STUDY REGARDING THE VARIATION OF TWO ABIOTIC PARAMETERS (TEMPERATURE AND RELATIVE HUMIDITY) IN THE AREAS WITH LIMESTONE SCREE IN THE LEAOTA MASSIVE, 2014

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Abstract. The study contains the partial results of permanent field registrations of the relative temperature and humidity, carried out between October 5th and November 26th 2014, in two limestone scree areas in Leaota. The registrations have gathered the data at every two hours, with abiotic parameters' collecting equipment, installed in boreholes at 0.5 m, 0.75 m and 1 m depths. In Romania, no other monitoring with permanent data registration at different scree depths was carried out, and less in the case of detritus. The data would be correlated to the periodically collected wildlife data, as well as with same type registrations, from other crystalline schists and sandstones areas of the massive. This paper is a part of a wider research context, which aims at determining the way in which the nature of the geological substratum in Leaota Mountains influences the distribution and dynamics of some biocoenotic components, especially in the case of invertebrates.

Keywords: Leaota, scree, limestones, abiotic parameters, data-logger.

Rezumat. Studiu privind variaţia a doi parametri abiotici (temperatura şi umiditatea relativă) în zone cu grohotiş calcaros din Masivul Leaota, 2014. Lucrarea conţine rezultate parţiale ale unor înregistrări permanente din teren a doi factori ecologici, temperatură şi umiditate relativă, efectuate în intervalul 5 octombrie – 26 noiembrie 2014, în două zone cu grohotişuri calcaroase din Munţii Leaota. Înregistrările au preluat date la fiecare două ore, pe toată perioada, cu aparate pentru colectarea parametrilor abiotici, instalate în sondaje, la 3 adâncimi diferite: 0,5 m, 0,75 m şi 1 m. În România nu au mai fost efectuate monitorizări cu înregistrare permanentă a datelor la adâncimi diferite, cu atât mai puţin în grohotişuri. Aceste date vor fi corelate cu elemente de faună colectate periodic, precum şi cu înregistrări de acelaşi tip, din alte zone cu şisturi cristaline epimetamorfice şi gresii ale masivului. Lucrarea de faţă face parte dintr-un context mai amplu din punct de vedere al cercetărilor, acestea propunându-şi să determine modul în care natura substratului geologic din Munţii Leaota influenţează distribuţia şi dinamica unor componente biocenotice, în special nevertebrate.

Cuvinte cheie: Leaota, grohotiş, calcare, parametri abiotici, data-logger.

INTRODUCTION

From the geological perspective, Leaota Massive, though having a relatively reduced area, 336 square kilometres (BADEA et al., 2001), displays a wide geological diversity, containing magmatic, metamorphic and sedimentary rocks in its structure.

This geological diversity has implications not only regarding the pedology, but also regarding the variation of the ecological parameters, which are responsible for a wide biocoenotic diversity (NIŢU et al., 2010). From the category of sedimentary rocks, limestone and sandstones are the ones covering most of the areas in the outcrops of the massive (BĂLTEANU & ŞTEFĂNESCU, 1987). Limestone is mostly met in the northern side of the massive, appearing on the surface of the slopes, the ones from the lower flow of Ghimbav, on the Cheii Valley and the Rudăriţa Valley frequently forming screes at the base of the slopes, as a result of cryogenic disintegration (MURĂTOREANU, 2007; 2009). Sandstones are met in outcrops in the southern side of Leaota Massive.

Described for the first time by Juberthie, Delay and Bouillon in 1980, the superficial underground environment is defined as being represented by the small areas that appear in the disintegration area of the rock, this environment being located between the soil horizon crossed by the roots of the plants and the mother-rock (parental), which can be limestone or other type (NAE, 2010). The superficial underground environment appears as a consequence of the friability of the rocks, considering the fact that epimetamorphic crystalline schists and limestone display a high friability degree. Leaota Massive displays large areas covered by superficial underground environment with various petrographic components, especially as a result of the mechanical disintegration induced by gelivation. Such clast accumulations appear on the slopes and at their basis, forming detritus. Generally, the superficial underground environment in the detritus and especially the one in the limestone detritus represent the preferential habitat of a rich invertebrate wildlife, which includes glacial relics and endemic species, insufficiently known until now (NIŢU et al., 2010).

The detritus communicates with the deep underground environment, namely with the caves, through deep cracks of the parental rock. It is clearly different from the endogenous environment, which covers it through texture, high porosity degree and wildlife (NAE, 2010). Thus, detritus functions as hideaway areas for different wildlife species, depending on the season, and as well as passing bridges from the soil surface toward the deep underground environment (caves). The ecological importance of detritus is highly significant from this perspective.

Studies in the area of Leaota Massive are pretty reduced and none has had a systematic approach, mostly based on connections between the substrate and the wildlife and the flora. Due to this reason, individual researches in progress try to fill a gap regarding this type of studies with an interdisciplinary future, making a comparison between the limestone screes and the ones with epimetamorphic crystalline schists, from the perspective of the modifications of the abiotic parameter values, then observing the relation between the variance of the relative humidity and the temperature at different depths within the detritus with different substratum, on one side, and the distribution and the dynamics of the invertebrate and micro-mammals wildlife on the other side.

MATERIALS AND METHODS

Research in Leaota Massive is carried out in 6 stationeries set in screes from epimetamorphic crystalline schists and limestone screes. One of the criteria at the basis of the choices was the one that these stationaries must be set in areas where the geological substrate in naturally set, its displacement not resulting from human activities.

The present study regards the stations set in limestone screes.

Station 2 is set on a slope located at maximum 150 m from the right bank of the Ghimbav River (Fig. 2), approximately 400 m upstream its gorges sector. The stationary was set in a limestone scree area, with a surface of approximately 5,000 m^2. Three surveys were carried out in this stationary: survey 1 was displayed at a depth of 1 m, in a grassy scree, 883 m altitude, having the following GPS coordinates: N 45° 22´ 43.21”, E 25° 13´ 48.81”; survey 2 was carried out in nude scree, at a depth of 0.75 m, 879 m altitude, with the following GPS coordinates: N 45° 22´ 43.5”, E 25° 13´ 49.01’’, and survey 3 was set in the forest at the base of the scree, at 0.5 m depth, 860 m altitude, with the following GPS coordinates: N 45° 22´ 43.42”, E 25° 13´ 49.31”. The inclination of the slope is 42° and the slope exposure is towards east.

Station 3 is set in a scree area on a limestone slope, on the right of the Rudăriţa creek and of the forest road (Fig. 2), at 1 km upstream of the area where the Uluce Cave is set. The scree has a surface of approximately 4,000 m^2, with the inclination of the slope of 50°. We have also set 3 boreholes here, as it follows: borehole 1 at a depth of 1 m in mobile, nude scree, at an altitude of 1,089 m, with the following GPS coordinates: N 45º 24´ 31.8”, E 25º 16´ 13.13”; borehole 2 at a depth of 0.75 m, at an altitude of 1,079 m, in semi-fixed and grassy scree with the following GPS coordinates: N 45º 24´ 31.2”, E 25º 16´ 12.13”and borehole 3 at a 0,5 m depth, in fixed screen, in forest area, at an altitude of 1,081 m, with the following coordinates: N 45º 24´ 31.5”, E 25º 16´ 13.72”.

Barber traps were set in the stationaries, in the boreholes, in order to register the temperature (TºC) and relative humidity (Ur) data. We also used DT 171 data-loggers, with continuous data reception. The data reporting period can be set, thus we set the devise for collecting the ecological factors values from 2 to 2 hours. These were suspended, one by one in PVC tubes, over the Barber trap, using a nylon wire, whose superior end is tied to the end of the PVC tube (Fig. 1) (NIŢU et al., 2010).

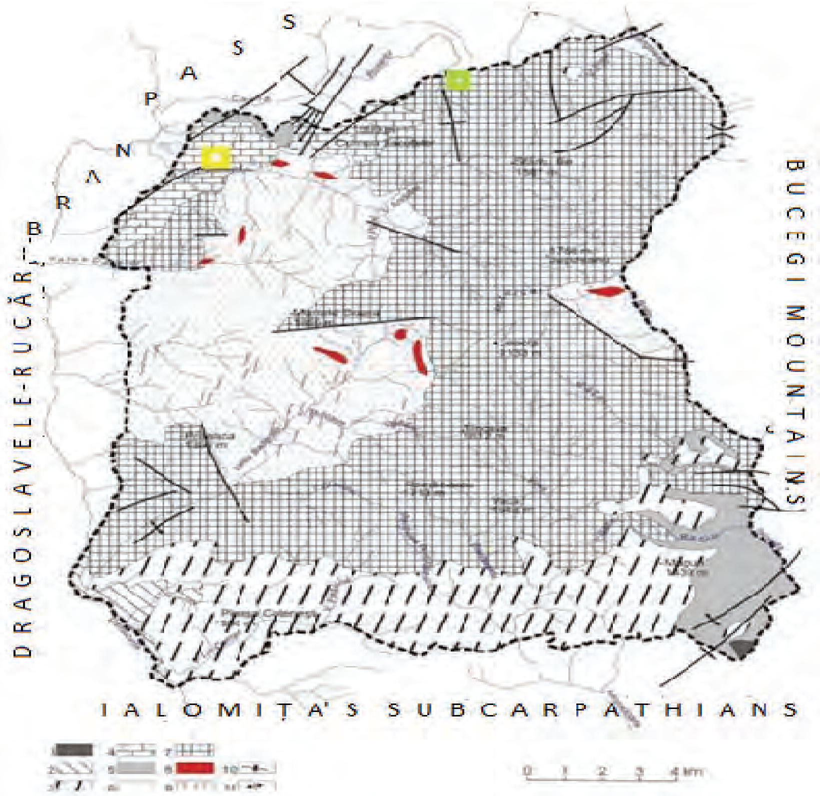

Figure 2. Geological map of Leaota Mountains (MURĂTOREANU, 2009)
with the placement of the ecological stationaries.: 1. gravels, sands, sandy clays (Late Holocene); 2. Marne, silt, massive sandstones, conglomerates (Vraconian - Cenomanian); 3. Sandstones coarse clay sandstones, conglomerates ofBucegi, limestone breccia (Albian); 4.Limestone, dolomitic limestone and dolomite, radiolarians (Late Jurassic); 5. Marls, sandstones, conglomerates (Turonian - Senonian); 6. Leaota Series - phyllite, schists with chlorite - sericite (Upper Proterozoic - Palaeozoic); 7. Cumpăna Series – metablastic migmatites (Late Anteproterozoic); 8. Granite (Palaeozoic igneous); 9. magmatic metablastic; 10. Trough spindle; 11. Anticline spindle. (after Geological map 1: 200,000 – Braşov Sheets) Placement of stationary 2 – Ghimbav; Placement of stationary 3 – Rudăriţa.

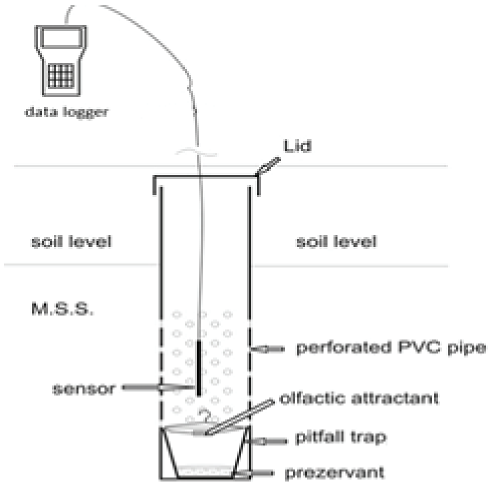

Figure 1. Abiotic parameters monitoring in the superficial underground environment (NIȚU et al., 2010).

RESULTS AND DISCUSSIONS

The results of the monitoring of the abiotic factor for the limestone screes in Leaota Massive supposed the centralization and interpretation of 618 pieces of data collected from each data-loggers that were set in the six boreholes, which are displayed in figures 3 – 8.

The maxim temperature value, at 1 m depth, in borehole 2, Ghimbav station, was 11.8º C, registered between 2:00 and 10:00 a.m., on the 16th of October 2014, a single time, at 4:08 p.m., but we consider that the values is irrelevant due to the fact that, at that hour, we took the Barber trap out of the borehole and we influenced the accuracy of the registration. Due to this reason, we consider the maximum value of 10.3º C, from the 16th of October 2014, 10:08 p.m., preceded by the value of 10.2º C, registered on the 15th of October 2014, 10 p.m. and the 16th of October 8:08 p.m. and succeeded by the value of 10.1º C, registered on the 17th of October 2014 between 12 a.m. and 6 a.m.

At a depth of 0.5 m, in borehole 3, the maximum value of the temperature reached 10.7º C, but it was measured during different time periods: the 14th of October, 10:50 p.m. – the 15th of October 2014, 4:50 a.m., the 16th of October, 10:50 p.m. – the 16th of October 2014, 6:50 a.m. and the 16th of October 2014, 10:50 p.m. – the 17th of October 2014, 4:50 a.m. (Figs. 3, 4, 5).

At station 3 – Rudărița, at 1 m depth (Fig. 6), the maximum value of the temperature was 12.1º C, on the 16th of October 4:25 p.m. Moreover, the temperature did not go below 11 ºC, from the 13th of October 2014, 10:25 p.m. to the 18th of October 2014, 10:25 p.m.

At 0.75 m deep (Fig. 7), the borehole 2, registrations showed that the maximum temperature of 15.2 °C was recorded on the 12th of October 2014, at 1:16 p.m. From the 13th of October, 11:16 a.m. to the 16th of October 2014, 5:16 p.m., the temperature did not go below 13ºC, reaching a maximum value of 13.7ºC.

In borehole 3, at 0.5 m deep (Fig. 8), the maximum temperature was 11.8º C, from the 16th of October 2014, 10:06 p.m. to the 17th of October 2014, 10:06 a.m. Also, from the 13th of October, 6:06 p.m. to the 18th of October 2014, 6:06 a.m., the temperature did not go below 11ºC.

Regarding the relative humidity, its values varied between 81% and 100% in the 6 boreholes.

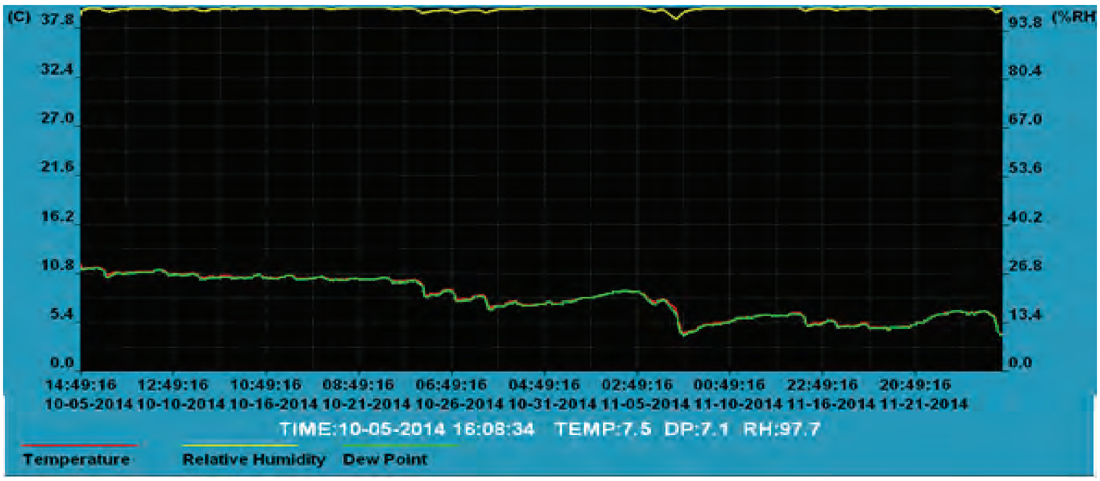

Figure 3. T, RH parameters recording, in station 2 – Ghimbav, borehole 1 – 1 m.

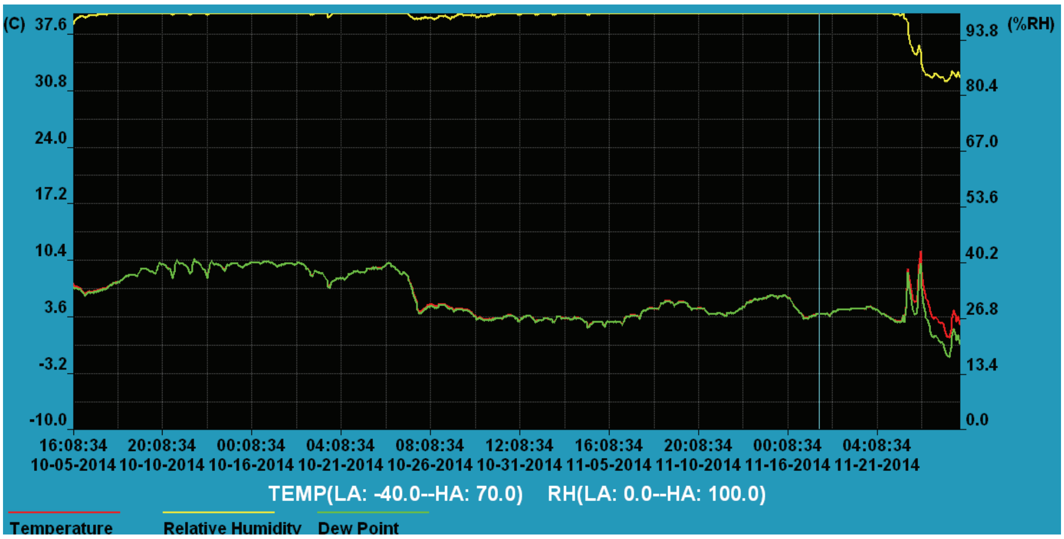

Figure 4. T, RH parameters recording in station 2 – Ghimbav, borehole 2 – 0.75 m.

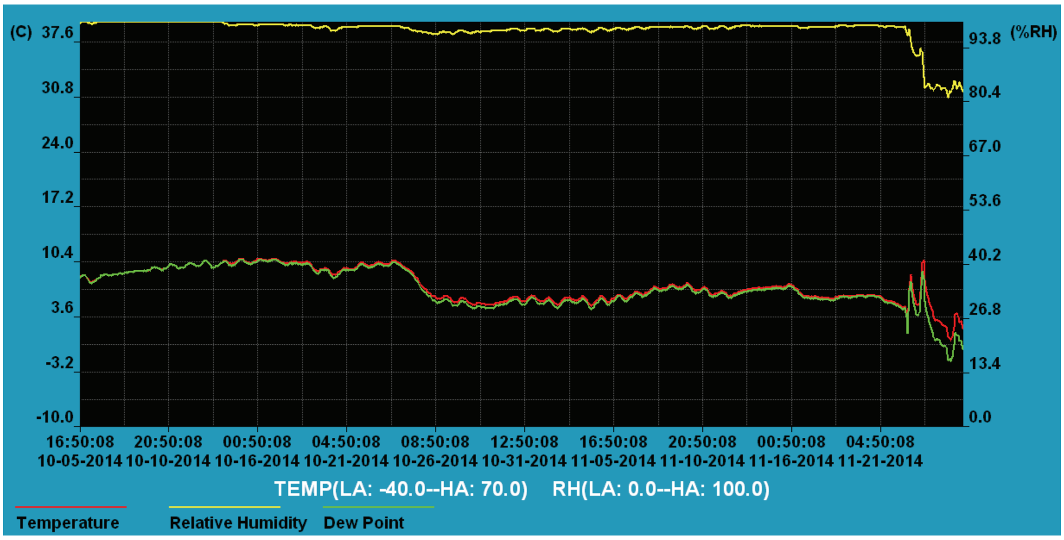

Figure 5. T, RH parameters recording in station 2 – Ghimbav, borehole 3 – 0.5 m.

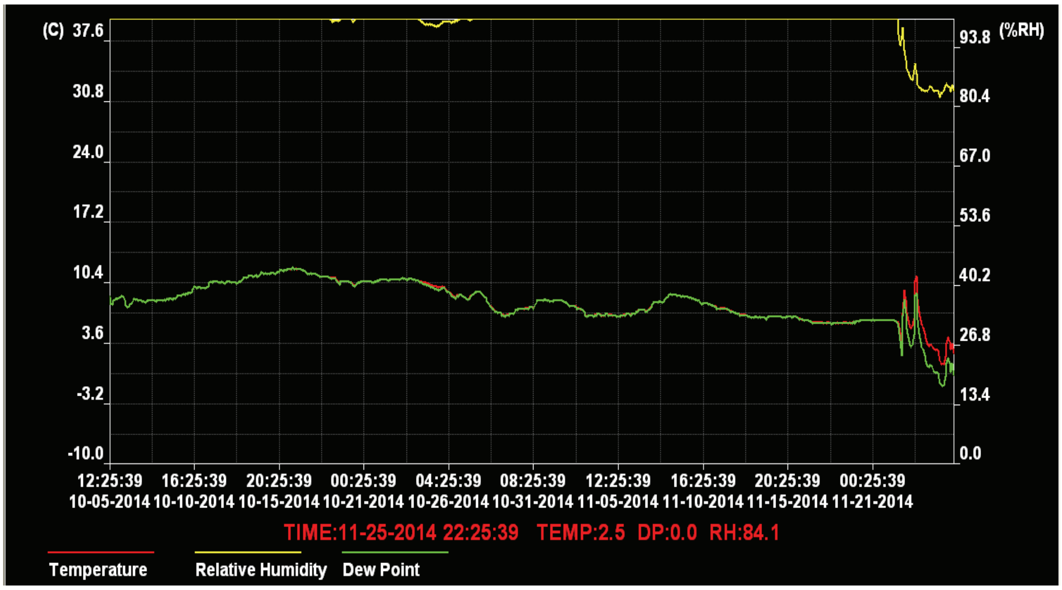

Figure 6. T, RH parameters recordings in station 3 – Rudăriţa, borehole 1 – 1 m.

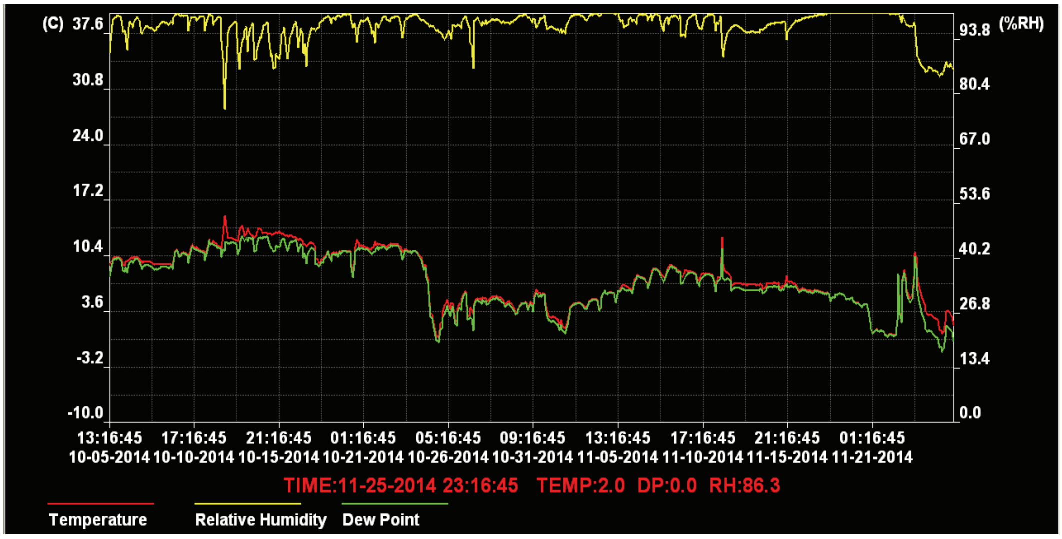

Figure 7. T, RH parameters recording in station 3 – Rudăriţa, borehole 2 – 0.75 m.

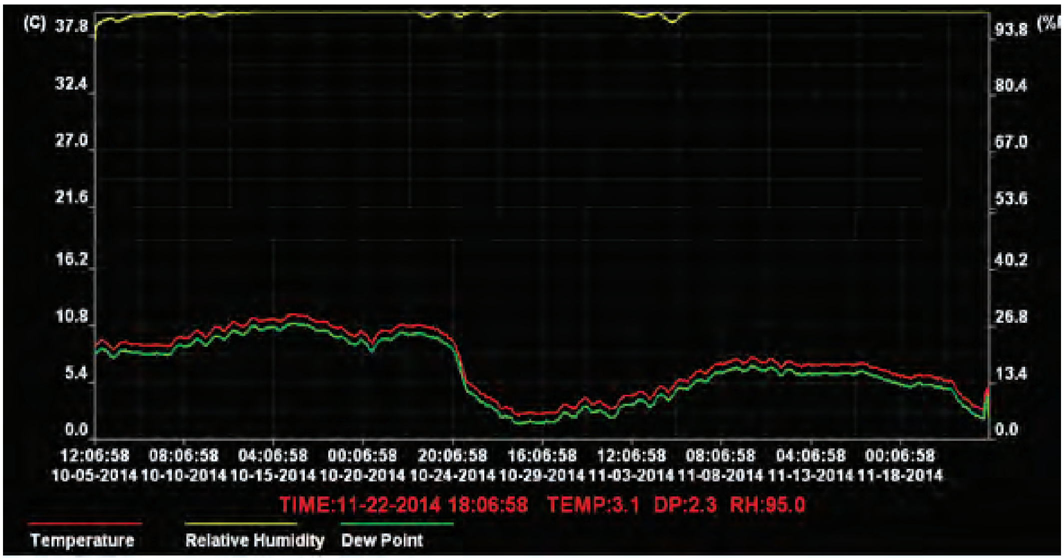

Figure 8. T, RH parameters recording in station 3 – Rudăriţa, borehole 3 – 0.5 m.

CONCLUSIONS

Temperature data registered in the boreholes in Ghimbav, but also in the ones in Rudăriţa show that the daily temperature variation in all the boreholes, irrespective of their depth, is low. Moreover, it has been observed that, in the case of longer time periods, even of several days, temperatures oscillate insignificantly, within less than 1 Celsius degree. Most of the temperature maximum values were registered between 6 p.m. and 6 a.m.

These two conclusions can be explained through the temperature inertia of limestone, the temperature relief being a slow process, during the night. No borehole has reported negative values of temperature, irrespective of the depth.

High values of the relative humidity were registered in all the studies limestone screes, on both slopes, in every borehole, irrespective of their depth. The 100% value of the registered relative humidity can be explained by the formation of sweat in the boreholes tubes and the influence exerted upon the humidity sensors of the thermohygrometers.

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