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DIFFICULTIES, ERRORS AND CORRECTION OF THEM DURING THE COLLECTION OF SAMPLES OR DURING THE MEASURING OF SOME ECOLOGICAL FACTORS (TEMPERATURE AND RELATIVE HUMIDITY) ON THE FIELD

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Key words: *ecological mains factors, temperature, relative humidity, errors of the measurements of the ecological factors, registration data recovery*

INTRODUCTION

Within different ecological, floristical, geological zoological researches which are made in the field, sample collection and it subsequent analysis in laboratories, their determining, made measurements, are very important regarding the quality of the gained scientific results. Eventual errors that might occur must be avoided; this can be done by meeting the procedures, standards regarding data collection and processing. These things are known; more problems seem to appear when dealing with typical cases, when, due to certain reasons, the measurements, data or material collections for the analysis are modified by various factors. It is mandatory, in many cases, trying to recover, at least partially, such data, correcting the measurements which, due to a reason or another, were modified or totally removing it from the whole data volume we analyze; detecting such wrong data and removing it is frequently solved in a non-usual manner, as there are no standard procedures to this extent. The present paper will present several such study cases we faced in the field, during the ecological, fauna, geological researches we have carried on in Leaota Mountains, in order to study the fauna of the mesovoid shallow substratum (MSS, named also shallow subterranean habitat, SSH) the geological substrate and the main ecological factors that condition the time and space distribution of the zoocenosis components in this environment.

MATERIALS AND METHODS

In order to collect the fauna material at the surface of the soil we have used Barber pitfalls. In order to collect this material at different depths in the scree (MSS) we have used the drilling samples method, used and described by researchers as Gers (1992), Nițzu *et al.* (2010; 2014); Lopez & Orómi (2010), Deltshev *et al.* (2011) etc. or more recently, by Dorobăț (2016); Mammola *et al.* (2017). This techniques uses subterranean sampling devices - SSD (Lopez & Orómi, 2010).

In both cases, the collection was made on a monthly basis. Both at the level of the soil and in the samples, we have installed data-loggers in order to constantly and continuously monitor the value and the variation of the temperature (T) and relative humidity (RH) as main ecologic factors. Devices were set to collect the values on hourly basis or from two to two hours, during all months. The subterranean sampling devices were installed in schist or limestone scree, at 1m, 0.75m and 0.5m deep (in the case of the schist at just 1m and 0.5m deep).

The size of the holes made at the basis of the sample tubes was 8-10 mm. The odor attractant we used was altered cheese.

RESULTS AND DISCUSSIONS

I. Errors in the measuring of the main ecological (environmental) factors (temperature and relative humidity)

In order to constantly monitor, during several years (2014 - 2016) the value and variation of the temperature (T) and relative humidity (RH) main ecological factors, we have installed data-loggers at the level of the soil, and also at different depths within the mesovoid shallow substratum (MSS), schist or limestone: at 0.5m, 0.75m and 1m. Sometimes, the analysis of the values registered by the devices displays clear strange, abnormal changes; we tried to detect abnormal value, to find the causes and to remedy the situation. We tried to recover the good data, distinguishing it from the deformed ones. We exemplify the following cases with which we met.

I.1. Thus, for the Valea Popii ecological stationary, installed on schist lithosoil (Fig.1) we faced the following problem: the maximum monthly average temperature was registered in May 2015 and reached 16.07°C (Tab.1) this was also the case of the monitoring periods from Oct. 2014 to Dec. 2015.

Fig. 1. Valea Popii ecological stationary on schist lithosoil; a partial vue.

Table 1. Average monthly value of the temperature, Valea Popii, soil level

SOIL TEMPERATURE (^{O}C)								
VALEA POPII, 2015	**May**	**June**	**July**	**August**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
	16.07	12.12	12.23	12.64	12.15	8.57**	5.05**	- 0.5*

* = only for the first five days of December, 2015.
** = the average between the registrations for the respective month of the years 2014 and 2015

Though, we are reserved regarding the significance of this average value of temperature (T) of 16.07°C. First of all, recording started on May 17th, due to climate reasons, as the area had been covered with snow until the beginning of May, thus missing the invertebrates fauna at the level of the soil. If we have started the measurements for May 2015 barely on May 17th means that the lower temperatures in the first part of May were not collected, leading to a higher average value for May. At the beginning of May we still found areas covered in snow in the shadowy areas. Secondly, in order to protect the data-logger against bad weather and in order to hide it, we put it in a jar with no cap on and the high values of May are due to the fact that sunbeams came in certain moments of the day right over the recipient, causing a higher internal temperature reported to the external one, by the magnifying glass effect.

This was possible in May, as many trees still didn't have leaves or just a part of them and thus the soil was less shadowed. We have subsequently verified in the field, and really, through the positioning of Popii Valley, in the area of the ecologic stationary, during morning hours, solar beams fell on the soil, while the area was shadowed during the rest of the day, due to its narrowness.

In this stationary it was the maximum values for temperature on the soil, 37.2°C, was registered on May 31st at 10:36. At the same hour, 10:36, May also, we notice other two high values: on May 30th, 32.2°C, on May 29th, 29.2°C, on May 28th, 35.1°C. On May 25th, at 8:36, the device registers 35.3°C, then, at 10:36, 35.1°C; on May 24th, it registers 30.3°C, and at 10:36, 29.7°C. Still at 10:36 we registered high values in June also: 35.9°C, on June 3rd and 35.7°C on June 1st. We consider these high values registered in the morning, at 10:36 or even 8:36, followed by lower values, are modified by the magnifying glass and thus they have no significance. Moreover, in some days, the values are normal, not atypical compared to the previous or the following ones.

This is explained by the fact that, at those moments, the sky was cloudy. Certain is that, after we stopped hiding the data logger in the glass recipient, starting with June 6th, we had not noticed such discordant values of temperature.

For the other hours in the days, except 10:36 and 10:36 we consider that the recordings are perfectly available, subsequently, on June 6th 2015, we have moved the data logger in another area of the stationary in a little groove, 1cm above the soil (in order not to be flooded), without placing it in another recipient.

We have recalculated the case of June, for the average temperature, starting from June 6th, until the end of the month (Table 2). The value of the recalculated average temperature is 11.37°C, while the one of the RH was 92.37%.

Table 2. Recalculated values of T (^{0}C) and RH (%) for June, 2015

Valea Popii, soil level temperature, June 6th - 30th 2015		
Average temperature	11.37	92.37
Maximum temperature	13.5	95.8
Minimum temperature	8.1	89.9

I.2. We faced another situation at the ecologic stationary placed on Rudărița Valley, with samples installed in limestone scree.

Here, we had two samples which were deactivated by some bears. The destruction of the two subterranean sampling devices first happened in April and then in May 2015. After we found the samples destroyed in April 2015, we had not used the odor attractant at all (though it was weak) for the Barber traps within the samples. Despite, in May 2015, the sample at 1m depth was destroyed, the corresponding data-logger of the sample was brought to the surface with the whole tube and it was found about 50 meters further from the point it was placed in (Figs. 2a, 2b).

Though, we were able to download the data registered, both for the moment it stood in the sample and at the surface; this device was still functional when we found it, as its placement amongst rocks kept it away from the damage caused by precipitations.

By interpreting the information provided by the graphic in figure 3, we separate two recording periods: the first one, available for the period the sample was not affected (named on the both figures, 3 and 4, SONDAJ) and the second one for the period the sample was pulled out and the data-logger did not function inside (named AFARĂ DIN SONDAJ).

Fig. 2a. The destroyed survey tube

Fig. 2b. The the data logger is thrown out, about 50 meters away from the survey

We were based on the fact that, subsequently to May 27th, the temperature graphics of the relative humidity showed total atypical values for a sample: nearly 40°C during the day, followed by low temperatures over the night, as well as very large variations of the RH ecological factor within hours. This cannot happen in samples placed in depths.

Due to this, we have considered that only the period of 17 - 27 May is the one for which the recordings in the data logger are accurate for this sample.

In the case of the sample at 0.75m depth, for April 2015, we recovered the data by interpreting the graphic displayed by the corresponding data-logger; we consider the period April 5th 15:37 – April 12th 7:37 as being the one in which the data registered by the data logger are available for the sample.

Subsequently to this last date, the sample and the data logger were taken out from the MSS; the rest of the recordings are corresponding to the period when the data logger was on the surface.

We base our belief on the fact that it is not possible that at 0.75m depth, to reach such large temperature variations, of more than 10° C in 2 hours (Fig. 4). Graphics are very different for the two periods, so that we were able to separate two different certain periods.

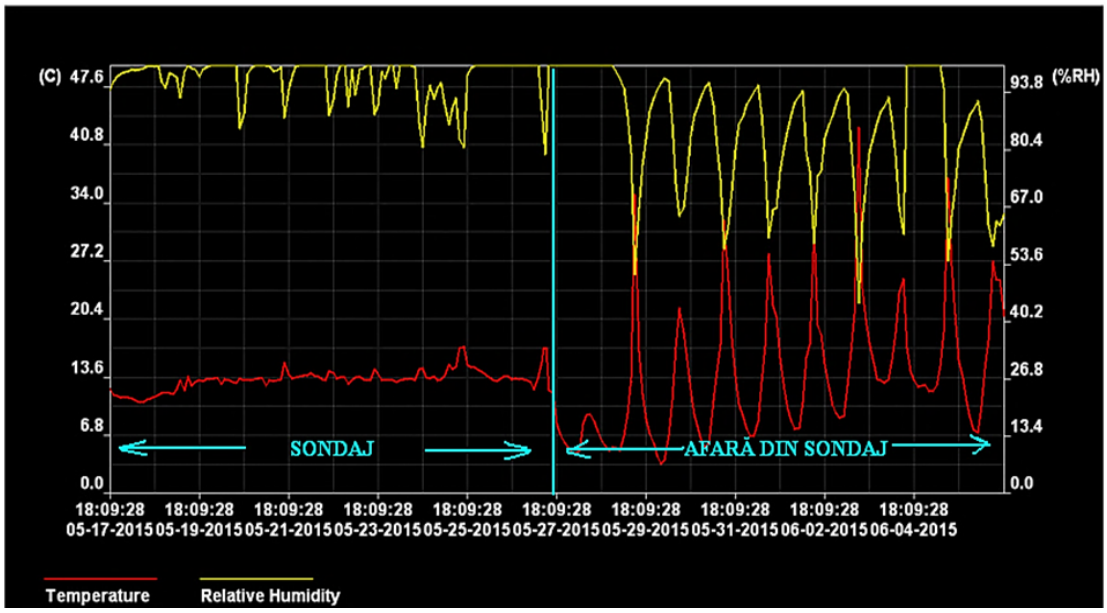

Fig. 3. Recovery of data for the period the data logger was in the 1m depth survey, subsequently to the data analysis and interpretation (from Dorobăț, 2016)

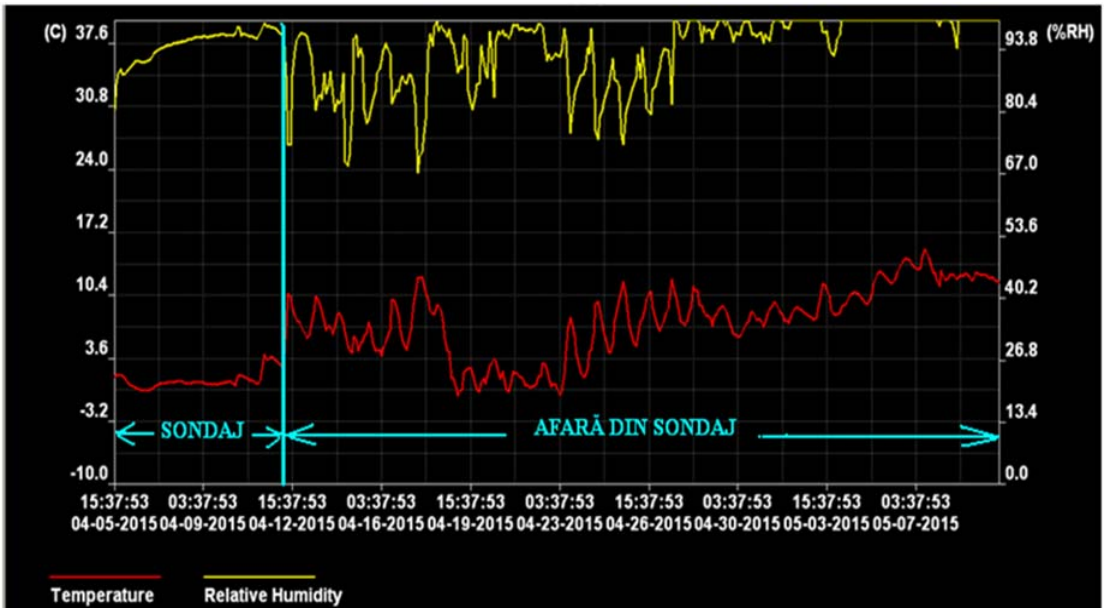

Fig 4. Graphic interpretation for sample 2 (0.75m depth), taken out by bears (from Dorobăț, 2016)

I.3. In the another ecological stationary, named Ghimbav 2 (samples stationary), recordings of the T and RH ecological factors were also taken between August – November 2014 and April-August 2015

We observed an interesting fact: for the 0.75 meters depth sample, the monthly average temperature in October and November reaches lower values compared to the 1m, respectively 0.5 meters depth. The explanation is that the influence of external temperatures is felt (for the climate types in Romania) at a maximum depth of two meters (meaning that in any point under the soil located at a depth between two meters and the surface, the measured temperature at a certain moment is the result between two heat sources: one coming from within the Earth (telluric energy) and the one being the heat that is defused through the rock layer, coming from the surface, from the solar energy. In fact, the continuous energy exchange between the atmosphere and the earth surface (radiative balance) leads to variations of the heat quantity received and

distributed between rocks; for the same point of the soil surface, the variation of the radiative balance can be daily, monthly, seasonal, multiannual (Loghin, 2000). Between the surface of the soil and 2 meters depth, there is a point on a vertical scale which records a minimum temperature. Considering that the radiative balance varies, than the energy volume coming from the surface also varies, and, implicitly the depth at which the minimum temperature is recorded varies.

I.4. Also, many times, the relative humidity in the samples frequently reaches 100% or close to 100% all months, being lower just at the beginning of the recording, for just several hours. As these lower values were registered only in the beginning of the measuring period, we can explain the decision of opening the upper part of the sample, in order to install the device and connect the data logger to the laptop and thus, different outside temperatures reached the inside, alongside a lower relative humidity, compared to the one of the air in the samples. In order to ensure the accuracy of the measurements, we removed this reduced period.

II. Errors that could be made during the collection of the fauna material

II.1 When capturing different individuals of the invertebrate species, we initially did not want to use any kind of attractant; this would though lead to the missing of the individuals capturing, which would have passed by the traps in the soil or the ones in the samples. In order to avoid the situation, we have used a weak odor attractant, as the use of a strong one would have been useful only if we would have analyzed the existence of some species in the mesovoid shallow substratum or depending on the variation of the T or RH ecologic parameters. But, considering that our scope was to study the extent to which the geologic substratum determines the variation of the ecological factors and they, in turn, influence the distribution of the fauna components, if we had used a strong attractant, the results wouldn't have been relevant.

II.2. Moreover, we have tried, when installing the samples, especially the ones in older schist scree, not to modify the position and especially the compactness of the scree, which had a very low interclastic porosity at depths lower than 0,5m, due to the development of residual clay material, which filled the cavities. If we had modified in a significant manner the position of clasts and we had increased the interclastic porosity, we would have created large, abnormal spaces, which would have allowed an easier but unnatural circulation of the invertebrates, leading to distorted results once again.

The price of respecting the natural situation was though the frequent filling of the samples' holes with clay material.

II.3. Another case we faced was the fact that we set an ecologic stationary on the right bank of Berbece's Creek, in order to collect fauna material and to monitor the main ecological factors in schist lithosoil. Subsequently though, after several months, on the lower part of this river a forest road was set, which functioned for a year and which was used to transport wood from the forests The road passed right by the stationary (Fig. 5), which is the reason why we stopped the research activity in here, considering that the stationary is affected by human activities. Our scope was to research areas that were not distorted by humans, which is why we also placed stationaries in such places, which were frequently barely available to humans.

Fig. 5. Berbece's Creek Valley transformed by the wood exploitation during 2015 year

III. Periodical measurements of the ecological factors

III.1. At this stationary, Rudărița – surveys, placed on limestone scree, we have repeatedly made measurements at the level of the soil, using an infra-red thermometer, on September 9th 2015, trying to observe the amplitude of the temperature differences between the permanently shadowed areas and the sunny ones, even if they are close to each other. Results are exposed in table 3.

Table 3. Rudărița – samples stationary, multiple measurements made on the soil,on September 9th 2015

Nr. crt.	Hour	Temperature in shadowed areas (°C)	Temperature in sunny areas (°C)
1	9:49	10.9	14.4
2	9:50	7	12.6
3	Interval 11:10-12:30	8.4	14.3
4		14.5	24.7
5		13.5	30.3
6		15.6	30.6
7		13.8	28.8
8		17	26.8
9		15.4	27.9
10		13.5	26.3
11		13.6	26.9
12		12.7	26.8
13		15.9	33.2
14		14.4	23.6
15		14.3	24
16		12.8	19.3
17		13.6	27.4
18		18.6	36.7
		Average T in shadowed areas: 13.6°C	**Average T in sunny areas: 25.3°C**

(from Dorobăț, 2016, modified)

The difference between the average temperatures in shadowed and sunny areas is 11.7°C.

Practically, by noticing all of the above values, leads to the fact that, if we made a punctual recording, at a certain hour only, for a certain place, it would be irrelevant, as the area could be shadowed and later sunny, with significantly higher temperatures at the level of the soil. For accurate measurements, for the calculus of the temperature or humidity averages with further higher accuracy, we would need permanent measurements which are only made using data loggers, as any punctual, periodical measurement is not very significant.

III. 2. Stationary – Valea Cheii only functioned for 3 months – July, August and September 2015; we mention the values of the measurements at the level of the soil: average temperature 31.5°C and average relative humidity of only 32.5%.

Obviously that these values must be reported only for July and August and they are less relevant, due to the low number of measurements. The reduced relative humidity and also the high temperatures of the scree are explained by the fact that in summer, at the time of the measurements, if the sky is sunny, the southern exposure of the slope leads to these kind of values.

CONCLUSIONS

A fundamental condition for the date, in the case of the research on fauna distribution, to be relevant, is that the placement of the stationaries to avoid the anthropic modified areas; if this condition was not met, than changes appear due to the anthropic intervention; the natural distribution of the microfauna is affected in a certain manner and the results are distorted.

If the recordings in the data logger were not removed, as the devices were not destroyed, we can set the limits of the period for which the data records are accurate, through the logical interpretation of the measurements, comparing the to the previous ones made in similar conditions.

Atypical values of the measurements always have an explanation; significant, unusual discontinuities, reveal an abnormal "behavior" of data-loggers and the cause leading to these recordings must be found and removed. The placing of measuring devices must be made as to avoid these situations, but the situations in the field are not always predictable.

Periodical or sporadic measurements of the values of the ecological factors are irrelevant; moreover, even for the same area, of several sq meters, it matters if the temperature measurement on the surface of the soil is made in a shadowed or sun-exposed area.

The altering, changing of the interclastic porosity or of the scree compactness can lead to the creation of spaces through which invertebrates could circulate easier through the samples, which is not exactly what happens in the nature. If we desire not only qualitative but also quantitative analysis, to correlate the number of individuals from various invertebrate species reported to the depth variance and of the value of the main ecologic factors, than the accuracy of the collection of the fauna material depends on keeping the natural conditions, conditioned by the careful placement of the samples especially in schist scree, making sure to distort the natural conditions as less as possible and not to artificially create free spaces.

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ABSTRACT

In this paper are presented various problems that we have encountered in our field research, regarding the monitoring of environmental factors temperature and relative humidity, regarding the collection of faunal material (invertebrates). Sometimes errors have occurred in the case of measurements or for various reasons, for some periods the measurements could not be considered relevant. We tried every time to save the recorded data for the time periods for which they could be considered valid and, of course, we identified the causes of the errors and eliminated them. Sometimes was difficult to understand why for some time intervals the results cannot be considered valid and for other intervals they are valid, we had to differentiate between them. It should be mentioned that permanent monitoring of the main environmental factors temperature and relative humidity, over the months, years, with the taking of the valleys every two hours, both at ground level and at different depths in the mesovoid shallow substratum (MSS), represents a premiere in Romania.

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