. Tetragnatidae														
21. <i>Metellina menzei</i> (Blackwall, 1869) W. Pal.											+			
22. <i>Metellina segmentata</i> (Clerck, 1757) Pal.													+	
• Fam. Araneidae														
23. <i>Aculepeira ceropegia</i> (Walckenaer, 1802) Pal.								+						
24. <i>Araneus angulatus</i> Clerck, 1757 Pal.											+			
25. <i>Araneus triguttatus</i> (Fabricius, 1775) Pal.								+						
26. <i>Aranella alpica</i> (L. Koch, 1869) W. Pal.	+(1)										+			

Species and distribution	Alpine zone				Sub alpine zone			Montane zone				
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
27. <i>Araniella cucurbitina</i> (Clerck, 1757) Pal.										+		
28. <i>Parazygiella montana</i> (C.L. Koch, 1834) Pal.												+
29. <i>Parazygiella x-notata</i> (Clerck, 1757) Hol. + Neotropical										+		
• Fam. Lycosidae												
30. <i>Alopecosa aculeata</i> (Clerck, 1757) Hol.							+			+		
31. <i>Pardosa amentata</i> (Clerck, 1757) Eur.			+							+		
32. <i>Pardosa paludicola</i> (Clerck, 1757) Pal.					+							
33. <i>Pardosa saltuaria</i> (L. Koch, 1870) C. Eur. – W. As.					+	+						
34. <i>Pirata hygrophilus</i> Thorell, 1872 Pal.										+		
• Fam. Agelenidae												
35. <i>Tegenaria silvestris</i> L. Koch, 1872 Eur.										+		

Species and distribution	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
44. <i>Ditaea dorsata</i> (Fabricius, 1777) Pal.										+		
45. <i>Misumena vatia</i> (Clerck, 1757) Hol.										+		
46. <i>Xysticus bifasciatus</i> C.L. Koch, 1837 Pal.			+									
47. <i>Xysticus cristatus</i> (Clerck, 1757) Pal.							+					
• Fam. Salticidae												
48. <i>Sitticus rupicola</i> (C.L. Koch, 1837) Hol.							+			+		
49. <i>Sitticus saxicola</i> (C.L. Koch, 1846) Pal.										+		

Hol. – Holarctic, **Pal.** – Palaearctic, **Eur.** – European

Species and distribution	Alpine zone					Sub alpine zone				Montane zone			
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269	
Height (m)													
8. <i>Ceratophysella engadinensis</i> (Gisin, 1949) Cosm.			+						+				
9. <i>Ceratophysella silvatica</i> (Rusek, 1964) Eur.				+					+				
10. <i>Ceratophysella armata</i> (Nicolet, 1841) Cosm.									+			+	
11. <i>Hypogastrura socialis</i> (Uzel, 1891) Eur.+Neaect.				+									
12. <i>Hypogastrura sahlbergi</i> (Reuter, 1895) Cosm.									+				
13. <i>Hypogastrura tullbergi</i> (Schaffer, 1900) Eur.+Neaect.									+			+	
14. <i>Choreutimula inermis</i> (Tullb., 1871) Eur.									+				
15. <i>Schoetiella ununguiculata</i> (Tullb., 1869) Eur.+Neaect.									+		+		
16. <i>Xenylla maritima</i> Tullb., 1869 Cosm.									+				
• Fam. Onychiuridae													
17. <i>Tetradontophora bielensis</i> (Waga, 1842) C.-E. Eur.									+			+	

Species and distribution	Alpine zone					Sub alpine zone			Montane zone				
	2196	2152	2047	2005		1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
Height (m)													
<i>18. Kalaphorura tuberculata</i> (Moniez, 1840) Eur.-Med.											+		
<i>19. Protaphorura ionescui</i> Radwanski, Fiera, Weiner, 2006 End. Carp.											+		
<i>20. Protaphorura armata</i> (Tullb., 1869) Cosm.											+		
<i>21. Protaphorura fimata</i> (Gisin, 1952) Eur.										+			
<i>22. Onychiuroides subgranulosus</i> (Gama, 1964) Eur.-Med.										+			
<i>23. Onychiuroides pseudogranulosus</i> (Gisin, 1951) Eur.-Med.										+			
<i>24. Heteraphorura carpatica</i> (Stach, 1954) Eur.-Med.			+							+			+
<i>25. Hymenaphorura sibirica</i> (Tullb., 1876) Cosm.						+						+	
• Ord. Entomobryomorpha													
• Fam. Tomoceridae													
<i>26. Pogonognathellus flavescens</i> (Tullb., 1871) Cosm.		+	+	+			+		+	+	+	+	+

Species and distribution	Alpine zone					Sub alpine zone				Montane zone			
	2196	2152	2047	2005		1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
27. <i>Tomocerus minor</i> (Lubbock, 1862) Cosm.						+	+	+	+	+	+	+	
28. <i>Tomocerus vulgaris</i> (Tullb., 1871) Cosm.			+	+							+		
29. <i>Plutomurus carpaticus</i> Rusek&Weiner, 1978 C.-E. Eur.										+	+		
• Fam. Isotomidae													
30. <i>Pseudisotoma sensibilis</i> (Tullb., 1876) Hol.										+	+		
31. <i>Folsomia quadrioculata</i> (Tullb., 1871) Cosm.											+		
32. <i>Folsomia inoculata</i> (Stach, 1947) Pal.											+		
33. <i>Folsomia alpina</i> (Kseneman, 1936) Eur.										+			
34. <i>Folsomia spinosa</i> Kseneman, 1936 Pal.										+			
35. <i>Folsomia listeri</i> (Bagnall, 1939) Eur.										+			

Species and distribution	Alpine zone					Sub alpine zone			Montane zone			
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
36. <i>Isotomurus palustris</i> (Muller, 1776) Cosm.								+				
37. <i>Isotomurus alticolus</i> (Carl, 1899) Eur.-Med.								+				
38. <i>Isotomurus palliceps</i> (Uzel, 1891) Eur.	+											
39. <i>Desoria violacea</i> (Tullb., 1876) Eur.								+	+			
● Fam. Entomobryidae												
40. <i>Orchesella alticola</i> Uzel, 1890 C.-E. Eur.	+	+			+				+		+	
41. <i>Orchesella spectabilis</i> (Tullb., 1871) Eur.												
42. <i>Orchesella pontica</i> Ionesco, 1915 C.-E. Eur.									5			
43. <i>Orchesella bifasciata</i> Nicolet, 1842 Eur.			+	+	8	+					+	
44. <i>Lepidocyrtus cyaneus</i> (Tullb., 1871) Eur.+Nearct.					+	+		+	20	+	+	+
45. <i>Lepidocyrtus lignorum</i> Fabricius, 1781 Cosm.		+	+	+				+	+	+		+

Species and distribution	Alpine zone					Sub alpine zone			Montane zone				
	2196	2152	2047	2005		1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
46. <i>Lepidocyrtus lanuginosus</i> Gmelin, 1788 Hol.		+											
47. <i>Wilowsia buski</i> (Lubbock, 1869) Hol.											+		
48. <i>Entomobrya lanuginosa</i> (Nicolet, 1841) Pal.						+							
49. <i>Entomobrya nivalis</i> (Linne, 1756) Cosm.							+		+	+		+	
50. <i>Entomobrya multifasciata</i> (Tullb., 1871) Cosm.										+		+	
• Ord. Symphypleona													
• Fam. Katiannidae													
51. <i>Sminthurinus elegans</i> (Fitch, 1836) Eur.+Nearct.										+			+
• Fam. Sminthuridae													
52. <i>Sminthurus viridis</i> (Linne, 1758) Eur.-Med.			+	+								+	
53. <i>Allacma fusca</i> (Linne, 1758) Eur.-Med.										+			+
• Fam. Dicyrtomidae													
54. <i>Dicyrtomina ornata</i> (Nicolet, 1841) Eur.-Med.									+	+		+	+

Height (m)	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
Species and distribution												
55. <i>Dicyrtoma fusca</i> (Lubbock, 1873)									+			
Cosm.												

Cosm. – Cosmopolite, **Hol.** – Holarctic, **Pal.** – Palaearctic, **Nearct.** – Nearctic, **C.-E.** – Central-Eastern, **Eur.** – European, **Eur.-Med.** – Euro-Mediterranean, **Carp.** – Carpathian

ANNEX I. C. The Species occurrence per altitude in the “Pietrosul Mare” Scientific Reserve
(core area of the Rodnei Mountains Biosphere Reserve)

ORD. COLLEOPTERA (Det. Eugen NITZU)

Species and distribution	Alpine zone					Sub alpine zone					Montane zone				
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269			
• Fam. Carabidae															
1. <i>Carabus aurontens escherii</i> Pallardi, 1825 Carp. (ssp.)			+	+	+		+								
2. <i>Carabus silvestris transsylvanicus</i> Dejean 1826 Carp. (ssp.)		+	+	+	+		+								
3. <i>Carabus linnei</i> Panzer, 1812 E. Alp.-Carp.							+			+		+			
4. <i>Carabus fabricii malachiticus</i> Thomson, 1875 Carp. (ssp.)			+	+											
5. <i>Carabus irregularis</i> Fabricius, 1792 C.-E. Eur.										+					
6. <i>Carabus arcensis carpathus</i> Bom, 1902 (= <i>C. arcensis carpathus</i> , = <i>C. arcensis eremita</i> Waldh.) Carp.			+		+										
7. <i>Carabus violaceus wolffi</i> Dejean, 1826 E. Eur. (ssp.)								+			+				
8. <i>Cychrus caraboides</i> Linnaeus, 1758 Eur.ec							+	+			+				

Species and distribution	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
19. <i>Pterostichus (Calopterus) pilosus wellensii</i> Drapiez, 1819 Carp.				+	+		+	+	+	+	+	+
20. <i>Pterostichus (Pentrophilus) foveolatus</i> Duftschmid, 1812 Carp.			+	+	+		+	+	+	+	+	+
21. <i>Pterostichus (Oreophilus) jurinei</i> Panzer, 1803 Carp.		+	+		+			+	+	+	+	+
22. <i>Pterostichus (Eosteropus) ruftarsis</i> Dejean, 1828 Carp.			+	+				+				
23. <i>Poecilus szeptigetii</i> Csiki, 1908 Carp.					+							
24. <i>Platyderus rufus</i> Duftschmid, 1812 Eur.					+			+	+	+	+	+
25. <i>Agonum hypocrita</i> Apfelbeck, 1904 Eur.-Ca.							+					
26. <i>Calathus metallicus</i> Dejean, 1828 Carp.-Balc.			+	+	+						+	
27. <i>Amara (Celia) misella</i> L. Miller, 1868 Carp.				+								
28. <i>Harpalus atratus</i> Latreille, 1804 Euro.-Ca.										+	+	

	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
Height (m)												
Species and distribution												
• Fam. Sphaeritiidae												
29. <i>Sphaerites glabratus</i> (Fabricius, 1792) Eur.												+
• Fam. Staphylinidae												
30. <i>Megarhtrus sinuaticollis</i> (Boisduval Lacordaire, 1835) Eur.-Sib.				+					+			
* <i>Eusphalerum pallens</i> Heer, 1841 C.Eur.											+	
31. <i>Omalium validum</i> Kraatz, 1857 Eur.					+				+			+
32. <i>Deliphrosoma prolongatum</i> Rottenberg, 1873 C.-E. Eur.									+			
33. <i>Niphetodes semicarinatus</i> Zerche, 1990 N. Carp.		+										
34. <i>Atreucus affinis</i> Paykull, 1789 (<i>Baptolinus</i>) Eur.-Sib.										+		
35. <i>Astrapeus ulmi</i> Rossi, 1790 Eur.-Med.										+		
36. <i>Othius melanocephalus</i> (Gravenhorst, 1806) Eur.-Ca.							+					
37. <i>Othius lapidicola</i> Märkel & Kiesenwetter, 1848 Eur.-Med.	+						+			+		

Species and distribution	Alpine zone					Sub alpine zone			Montane zone				
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269	
38. <i>Quedius (Quedionuchus) cinctus</i> Paykull, 1790 Eur.-Med.								+		+			
39. <i>Quedius (Raphirus) fumatus</i> Stephens, 1833 Eur.					+		+						
40. <i>Quedius (Raphirus) transsylvanicus</i> Weise, 1875 Carp.					+			+				+	
41. <i>Quedius mesomelinus</i> Marsham, 1802 Eur.								+			+		
42. <i>Ocypus (Goerius) biharicus</i> J. Müller, 1926 Carp.												+	
43. <i>Ocypus (Goerius) nitens</i> Schrank, 1781 (= <i>similis</i> Fabricius, 1792) Eur.							+						
44. <i>Bryophacis rufus</i> Erichson, 1839. Eur.			+	+								+	
45. <i>Tachinus elongatus</i> Gyllenhal, 1810 Eur.-Sib.			+	+									
46. <i>Tachinus pallipes</i> Gravenhorst, 1806 Eur.-Sib.					+			+	+	+		+	

Species and distribution	Alpine zone				Sub alpine zone			Montane zone				
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
91. <i>Timarcha metallica</i> (Laicharting, 1781) Eur.						+						
• Fam. Curculionidae												
92. <i>Plinthus tischeri</i> Germar E. Eur.									+			
93. <i>Otiorrhynchus orbicularis</i> (Herbst, 1795) C.-E. Eur.			+		+							
94. <i>Otiorrhynchus scaber</i> (Linnaeus, 1758) [<i>ambigener</i>]* Eur.			+						+			
95. <i>Otiorrhynchus valachiae</i> <i>kelesenyii</i> Fritvaldsky Carp.					+							
96. <i>Otiorrhynchus uncinatus</i> Germar, 1824 Eur. (boreo-mont.)									+			
97. <i>Otiorrhynchus (Dodecastichus)</i> <i>geniculatus</i> (Germar, 1817) C.-E. Eur.							+					
98. <i>Otiorrhynchus coecus</i> Germar, 1824 (= <i>niger</i> Fabricius, 1775)												
99. <i>Hyllobius abietis</i> (Linnaeus, 1758) Eur. (mont.)									+			
100. <i>Phyllobius cinerascens</i> (Fabricius, 1792) C. Eur.							+					

Species and distribution	Alpine zone			Sub alpine zone			Montane zone					
	2196	2152	2047	2005	1800–1795	1755*	1689	1423 (Ripisylv.)	1413	1393–1386	1353	1269
• Fam. Scolytidae												
<i>101. Tomicus (Myelophilus) minor</i> (Hartig, 1834) Eur.									+	+		
* <i>102. Thammurgus varipes</i> Eichhoff, 1878 Eur.										+		

C.-E. – Central-Eastern, **N** – Northern, **W** – Western, **E. Alp.-Carp.** – E. Alpino-Carpathian, **Eur.** – European, **Eur.-Ca.** – Euro-Caucasian, **Eur.-Med.** – Euro-Mediterranean, **Eur.-Sib.** – Euro-Siberian, **Balc.** – Balkans, **Carp.** – Carpathian, **Pal.** – Palaeartic, **Hol.** – Holarctic.

ANNEX II. The list of species of Orthoptera from the Rodnei Mountains Scientific Reservation
(leg. et det. Claudiu IUȘAN)

Species/site and habitat	Izvorul Tăușoarelor (915 m elev.)	Pietrosul Mare (1370–1800 m)	Dealul Popii (near to Baia lui Schneider) 943 m	Valea Cobasel 956 m	Piatra Rea 965 m	Distribution
Fam. Acrididae						
1. <i>Chorthippus biguttulus</i> Linne, 1758			+ Meso-xerophilic meadows, cliffs chorto-geobiont	+	+	Palae-arcitic
2. <i>Chorthippus brunneus</i> Thunberg, 1815	+ Meso-xerophilic meadows, cliffs (chorto-geobiont)	+			+	Palae-arcitic
3. <i>Chorthippus dorsatus</i> Zetterstedt, 1821	+ Meso-hygrophilic meadows (chortobiont)		+			Euro-Siberian
4. <i>Chrysochraon dispar</i> Germar, 1834		+ Hygrophilic meadows (chortobiont)	+	+		Euro-Siberian
5. <i>Chorthippus pullus</i> Philippi, 1830			+ Mesophilic meadows, cliffs chortobiont			Central-European
6. <i>Chorthippus scalaris</i> Fischer, 1846				+ Mesophilic meadows chorto-biont		Euro-Siberian
7. <i>Gomphocerus rufus</i> Linnaeus, 1758				+ Mesophilic meadows, shrubs chorto – thamno-biont		Euro-Siberian

Species/site and habitat	Izvorul Tăușoarelor (915 m elev.)	Pietrosul Mare (1370–1800 m)	Dealul Popii (near to Baia lui Schneider) 943 m	Valea Cobasel 956 m	Piatra Rea 965 m	Distribution
8. <i>Myrmeleotettix maculatus</i> Thunberg, 1815					+ Meso-xerophilic meadows, cliffs. geo-chortobiont	Palae-arctic
9. <i>Omocestus haemorrhoidalis</i> Charpentier, 1825	+ Montane mesophilic meadows (geo-chortobiont)	+				Palae-arctic
10. <i>Omocestus viridulus</i> Linne, 1758	+ Montane meadows (chortobiont)	+				Euro-Siberian
11. <i>Psophus stridulus</i> Linne, 1758	+ Montane mesophilic meadows (geo-chortobiont)					Euro-Siberian
12. <i>Stenobothrus stigmaticus</i> Rambur, 1839	+ Montane pastures (chortogeobiont)					Central-south-European
13. <i>Stenobothrus lineatus</i> Panzer, 1796				+ Mesophilic meadows, clearings in forests chortobiont		Euro-Siberian
Fam. Catantopidae 14. <i>Miramella ebneri carpathica</i> Galvagni, 1953		+ Subalpine meso-hygrophilic meadows (chortobiont)				Carpathians (end.)
15. <i>Pseudoopodisma fieberi</i> Scuder, 1897		+ Montane, meso-philic meadows chortobiont				South-East-European

Species/site and habitat	Izvorul Tăușoarelor (915 m elev.)	Pietrosul Mare (1370–1800 m)	Dealul Popii (near to Baia lui Schneider) 943 m	Valea Cobasel 956 m	Piatra Rea 965 m	Distribution
Fam. Gryllidae 16. <i>Gryllus campestris</i> Linne, 1758	+ Xeric meadows geobiont			+		Palae-arctic
Fam. Gryllotalpidae 17. <i>Gryllotalpa gryllotalpa</i> Linne, 1758	+ Mesophilic meadows geobiont	+		+		Palae-arctic
Fam. Tettigoniidae 18. <i>Decticus verrucivorus</i> Linne, 1758	+ Mesophilic meadows, shrubs (chorto-thamnobiont)	+		+		Euro-Siberian
19. <i>Isophya brevipennis</i> Brunner, 1878		+ Montane meso-philic meadows (chortobiont)				Carpathians (end.)
20. <i>Isophya pienensis</i> Maran, 1954		+ Montane meadows (chortobiont)				Carpathians (end.)
21. <i>Leptophyes albovittata</i> Kollar, 1833			+ Shrubs (Thamnobiont)	+		West-Palae-arctic
22. <i>Metrioptera roeseli</i> Hagenbach, 1822		+ Hygro-philic meadows (chortobiont)				Euro-Siberian
23. <i>Metrioptera brachyptera</i> Linne, 1761			+ Montane meso-philic meadows (chortobiont)			Euro-Siberian
24. <i>Pachytrachis gracilis</i> Brunner, 1861	+ Shrubs, mesophilic meadows (chorto-thamnobiont)					South-East-European
25. <i>Phaneroptera falcata</i> Poda, 1761				+ Shrubs thamnobiont		Euro-Siberian

Species/site and habitat	Izvorul Tăușoarelor (915 m elev.)	Pietrosul Mare (1370–1800 m)	Dealul Popii (near to Baia lui Schneider) 943 m	Valea Cobasel 956 m	Piatra Rea 965 m	Distribution
26. <i>Pholidoptera fallax</i> Fischer, 1853			+ Mesophilic meadows, shrubs (chorto-thamnobiont)			Central Asian - South-European
27. <i>Pholidoptera griseoptera</i> De Geer, 1773			+ Shrubs (thamnobiont)			European
28. <i>Pholidoptera transylvanica</i> Fischer, 1853		+ Meso-hydrophilic meadows, shrubs thamnobiont – chortobiont		+	+	Carpathians (end.)
29. <i>Platycleis grisea</i> Fabricius, 1781					+ Meso-xerophilic meadows, cliffs. Chortobiont	Central-European
30. <i>Poecilimon schmidti</i> Fieber, 1853					+ Meso-xerophilic meadows, cliffs, shrubs thamnobiont	South-East-European
31. <i>Tettigonia cantans</i> Fuessly, 1775			+ Shrubs (thamnobiont)	+		Euro-Siberian
32. <i>Tettigonia viridissima</i> Linne, 1758	+ Shrubs (Thamnobiont)	+	+	+		Palae-arctic

Species/site and habitat	Izvorul Tăușoarelor (915 m elev.)	Pietrosul Mare (1370–1800 m)	Dealul Popii (near to Baia lui Schneider) 943 m	Valea Cobasel 956 m	Piatra Rea 965 m	Distribution
Fam. Tetrigidae <i>33. Tetrix bipunctata</i> Linne, 1758				+ Meso-xerophilic meadows, cliffs. Geobiont	+	Euro-Siberian
<i>34. Tetrix nutans</i> Hagenbach, 1822			+ Litter, meso-xerophilic meadows (geobiont)			Palae-arctic
<i>35. Tetrix subulata</i> Linne, 1761		+ Hygro-philic meadows (chorto-geobiont)				Holarctic