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ECOLOGICAL FACTORS IN THE COLLUVIAL MESOVOID SHALLOW SUBSTRATUM, LIMESTONE SCREE, CĂPĂŢÂNA MOUNTAIN (LEAOTA MASSIF), WINTER 2014-2015

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INTRODUCTION

Leaota Mountains are located between the Piatra Craiului Mountains and the Bucegi Mountains (Fig. 1), displaying a wide geological diversity compared to their quite narrow surface, including magmatic, metamorphic and sedimentary rocks. On their north-western side, limestone slopes appear, in vertical or nearly vertical rocky outcrops. Due to the interactions between this limestone and the external modelling agents, especially due to the action of the gelivation phenomenon, colluvial scree appears, which gravitationally accumulated at the base of the slopes.

Fig. 1. Mts. Leaota location
(https://catalogmontan.wordpress.com/ghid/munti/grupe-de-munti)

Thisscree are known in speleology as **mesovoid shallow substratum (MSS)**[Juberthie, 1998] also called **superficial subterranean environment (SSE)** [Nitzu et.*all*., 2010], or **shallow subterranean habitats (SSHs)**[Culver&Pipan, 2014], this environment being considered "a less known division of the underground environment" [Ilie-Boitan,2001] but separated from the deep underground environment (the caves). The importance of this environment type originates in the ecologic function it meets; thus, it works like a shelter for some biocenosis components, in their different evolutional stages. In the case of other invertebrate species, and also in the case of some small vertebrate (micro-mammals), MSS eases the migration, the transition between two deep underground environments of these fauna elements, due to the conditions it provides, through the existence of the free spaces between the clasts that are included in scree. Considering that the geological substrate from the north-western area of Leaota is highly composed of limestone and considering that this type of limestone is identical to the one in the nearby Piatra Craiului Mountains [Mutihac & Mutihac, 2010], we can say that this scree from the studied area eases the invertebrates' migration, but, also possible, of the micro-mammals, and the extension of their surface in the neighboring Piatra Craiului Mountains, in the nearby limestone areas, namely Leaota. Due to this, we started a monitoring activity of the relative humidity and temperature ecologic factors in areas with different geologic substrate, crystalline schist and limestone, the monitoring of the abiotic parameters being made for different depths.

MATERIALS AND METHODS

To make the observations, we placed an ecologic stationary in the field, in an area with MSS (formed by limestone), from the southern slope of Căpăţâna Mountain, on the right side of the Rudăriţa Gorges, which is located in the north-western area of Leaota Massif (Fig.2). The stationary was placed far away from human activity-areas (forestry, excavations, constructions, etc) in order to avoid the negative influence of the observations. The angle of the slope is nearly 50°.

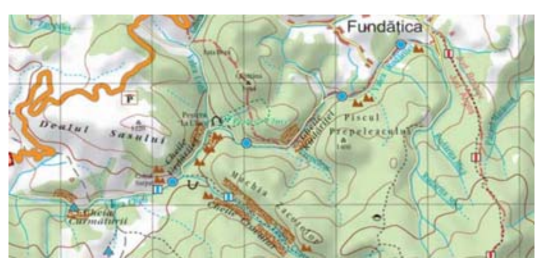

Fig. 2. Mt. Căpăţâna and Rudariţei Gorges location(http://www.ecoazimut.ro/index.php/tinteste-sus/118-ecoturism-in-leaota/522-harta-muntilor-leaota)

On this surface covered with limestone MSS (Fig. 3), we placed three surveys:

Survey 1, at 1089 m high, at a depth of 1 meter, in nude, mobile MSS, N 45°24´39.8”; E 25°16´13.1” GPS coordinates.

Survey 2, at 1085 m high, at 0.75 m depth, with N 45°24´39.2”; E 25°16´12.3” GPS coordinates, in mobile, nearly nude MSS, but rare herbaceous plants.

Survey 3, at 1080 m high, at a depth of 0.5 m with N 45°24´31.5”; E 25°16´13.7” GPS coordinates, was placed at the limits of a forest, in fixed MSS, covered by a surface of 5-10 cm scree clasts and litter.

Fig. 3. MSS (limestone scree area), April 2015

Each survey was made of a PVC tube (Fig. 4) which displayed all around the lower part 10 mm holes, to ease the circulation of the underground fauna and to collect it in the Barber trap, installed within the tube. (the diameter of the holes was not larger than 10 mm, as there was the risk to obstruct the holes with small scree parts). The area with holes has a height of 10 cm starting from the height of the glass limit. We used ethylene-glycol as conservatory liquid. In each survey, over the Barber trap, we placed an electronic measuring (data-logger), collecting and stocking device, continuously measuring the temperature, the relative humidity and the value of the dew point temperature (DT 171 data logger). The devices were set to measure the values of the abiotic parameters from 12 to 12 hours; considering that, alongside with the decrease of the temperature, batteries also get consumed, we replaced the original battery with a set of alkaline ones, with a higher capacity, in order to face the winter from the perspective of the data-logger functioning. Batteries were covered in adhesive tape and then in insulating foil with bubbles and were connected to the data-logger by attaching two wires with acid-core solder (Fig.5). The tubes were introduced in scree (Fig.6), and then were covered with a plastic foilandthen with scree or, in the case of survey 3, with litter and scree. The period in which the observations were made was December 5th 2014 – April 4th 2015. The collecting of the fauna captured in this period was made at the same last date, due to the lack of access during winter, due to snow and the angle of the slope.

RESULTS AND DISCUSSIONS

In survey 3, at 0.5 m depth, during the monitored period, the minimal value of the temperature was – 3.1°C, andwasregistered for the first time between January 19th 2015, at 09:34 p.m. and maintained until January 20th 2015, at 03:34 p.m.; this value was met again in the following period: February 10th 2015,between01:34 a.m– 09:34a.m.From the graphic in Fig. 7, we can see that the value of the survey temperature starts increasing even since its setting, quite fast, on December 5th 2014, reaches 0°C on 28th December, 03:34 p.m., then is a period between January 7th2015, 03:34 p.m. and February 28th 2015, 00:34, in which the temperature is nearly constant, varying by no more than one degree Celsius, to notice only a slow evolution to 1.7°C at the end of the monitored period.As for the relative humidity, the minimal value was 92.9 %, registered between February 28th 2015, 06:34 a.m. and March 2nd2015, 04:34 a.m. and the maximum value was 99.8%, measured at the end of the monitoring period, on April 4th 2015.Lower values, fewer than under 100% of the relative humidity are explained by the fact that, being closer to the surface, the air in the survey being colder, drier, the absorption capacity of the water vapors being lower. In the case of survey 2, at 0.75 m depth, (Fig. 8)displays the fact that the minimal registered temperature was – 2.9°C, starting from February 22nd 2015, 10:31, until February 24th 2015, 04:47 p.m. This value appears again between February 2nd 2015, 12:31 and February 4th 2015, 12:31, as well as between February 6th 2015, 12:31 and February 7th 2015, 12:31. However, very close values were registered between February 2nd 2015, 10:47 a.m. and February 28th2015 10:47 a.m., the variation was no more than 1°C.The relative humidity in sample 2 was 100% or nearly 100%, lower values being registered on the beginning of measurements, 94%, this lower value being influenced by the fact that we opened the top of the survey, for the installation of Barber trap and data-logger.In survey 1, at 1m depth, (Fig. 9), the minimal temperature was -1.4°C, on the period February 8th 2015, 07:47 p.m. and February 17th 2015, 04:17 a.m. Fromthe setting of the survey, the temperature decreases, lower than for the 2 and 3 surveys and maintains with a one Celsius degree variation between January 26th 2015, 00:17 until the end of monitoring period, April 4^{th,} 2015.As for the relative humidity, it reached the minimal value on January 25th 2015, 08:17 a.m.and on January 26th 2015, 00:17, but almost the whole period of monitoring range the relative humidity was reached100%, the air being saturated in water vapors.

Fig. 4. PVC tube with holes

Fig. 5. Data-logger connected to external batteries protected against frost

Fig. 6. Survey introduced in debris

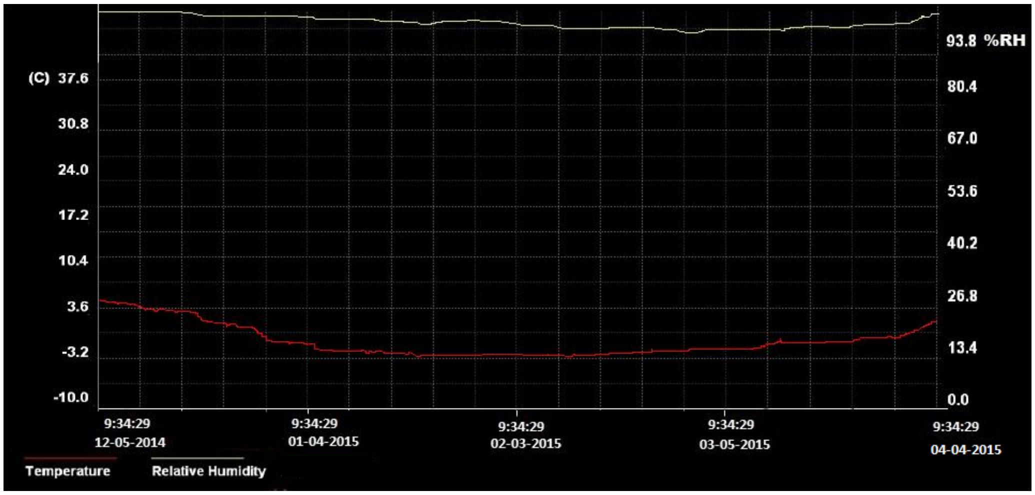

Fig. 7. Variation of temperature and relative humidity, survey 3, 0.5m depth

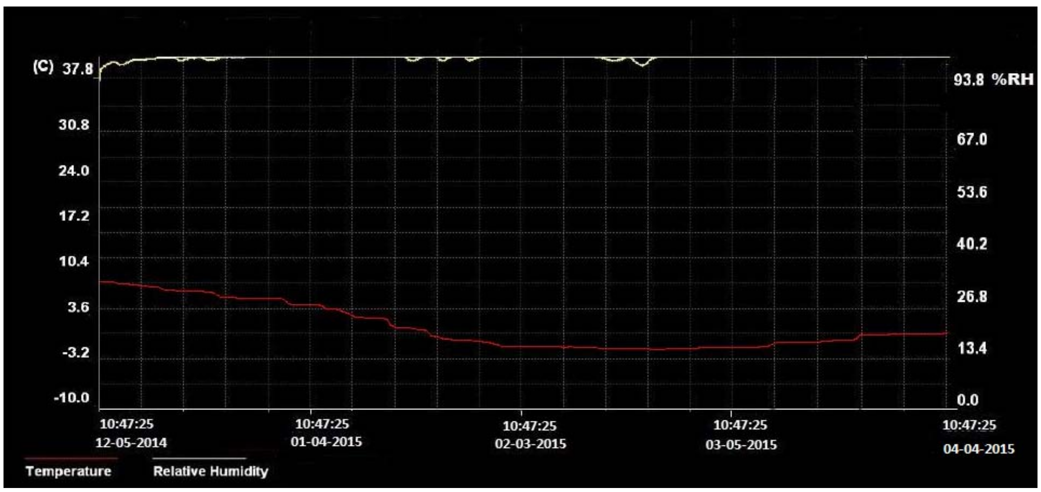

Fig. 8. Variation of temperature and relative humidity, survey 2, 0.75m depth

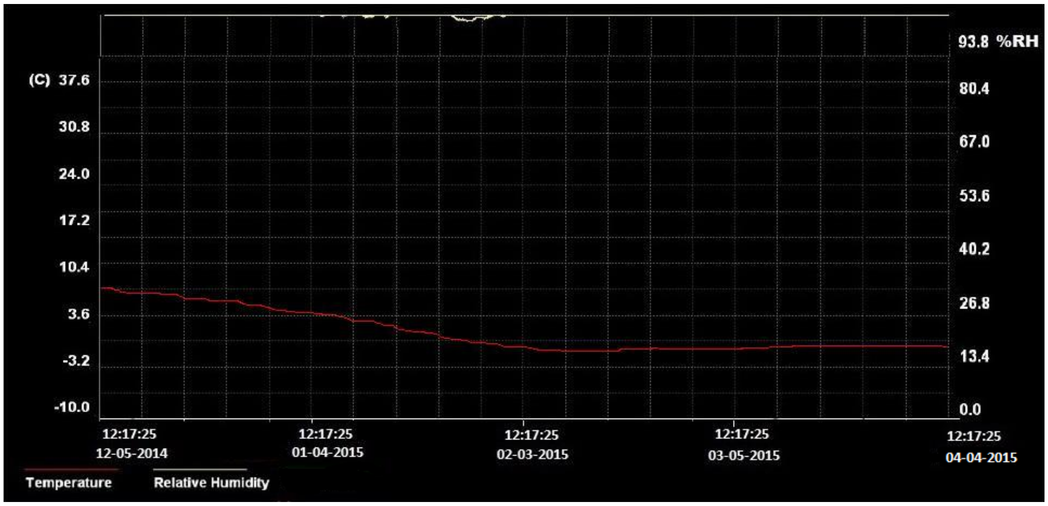

Fig. 9. Variation of temperature and relative humidity, survey 1, 1m depth

CONCLUSIONS

Subsequently to the analysis and interpretation of the collected data, we can conclude that:

The lowest values of air temperatureincreases in the surveys as their depth increases. The minimal temperature of the air, in the case of sample 3(0.5m depth) was -3.1°C, for the sample 2 (0.75m depth) was -9°C and in the case of survey1 (1m depth) was -1.4°C.

Considering the observed temperatures during winter, with negative values even for the depth of 1 meter, we conclude that the limestone MSS does not allow, even at a depth at depths of 1 meter, during a winter with normal thermal values, the survival of some invertebrate components sheltered in the intersections between these clasts.

Considering the fact that the negative temperatures were not that high, it would be possible that, during a mild winter, at 0.75 m depth, or the more, at 1m depth, positive temperatures can be maintained, if the scree would be separated from the external environment through a layer of litter or snow.

During nearly the whole monitoring period, the value of the relative humidity was maximum (100%) or close to this value in the survey 2 and 1. This confirms all recordings made in polls in MSS, in warmer periods too, in which air is saturated or nearly saturated, and almost always we found condensation on the walls of the tubes.

In the survey 3, at a depth of 0.5m, relative humidity have slightly lower values, because here is colder air and because of better communication with the surface of the soil.

The variation on air temperature in polls during the winter is not higher limits; this can be explained through the depth of surveys, which makes the recorded temperature to be less influenced by the external variations, and also by the covering with a layer of protective snow and/or litter.

Future work: This work is part of a larger project that seeks correlations between ecological factors (humidity, temperature) registered in various types of screes (limestone and crystalline shists) and some zoocenotic components (invertebrates). This research aim to know the importance of MSS for invertebrates or small vertebrates fauna.

ABSTRACT

This paper present and discussed the results of the monitoring of two ecological factors, the temperature and the relative humidity monitorised during winter 2014 -2015, in an ecological station in the in the north-western area of Leaota Mountains. In this station, three polls were located in areas with limestone forming mesovoid shallow substratum (MSS), also called shallow subterranean habitats(SSHs).

The first survey has 1m deepth, the second has 0.75m depth and the third was drilled up to 0.5m depth. In each survey was placed a datalogger above a Barber trap, wich recorded continuously for the winter 2014-2015 relative humidity and temperature. The values of this abiotic parameters were collected on every twelve hours. The continuous data collection on ecological parameters mentioned before is a first for Romania.

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