Studii şi Cercetări	Mai 2017	Biologie	26/2	67-74	Universitatea"Vasile Alecsandri" din Bacău

RESEARCHES REGARDING THE INVERTEBRATE FAUNA IN THE EDAPHIC ENVIRONMENT (LIMESTONE LITHOCLASTIC SOIL) IN THE RUDĂRIȚEI KEYS

Magdalin Leonard Dorobăț, Eugen Nitzu, Ionuț Popa, Andrei Giurginca, Augustin Nae, Ştefan Baba, Codruța Mihaela Dobrescu

Key words: *Rudărița Keys (Rudărița), Leaota, invertebrate fauna, edaphic, litoclastic limestone soil*

INTRODUCTION

Rudăriței Keys are located in the Leaota Massif, which is a part of the Bucegi Mountains Group, the Meridional Carpathians; though not easily accessible, they have not been researched nearly at all from the micro-fauna (the invertebrate fauna) perspective, as well as the whole Leaota Massif. From this reason, our studies have focused on this mountain massif and they have been located in the north-western region of Leaota, a sector with geological diversity, where both limestone and mezo-metamorphical crystalline schist develop. This limestone sector of the mountains, in turn, represents an extension, a continuing part of the karst that had developed in the neighboring mountains, Piatra Craiului. In the area of the Keys with the same name, which represent a component of the karstic sector in the north-western part of Leaota Massif, we installed an ecologic stationary to study the distribution of the some main taxonomic groups of invertebrates.

MATERIALS AND METHODS

To collect the fauna material in the field, we have placed an ecologic stationary in the edaphic environment, in a limestone litho-soil (Fig. 1), placed on the left bank of Rudărița Brook (Fig. 2). The GPS coordinates that define the position of the stationary are: N 45 ° 24'29.4 "; E 25 ° 15'50.2 ", the altitude being 985 meters. The limestone litho-klasts had sizes of centimeters or decimeters (Dorobăț, 2016). The stationary site is in contact with the phytocoenoses of the forest that belong to the **91V0 Dacian Beech Forest (*Symphyto-Fagion*)** (Gafta & Mountford, 2008; Doniță, 2005).

The collecting of the captured fauna material in the ecologic stationary has covered all the seasons: spring, summer and autumn. The collecting period was July 2014 – November 2015).

The samples with captured fauna material were collected on a monthly basis. To collect the fauna material, we have placed five Barber traps on the left bank of Rudărița, on the top of an imaginary square with a 5 meters side, and another trap in the middle of the square (Fig. 3). We have used a light attractant that we have spread on the walls of the trap as conservation liquid, we have used technical ethylic alcohol, 70° or, when the weather was warm, ethylene glycol, which evaporated much harder. The traps were left to function for 10 days/month.

Fig. 1. Limestone litho-soil on the ecologic stationary, Rudărița Keys (Foto Dorobăț L.)

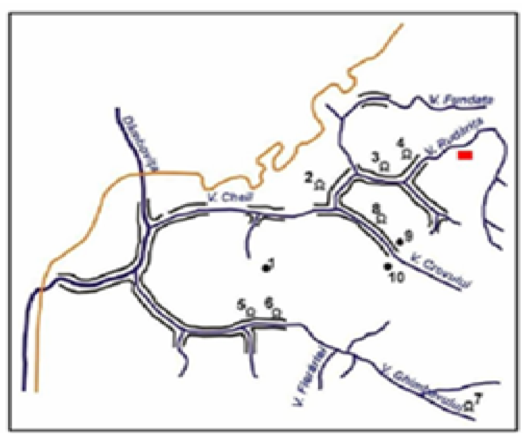

Fig. 2. The karstic sector in the north-western Leaota (1. Pereți Pit Cave; 2. Colțul Surpat Cave; 3. Uluce Cave; 4. Fulga Cave; 5. Decebal Cave; 6. Mare (Great) Cave; 7. Avene Cave; 8. Emilian Cristea Cave; 9. Crovului Pit Cave; 10. Perete Pit Cave (from Murătoreanu, 2009) Keys sector

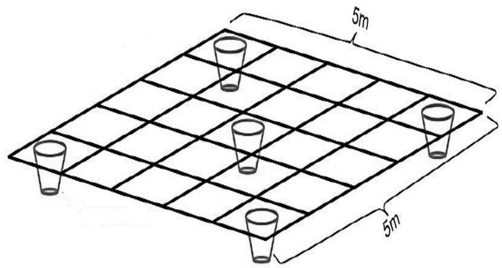

Fig. 3. Barber traps layout (from Nae, 2010)

The registration of the abiotic parameters – relative humidity (RH) and the temperature (T) was possible, by placing, at the level of the soil, a DT 171 data-logger, camouflaged in the litter and protected against direct precipitations which might have destroyed it. The device was set such that it would register the values of the RH and T ecologic factors from two to two hours. The Ph was measured with a TECPEL PH 707 device. Alongside the collection of the captured material, the data-logger registered data was also downloaded.

The collected material has been the subject of a primary selection of the main taxonomic groups: aranee, coleopteran, collembola, diplopoda, isopoda, chilopoda, the species being subsequently determined in the laboratories of the Speleology “Emil Racovitza” Institute in Bucharest.

RESULTS AND DISCUSSIONS

In the Rudărița ecologic stationary, subsequently to the processing of the observation on the main ecologic factors, relative humidity (RH) and temperature (T), observations made in the data-logger that has been placed on the soil, we have reached the following results, which are synthetically displayed below (Fig. 4):

Observation period: August – November 2014; April – August 2015.

- The maximum average monthly temperature has been registered in August 2015 and reached 20.44°C.
- The maximum temperature on the soil was 42.8°C in June 2015, 12:09; such high values are possible only if the sun rays fall directly on the soil, thus directly on the data-logger (the device was placed at that time (June 2015) under a glass recipient, which looked like trash, in order not to be detected by individuals (we exclude this value of the temperature, considering it to be influenced by the magnifying glass effect generated by the glass and not specific to the area). Subsequently, we have removed the glass and we placed the data-logger between two rocks. In order to accurately reproduce the observations, we though kept the same dysfunctional value in the table.
- The minimum average monthly temperature was 7.15°C in November 2014.
- The minimum temperature for the whole observation period was 0°C, registered on April 6th 2015, at 3:13 and 5:13 and on April 8th 2015, at 23:13.
- The maximum value of the relative humidity monthly average was 91.13% in May 2015.
- The minimum value of the RH monthly average was 59.14% in August 2014.
- The maximum value of the RH was 100%, registered during more hours between May 22nd and May 29th and June 4th and 5th 2015.
- The minimum value of the RH was 32% and was reached on July 10th 2015, at 3:08; a very close value, of 32.4% was reported on August 18th 2014, at 18:30.
- The average monthly temperature for the whole period was 14.01°C.
- The average monthly relative humidity for the whole period is 71.82%.
- For late autumn month, the minimum temperature was 5.3°C for October, the minimum temperature decreases slowly, from 7.6°C (Fig. 5.a.). ($\Delta T_{min\ October}$ = 2.3°C); the minimum temperature decreases faster in November, from 5.2°C to 2.3°C (Fig. 5.b) ($\Delta T_{min\ November}$ = 2.9°C).

The measured value of the soil Ph has floated between 7.1 – 7.3 units in the area of the stationary.

As for the taxonomic analysis on units that are lower than the subphylum (overclass, class, under-class, over-order, order, infra-order), there are many ranking systems as a result of some different opinions amongst the arthropods’ groups specialists.

Based on the collected material, a total number of 143 taxons of Phylum Arthropoda have been identified, which, from the systematic perspective, belong to the Chelicerata, Crustacea, Hexapoda and Myriapoda subphylum; the largest number is the one of the coleopteran species, namely 68 species, representing 47% of the total. Then come the 47 species of collembolan, representing 33% of the total. We then enumerate, downwards, the diplopoda, with 11 species (8% of the total), the araneae, with 8 species (6% of the total), then the isopodan and the chilopoda with 5, respectively 4 captured species (approximately 3% of the total each) (Fig.6).

Of a total of 1126 individuals, collected in the Barber traps in the Rudărița stationary, the collembola group is the best represented, with 685 captured individuals, representing 61%, followed by the coleopteran with 299 individuals (26%), then diplopoda, with 82 individuals (7%), isopoda 29 individuals, representing 3% of the total. Downwards araneae, with 21 individuals (2 %) come the and the last ones, the chilopoda, with only 10 captured individuals (representing only 1% of the total number.

AUGUST 2014		
	TEMPERATURE	HUMIDITY
AV. VAL	20.44	59.14
MAX. VAL	28.20	77.70
MIN. VAL	12.40	32.40

SEPTEMBER 2014		
	TEMPERATURE	HUMIDITY
AV. VAL.	15.45	61.81
MAX. VAL.	25.10	89.90
MIN. VAL	8.20	35.30

OCTOBER 2014		
	TEMPERATURE	HUMIDITY
AV. VAL.	10.86	70.86
MAX. VAL.	20.10	81.80
MIN. VAL.	5.30	45.00

NOVEMBER 2014		
	TEMPERATURE	HUMIDITY
AV. VAL.	7.15	66.64
MAX. VAL.	11.40	85.60
MIN. VAL.	2.30	42.40

APRIL 2015		
	TEMPERATURE	HUMIDITY
AV. VAL	10.82	79.46
MAX. VAL	31.00	95.00
MIN. VAL	0	39.70

MAY 2015		
	TEMPERATURE	HUMIDITY
AV. VAL	11.72	91.13
MAX. VAL	34.90	100
MIN. VAL	3.50	51.20

JUNE 2015		
	TEMPERATURE	HUMIDITY
AV. VAL	15.97	82.39
MAX. VAL	42.80	100
MIN. VAL	6.70	44.50

JULY 2015		
	TEMPERATURE	HUMIDITY
AV. VAL	16.24	64.55
MAX. VAL	20.20	79.70
MIN. VAL	10.50	32.00

AUGUST 2015		
	TEMPERATURE	HUMIDITY
AV. VAL	17.40	70.44
MAX. VAL	21.30	88.70
MIN. VAL	13.40	44.10

Fig. 4. Mounthly values of the environmental factors temperature and relative humidity (average, maximum and minimum value)

The monthly variations of the cumulated abundances of the species and the wealth that is specific to the Rudărița ecologic stationary are displayed in the following graphics, for all the six taxonomic groups (Fig. 7-18).

By analyzing the synthetically displayed data in the radar-diagrams, we can notice the following:

- in the cases of the araneae, both the specific diversity and the cumulated abundance have registered very low values (Fig. 7 and Fig. 8). In August, the highest numbers of individuals and species were noticed.
- as for the collembolan, the most specific diversity has been noticed in July: the cumulated abundance in the case of the collembolan species reaches its peak one month later, in August (Fig. 9, 10). The diversity of species decreases quite slow, between August and October, as well as the cumulated abundance, with a higher decrease between August and October. The values of the cumulated abundance, and also of the larger species are high for average high temperature and they lower, reaching zero, when minimum temperatures of lower than 3- 4°C are registered.

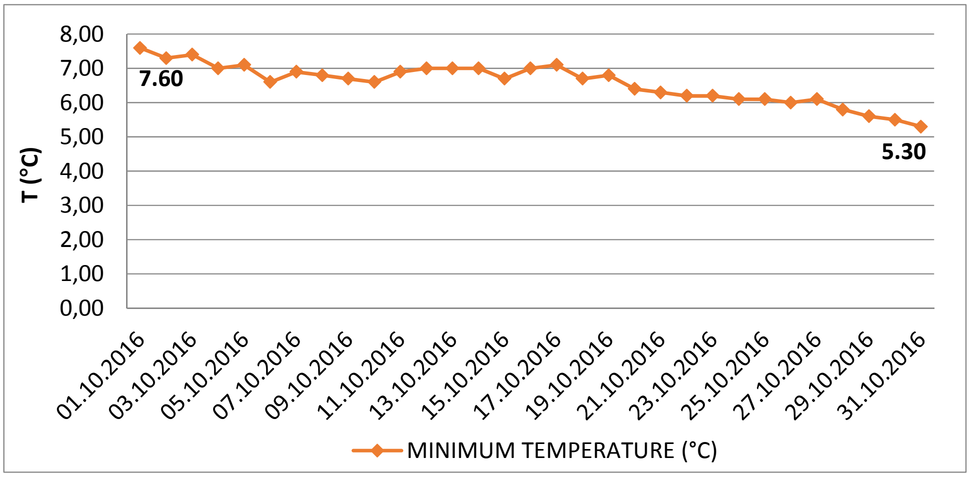

Fig. 5a. The variation of minimum daily temperature (°C) in October

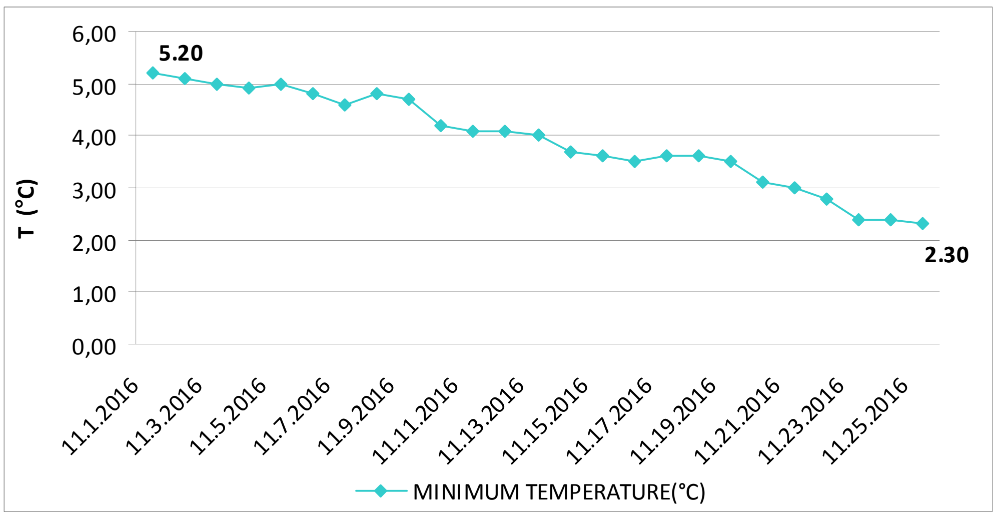

Fig. 5b. The variation of minimum daily temperature (°C) in November

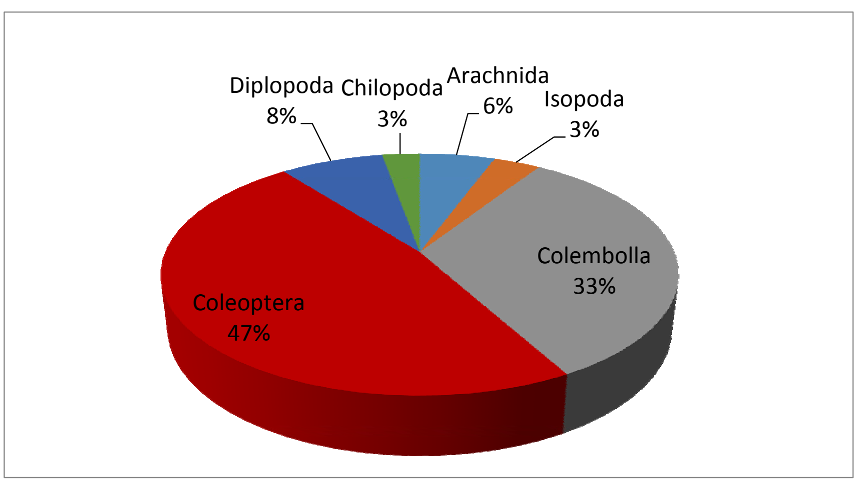

Fig. 6. The distribution of the six invertebrate groups in edaphic, Rudărița stationary

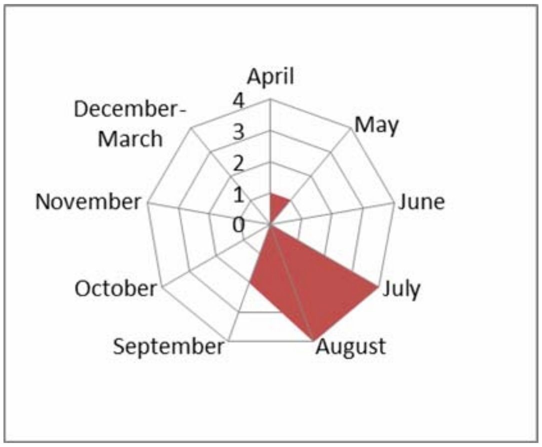

Fig. 7. The radar diagram of the araneae species' diversity from the edaphic soil on stationaries and months

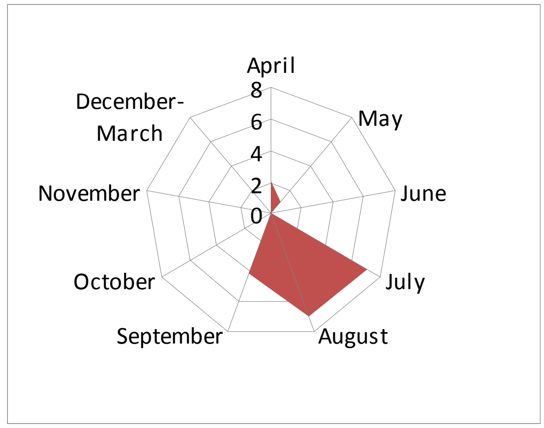

Fig. 8. The and months radar diagram of the cumulated abundance of the araneae species from the edaphic soil on stationaries

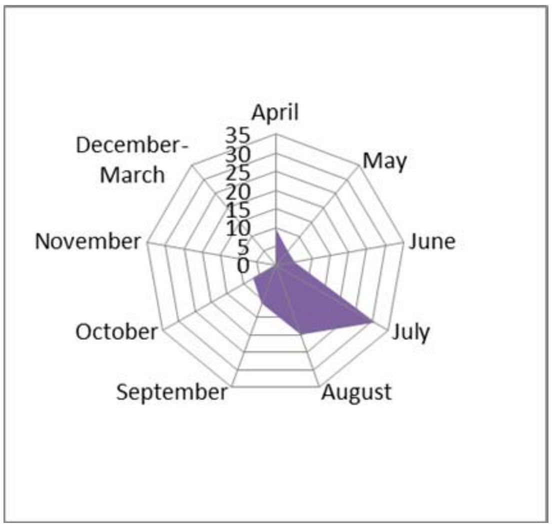

Fig. 9. The radar diagram of the collembolan species' diversity from the edaphic soil on stationaries and months

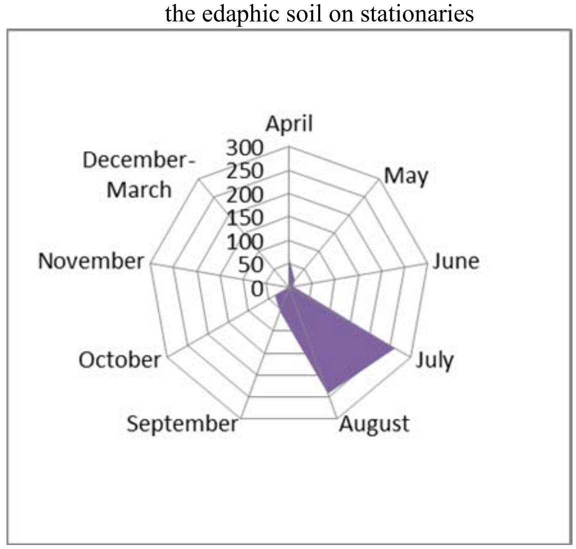

Fig. 10. The and months radar diagram of the cumulated abundance of the collembolan species from the edaphic soil on stationaries

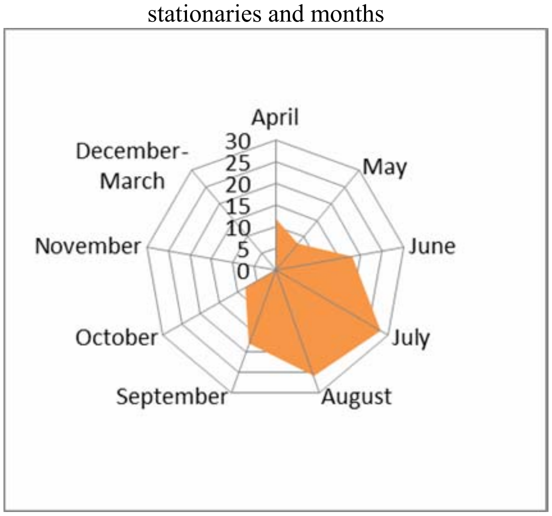

Fig. 11. The radar diagram of the coleopteran species' diversity from the edaphic soil on stationaries and months

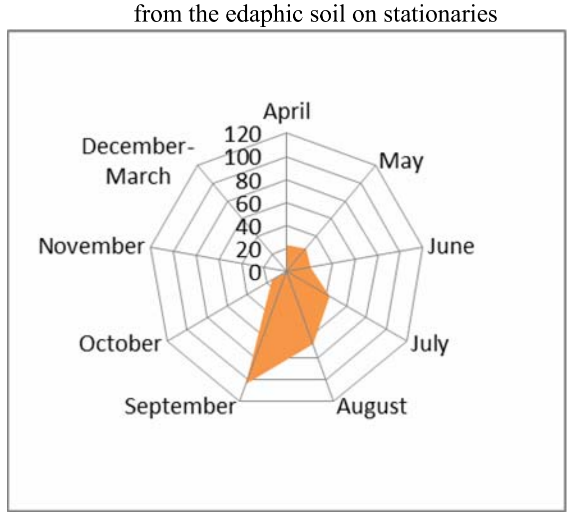

Fig. 12. The and months radar diagram of the cumulated abundance of the coleopteran species from the edaphic soil on stationaries

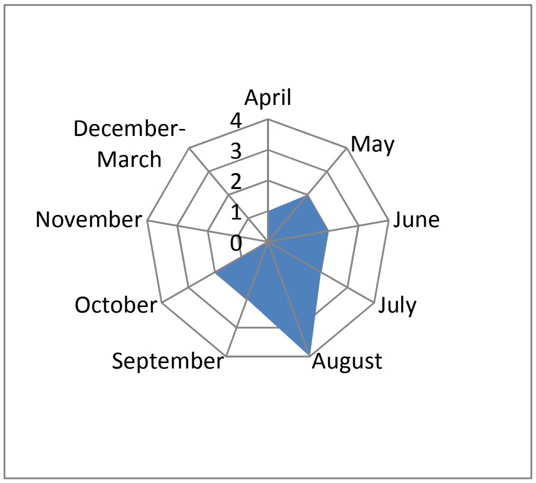

Fig. 13. The radar diagram of the isopods species' diversity from the edaphic soil on stationaries and months

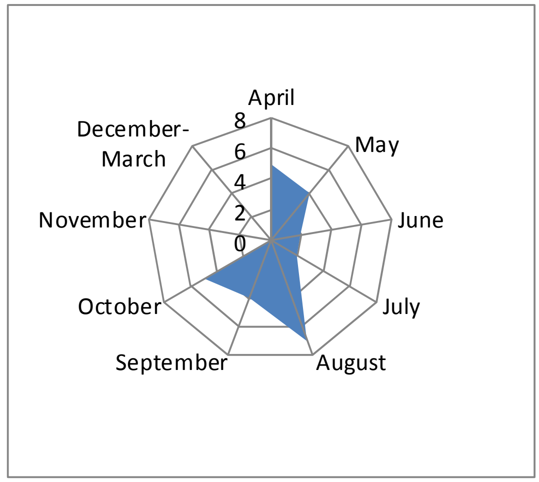

Fig. 14. The and months radar diagram of the cumulated abundance of the isopods species from the edaphic soil on stationaries

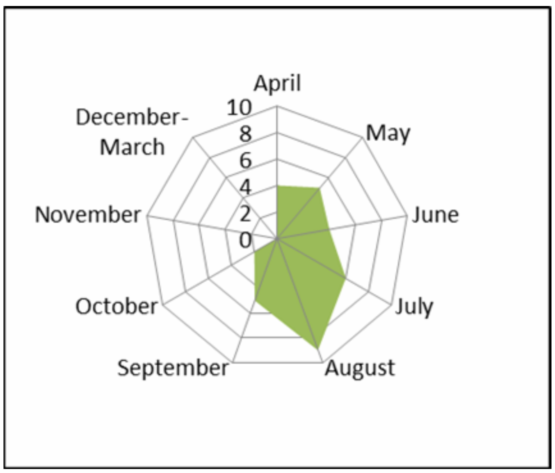

Fig. 15. The radar diagram of the diplopoda species' diversity from the edaphic soil on stationaries and months

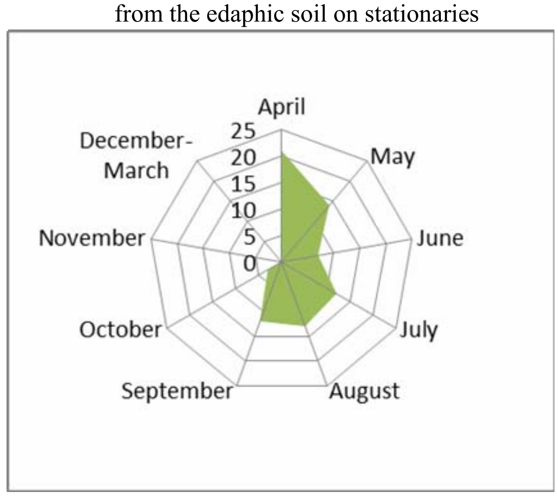

Fig. 16. The and months radar diagram of the cumulated abundance of the diplopoda species from the edaphic soil on stationaries

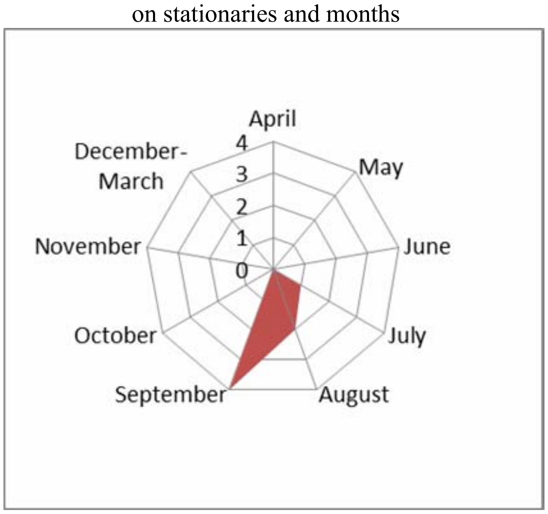

Fig. 17. The radar diagram of the chilopoda species' diversity from the edaphic soil on stationaries and months

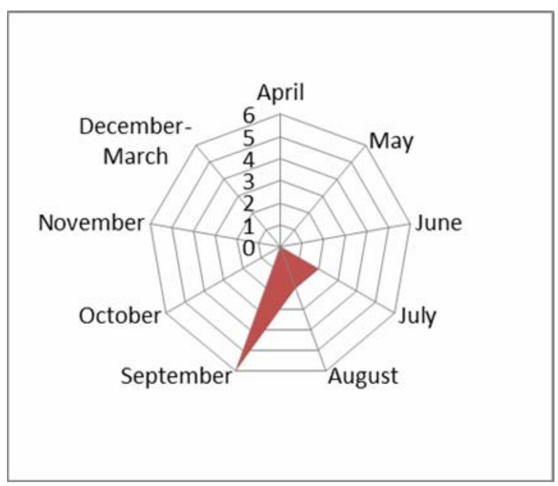

Fig. 18. The and months radar diagram of the cumulated abundance of the chilopoda species from the edaphic soil on stationaries

• regarding the coleopteran (Fig. 11, 12), we notice that the specific diversity is the highest during the warm season, especially in July and August. Since May, its value grows progressively until July, when it reaches its peak. The decrease of the specific diversity is lower in September, compared to august and notable from September to October. The highest number of coleopteran individuals was captured in September. Watching the diagram in Fig. 12, we though conclude that the cumulated abundance has lower values, compared to the specific diversity.

● as for the isopods, the specific diversity (Fig. 13), reaches its peak in August. The cumulated abundance in the case of the isopods registers low values, with its maximum in August, which can be easily noticed (Fig. 14).

● for the diplopoda, by analyzing the radar diagrams (Fig. 15, 16), we notice a lower growth from April to May and a faster growth from May to August (the peak) of the species' diversity in this ecologic stationary. Then comes a significant decrease. Regarding the cumulated abundance, the maximum number of individuals is in April, and then we notice that the abundance slightly lowers in May.

● analyzing the case of the chilopoda by using the diagrams (Fig. 17, 18), we notice that both the specific diversity and the cumulated abundance are featured by a low value.

CONCLUSIONS

By analyzing and correlating the values of the T and RH parameters to the variations of the cumulated abundance and the specific diversity, we can conclude that:

The cause of the brutal reduction of the cumulated abundance and of the specific diversity in the case of all the studied taxonomic groups from this ecologic stationary is represented by the existence of the minimum temperatures below 3-4°C.

We consider that this reduction of the minimal value of the ecologic factor T below 3°C is more important than the value of the average monthly temperature. Practically, in a month, there can be a pretty high average temperature, but with cold nights, with critical low temperatures below 3°C, which lead to the reduction of disappearance of most invertebrates. It is sufficient for the minimum temperature to go below 3°C for a night or a few nights so that the values of the cumulated abundance and the species' diversity to decrease. The survival of the individual themselves, of different invertebrate species, is difficult or impossible at temperature close to 0°C.

The relative humidity has a less important role in the fluctuations of the values of the cumulated abundance or the specific diversity. This affirmation is available for values of the RH of at least 32%, value under which this ecologic factor has not gone.

In the case of the araneae, the low number of collected individuals is caused by the fact that the capturing methods, through Barber traps, are not the most successful ones. In order to optimize the collecting process, in the case of the Araneae, we must combine more capturing methods.

ABSTRACT

This paper displays the results of some fauna research, carried out for more than one and a half years. They represent not only a premiere for the Rudăriței Keys but also for Leaota Mountains. Also, a fascinating thing is represented by the continuous, permanent monitoring, during this period, of the main ecologic factors, the temperature and the relative humidity and the collecting of their values from two to two hours during this whole period, as well as the correlation of this abiotic parameters to the distribution of the some main fauna groups (Ord. Araneae, Cls. Colembolla, Cls. Diplopoda, Ord. Isopoda, Ord. Coleoptera, Cls. Chilopoda). This study represents a component of some wider research, which has been carried on in Leaota, both in the limestone and schist substratum, the edaphic soil and also in the subterranean shallow habitats.

AKNOWLEDGEMENT

This work of Magdalin Leonard Dorobăț was supported by the strategic grant POSDRU/159/1.5/S/138963 - PERFORM, co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007-2013.

REFERENCES

1. DOROBĂȚ M.L., 2016 - Cercetări asupra mediului subteran superficial din sectorul nord-vestic al Masivului Leaota (Carpații Meridionali), Teză de doctorat, Universitatea din Pitești;
2. DONIȚĂ N., COMĂNESCU-PAUCĂ M., POPESCU A., MIHĂILESCU S., BIRIȘ A.I., 2005 - Habitatele din România, Ed. Silvică, București;
3. GAFTA D., MOUNTFORD O. (coord.), 2008 - Manual de interpretare a habitatelor Natura 2000 din România, Ed. Risoprint, Cluj-Napoca;
4. MURĂTOREANU G., 2009 - Munții Leaota-Studiu de geomorfologie, Ed.Transversal, Târgoviște;
5. NAE A., 2010 - Cercetări biospeologie în Masivul Piatra Craiului, Teză de doctorat, Academia Română, Institutul de Speologie "Emil Racoviță", București.

AUTHORS' ADDRESS

DOROBĂȚ MAGDALIN LEONARD, DOBRESCU CODRUȚA MIHAELA - University of Piteşti, Faculty of Science, Department of Natural Science, Târgu din Vale Street, No. 1, Romania
e-mail: coltanabe@yahoo.com;
codrutza_dobrescu@yahoo.com.

NITZU EUGEN, POPA IONU□, GIURGINCA ANDREI, NAE AUGUSTIN, ŞTEFAN BABA - Institute of Speleology "Emil Racoviță", Calea 13 Septembrie, No. 13, Bucarest, Romania, e-mail: eunitu@yahoo.com;
ionut.popa@iser.ro; sankao2@yahoo.com;
augustin.iser@gmail.com; cata_stef92@yahoo.com