CONTRIBUTIONS TO THE STUDY OF CHIROPTERA FROM MOLDAVIA (ROMANIA)

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Abstract. This paper presents the results of a research study that took place between 1999-2003, regarding the natural and artificial shelters on Moldavia country, from the N-NE of Romania, more precisely, from Suceava and Iasi districts. The study aimed the identification and monitoring of the hibernation colonies as well as the ecological dates of the sites. I also did a short description of each cavity.

Keywords: Arealography of the Chiroptera in Moldavia.

Rezumat. Contribuţii la studiul chiropterelor din Moldova (România). În această lucrare sunt prezentate rezulatatele unui studiu chiropterologic, obţinute între anii 1999-2003 în N-NE României. Sunt prezentate câteva hibernacule atât artificiale cât şi naturale. Majoritatea au fost studiate atât din punct de vedere faunistic cât şi ecologic. De asemenea, sunt semnalate câteva specii importante pentru zonă şi pentru ţară.

Cuvinte cheie: Distribuţie, chiroptere, Moldova.

Introduction

The research took place between the years 1999-2003, and the working areas included the Maramureş Mountains, Rarău-Giumalău Mountains and Obcinele Bucovinei from Suceava as well as Repedea Paleontological Reservation from Iaşi district, both from N-NE of Romania.

The study consisted in monitoring some Chiroptera hibernation colonies. These colonies were found either in natural cavities or in artificial ones. I managed to follow the dynamic of the bats during hibernation, as well as some microclimatic factors, like temperature and humidity, correlated with external temperature variations. I compared the data obtained for certain shelters with those from the previous studies.

Thus, there have been studied the following caves and mines: Peştera Liliecilor from Culmea Hăgimişului, the Mine from Abruptul Rarăului from Masivul Rarău, Cave No. 2 from Piatra Albastră şi Mantz Mine from Valea Putnei**, (**Obcinele Bucovinei), Peştera Laptelui – Maramureş Mountains, from Ţibău locality; all this are localized on Suceava district's teritory. In Iaşi district, the second area of research, I studied Grota Mare localized on Repedea Hill**,** from the Repedea Paleontological Reservation.

Also the quoted sites, as The Mine from Abruptul Rarăului, from Rarău Mountain, Cave No. 2 from Piatra Albastră, Mantz Mine, Peştera Laptelui, are locations which offer new informations about the spreading of chiroptera in Moldavia region.

Preveously, in this area, only Valenciuc has studied the Peştera Liliecilor from Culmea Hăghimişului, staring the year 1960 (Valenciuc, 1969). The rest of the sites captured the attention of the "Speo Bucovina" Club, starting 1983, but only since 1998 the majority of this sites has been chiropterologicaly studied (Done, 1994).

Material and Methods

The materials used in the field, during our journeys were: thermometer, psychrometer, camera with accessories, mist-nets, sliding callipers and mapping instruments like compass and clinometer.

The species were determined by using the identification keys (Valenciuc, 2002; Murariu *et al*., 2003) and after the morphometrical measures.

The caves in study were distributed in sectors; for each cave the temperature and humidity were measured, the bats were counted or we made estimations about the big colonies, and sometimes the species were determined.

Because these caves are shelters for hibernation (one exceptions), the bats were not observed during summer; the determination and study of the bats were performed with minimal disturbance. During the next journeys we investigated the numerical distribution of the bats in the corridors of the caves or mines and we determinated the microclimatic factors.

Results and Discussion

The studied shealters will be discussed in order, with a brief presentation of the area and the research.

I. Rarău Mountain. The aria in discussion is situated between 47º 23' 47" (the confluence of Chiril brook with Bistriţa river) and 47º 32' 32" (the Moldova river at Câmpulung-Moldovenesc) northern latitude, and between 25º 28' 6" (the confluence of Giumalău brook with Moldova river at Pojorâta) and 25 º39' 30" (Slătioara) eastern longitude.

1. Peştera Liliecilor from Culmea Hăghimişului (U.T.M.: LN 95)

Situated at 1500 m altitude, the cave is localized at approximate 1 km North of Pietrele Doamnei Reservation. The first description of the cave was made by N. Valenciuc (1969) and the specifications regarding the dimensions and the difference of level, were added subsequently by A. Done and co. (1975). The entrance is represented by a 2-3 meter wide aven, with a difference of level of approximate 86 meters and 340 meters long.

After a 14 m descent, there is the room called Sala luminată (S I). Following a 7 m diaclase, the space becomes larger and the way continues sloping to a point were the ceiling lowers much. Beyond this region there is the Sala Liliecilor (S II) room, which is 13 m long, with a maximum breadth of 11 m and 9 m height. The next is Sala Dreptunghiulară (S III), 10 m long and the height varies between 4 and 6 m, Sala Conică (S IV), with the approximate lenth of 5-6 m, and 8 m height, Sala Ramificată (S V) 19 m long and the last room called Sala Ascunsă (S VI) with two ramifications of 7 m respective 9 m long and variable height of 5 m.

During the 60s, the colony formed by aproximatively 8000 exemplars represented the biggest *Myotis* sp. hibernation colony in Romania, from 1600 m altitude (Valenciuc, 1982).

Today it has, aproximatively, 2400 exemplars and it is believed that it extents, the cave being accessible to the experienced tourists, and its perturbation degree is highly enough.

The observations and estimations about the number of bats are found in the table below, where you can follow the evolution of total number of chiroptera and their dispersion on rooms. As it results from the table, the bats are found only in four of the cave's rooms.

Comparing the results with the studies performed in the cave between 1960-1970 by N. Valenciuc and I. Ion, the colony reduced very much, from 7000-8000 exemplars to a maximum number of 2400 exemplars. According to N. Valenciuc (1982) this colony

contains 95% *Myotis blythi* species, 4% *Myotis myotis* species and 1% is represented by other species, among this *Myotis mystacinus* (Valenciuc, 1982).

Table 1. Observations in the studied months (October 1999 – February 2003): the dynamic of the bats` number (yearly, seasonal and inside the shelter).

Observations date	Total	S II	S III	S IV	S V
10.X.1999	400	300	80	18	2
14.XI.1999	2000	1500	250	240	10
20.II.2000	2000	1800	170	25	5
20.V.2000	40	38	2	0	0
17.XII.2000	2300	1800	350	145	5
17.IV.2001	1256	715	530	11	0
21.XII.2002	2000	1500	300	185	15
22.II.2003	2400	1800	450	140	10

The bats arrive at this cave at the end of August, and in October (10.X.1999) there were 400 exemplars. Their number remains constantly of approximate 2000 exemplars (21.XII.2002) during the cold months: November, December, January, February and at the beginning of May there remained only 40 individuals (17.V.2000). The nursery colony arrive at the end of june.

According to the observations during the three winters: 1999-2000, 2000-2001 and 2002-2003, we believe that the arrival and retirement of the bats from the cave belongs to similar informations of each year.

Exemplars of *Myotys myotis/Myotis blythi* were distributed in groups of variable sizes and shapes for example chain shape or wheel shape, placed especially on the ceiling of the cave but individual exemplars were also found on the lateral walls of the cave.

The temperature inside the cave varies constantly between 2-4^{o}C, and the humidity is 99%.

Each time we noticed that our visit disturbed the bats because the number of awaked and agitated exemplars was increasing as we stayed there.

In 22 July 2003, in the Programme "Survey of Romanian's underground bat habitats" a trip to Peştera Liliecilor was made and mistnettings was part of the program. The specimens caught were identified by Tomasz Postewa and Anna Gas, measured, weighed and set free. In this trip a small nursury colony of 70 individuals was observed by Tomasz Postewa (the only one who went down in the cave). 14 *Myotis blythi*, 10 *Myotis myotis,* 1 *Myotis daubentonii*, 1 *Myotis mystacinus*, 1 *Myotis brandtii* and 2 *Myotis dasycneme* were caught and studied. At that time the *Myotis daubenton*i, *Myotis brandtii* and *Myotis dasycneme* were mentioned for the first time in this cave and area (Nagy *et al.,* 2003*)*.

After that, in August 2005, Ifrim Irina made mistnettings and caught *Myotis brandtii* also (Ifrim & Valenciuc, 2006).

2. The Mine from Abruptul Rarăului (U.T.M: LN95)

We have had the occasion to enter this cave while I was roaming an unmarked route for a better knowledge of the area, on 16 October 2001. The mine situated in the area of the mountain called Abruptul Rarăului, is no longer than 100 m on horizontal and it continues with two branches on the right side and one on the left side. The number of bats observed was 18. Among this we determined 10 exemplars of *Myotis myotis*, and the rest of the individuals belong to ather species. Two individuals were exemplars of *Myotis mystacinus* and *Eptesicus* nilssoni (Barti, 2002; Valenciuc *et al*, 2007).

Table 2. The specific composition and different parameters on the bats captured with net at Peştera liliecilor from Culmea Hăghimişului in 22 July 2003.

No.	Species	Sex	Age	F.A. (mm)	Weight	Parasites
1.	*Myotis blythi*	♀	ad	61.6 mm	22.5 g	yes
2.	*Myotis blythi*	♀	ad	58.3 mm	22.5 g	no
3.	*Myotis dasycneme*	♂	ad	45.7 mm	15.5 g	no
4.	*Myotis mystacinus*	♂	ad	36 mm	5 g	no
5.	*Myotis brandtii*	♂	ad	37.6 mm	5.5 g	no
6.	*Myotis dasycneme*	♂	ad	44.3 mm	13.5 g	no
7.	*Myotis daubentonii*	♂	ad	37.1 mm	7 g	no
8.	*Myotis blythii*	♂	ad	59.1 mm	23.5 g	no
9.	*Myotis blythii*	♀	ad	60.9 mm	23 g	yes
10.	*Myotis blythii*	♀	ad	60.6 mm	24 g	yes
11.	*Myotis myotis*	♀	juv	62.8 mm	23 g	yes
12.	*Myotis myotis*	♂	ad	57.1 mm	24 g	yes
13.	*Myotis myotis*	♂	ad	59.4 mm	28 g	yes
14.	*Myotis blythii*	♀	ad	63.2 mm	24 g	no
15.	*Myotis myotis*	♀	juv	58 mm	24.5 g	yes
16.	*Myotis myotis*	♀	ad	62.2 mm	23 g	no
17.	*Myotis blythii*	♂	ad	36.1 mm	23.5 g	yes
18.	*Myotis blythii*	♂	ad	57.8 mm	23 g	yes
19.	*Myotis blythii*	♀	ad	61.3 mm	23.5 g	yes
20.	*Myotis myotis*	♀	ad	60.3 mm	25.5 g	yes
21.	*Myotis blythii*	♀	ad	61.5 mm	24.5 g	yes
22.	*Myotis blythii*	♀	juv	60.9 mm	25 g	yes
23.	*Myotis blythii*	♀	ad	60.8 mm	24 g	yes
24.	*Myotis myotis*	♀	ad	60.3 mm	25 g	yes
25.	*Myotis myotis*	♀	juv	60.1 mm	23.5 g	yes
26.	*Myotis blythii*	♂	ad	55.8 mm	23 g	no
27.	*Myotis blythii*	♀	juv	62.6 mm	25 g	yes
28.	*Myotis myotis*	♀	ad	63.2 mm	24 g	yes
29.	*Myotis myotis*	♀	ad	58.6 g	26 g	yes

II. Cavities in Valea Putnei. The area is settled between Valea Putnei and Pojorâta, including the Putna Mare River basin. Geographically speaking, Valea Putnei separates the Rarău-Giumalău from the Obcinas. Thus, the cavities from the two mountainsides belong those two special karst areas: the left mountainside, to the 1034 area; and the right one to the 1051 area (Goran, 1982).

1. Mantz Mine (U.T.M.: LN 66)

It is a 19th century artificial cavity for geological exploration. It has a length of 123,15 m and a 62,8 m extention. It is a bit curved, having two ramifications to the left. The dimensions of the galleries sections are about 1.8*1m.

The filling is rich and varied. The depositation forms on the ceiling and the parietal ones are remarkable (stilolites having few centimetres and being differently coloured, odontolites), as well as on the floor (form of pearls dripping).

The main gallery has no formations after passing the second ramification, but, in exchange, small and not very deep lakes appear (Done, 1994).

Our observations and journeys are synthetized in the next table, thus observing the colony's dynamic during hibernation.

In Mantz Mine we determined two species: *Myotis myotis and Myotis daubentonii*. On the 10th March 2001 this colony had a maximum of 32 exemplars.

From the dynamic observed during hibernation, in this shelter most of the bats are constituted into two big groups of 14-16 exemplars, on the second gallery, and 8-11 exemplars, on the fourth gallery. The other exemplars were hibernating alone in the depth of all four-mine galleries.

Table 3. Observations in the studied months (October 1999 – February 2003): the dynamic of the bats`number (yearly, seasonal and inside the shelter).

Observations date	Total	Gallery I	Gallery II	Gallery III	Gallery IV
31.X.1999	17	3	2	9	3
26.III.2000	27	2	2	14	9
28.V.2000	0	0	0	0	0
18.IX.2000	7	2	1	1	3
24.IX.2000	5	1	1	0	3
2.XII.2000	22	3	2	10	5
3.II.2001	28	2	6	9	11
10.III.2001	32	2	6	16	8
28.XI.2002	29	3	5	16	5
15.II.2003	20	2	4	10	4

This colony is 99% formed of *Myotis myotis*, and 1% is represented by the *Myotis daubentonii* (their maximum number being of two males and one female). It is not known when the mine was populated because it had been abandoned 150 years ago.

Since 1983, the "Speo Bucovina" members have been coming here, and since then the number of bats observed, remained constantly around 30 exemplars (Done, 1994).

This fact, makes us believe that there were no major perturbating factors to lead to their number diminuation, as it happened in other shelters.

We observed few ecological elements, that means the existing temperature and humidity in the cave during hibernation months. The Bucovina Speo Club has made climatologycal observation here, in the warm months of 1988 and the result was that the temperature inside the mine has a very little variation along these months, remaining almost constantly around 7ºC. The same constant value was recorded in the cold months, and the conclusions would be that all along the year the temperature remains constantly in this mine. Thus, we measured a 86% humidity and the following temperatures:

Table 4. Observations in the studied months (October 1999 - February 2003): the values of temperature.

Observations date	Entrance	Gallery I	Gallery II	Gallery III	Gallery IV
31.X.1999	15°C	8°C	8°C	8°C	8°C
26.III.2000	5°C	6°C	6°C	6°C	7°C
24.IX.2000	15°C	8°C	7°C	6°C	7°C
3.II.2001	-4°C	7°C	7°C	8,5°C	8°C
10.III.2001	9°C	7°C	7°C	7°C	7°C
28.XI.2002	0°C	6,5°C	7°C	7°C	8°C
15.II.2003	-10°C	6°C	7°C	7°C	7°C

2. The Cave No. 2 from Piatra Albastră (U.T.M.: LN 66)

It is placed on the opposite mountainside of the Mantz Mine, on the right of Putna Mare River, and geographically speaking it belongs to the Rarău-Giumalău Mountains (area 1051), having No. 1034/2 in the cadastre (Goran, 1982). The cave has two small entries, a 133.1m length and 37.25 m extention. This is the biggest cave in the area. After a 3 m leap we get to the first room (6*3.5 m and 1.9 m height), named by us The Bats Room. From this point the cave continues with three galeries which finish with three small rooms.

Bats were not seen in the summer. They were seen in March two years in a row, when the exemplars of *Myotis myotis* were hibernating. The maximum number of bats found here was of 5 exemplars in two galeries on 10th March 2001; two exemplars in the Bats Room, and three in the Room II.

It is observed an important variation of the temperature in the first measure point, because of the short distance to the surface as well as of the gllery access with the exterior. In May this variation is also dephased with the average variation of the exterior, although outside there were 10ºC, inside the temperature was of only 4.5ºC. In October, although at the registration time the temperature outside was of 6ºC and the average was to be 0ºC (at night it was of -3ºC, -4ºC), inside the temperature was of 8.4ºC. During the bat hibernation, I was more interested in the temperature from the Bats Room, right under the colony. This was 5°C.

III. Maramureş Mountains

Peştera Laptelui (U.T.M.: LN 48)

This is another cave that we took in consideration; it appears in the cadastre having the number 1031/7, and situated in the Tibau River basin, Maramures Mountains (Goran, 1982).

We don't know when the bats appear here, because at the end of September and in May they were not registrated. On 25th December 2000, in the depth of the main gallery, three exemplars of *Myotis myotis* were hibernating.

On 29th December 2002, by forcing another galeries of the cave, we found a room, where 39 individuals belonging to *Myotis myotis* (35 exemplars), an undetermined species of *Myotis* and e individuals belonging to Plecotus auritus/ austriacus.

The temperature in this gallery was between 0-3ºC.

IV. Iaşi District

Grota Mare (Repedea, Iaşi , U.T.M.:NN42)

The Paleonthologycal Reservation "Dealul Repedea" (Repedea Hill) is settled 10 km south of Iaşi locality, and the protected area, as a scientific one, have been enlarged to 5.8 hectares and surrounded by a protection belt of 38.5 hectares to avoid the impact with the less conscient population for protecting this important natural museum.

One has to crawl to entry the cave, and after 5 m right an intersection of two galleries is reached, when the ceiling rises up to 2.5 m. The cave has many galleries, with dendritic disposing, and a 120 m development.

Table 5. Oservations in the studied months (January 2001 - February 2005): the dynamic of the bats`number (yealry, seasonal and inside the shelter) and the values of temperature.

Observations date	Total numbers of exemplars							Entrance	Depth
	T	S I	S II	S III	S IV	S V	S VI		
28.I.2001	17	3	3	0	3	5	0	11°C	6°C
18.II.2001	18	4	7	2	1	2	2	8°C	6°C
05.III.2001	16	4	5	1	1	2	3	7°C	6°C
25.III.2001	10	1	1	2	3	3	0	16°C	6°C
22.IV.2001	2	1	0	0	0	1	0	18°C	6°C
7.XII.2002	25	6	3	3	4	5	4	-3,5°C	9,5°C
15.II.2003	26	6	4	3	5	5	3	-4,5°C	6,5°C

In this cave, from December to April we have been observations hibernating exemplars, most of them solitary ones. The maximum number of bats that we found here is of 26 exemplars on the 15th March 2003 and the minimum number of 2 exemplars on 22nd April 2001. The determined species were *Myotis blythii, Myotis daubentonii, Myotis nattereri, Myotis bechsteinii, Plecotus sp, Eptesicus serotinus*. Grota Mare (Repedea,Iaşi), the only one in this eastern part of Romania, although it has a population of 25 individuals, it is very varied, having six species, from the nine ones pointed out in the N-NE of România: *Myotis blythii, Myotis daubentonii, Myotis nattereri, Myotis bechsteinii,*

Plecotus sp., Eptesicus serotinus (Valenciuc & Chachula 2001, 2002). During 2003, 2004 and 2005 it was discovered here other species as *Myotis myotis, Myotis mystacinus, Myotis brandtii, Myotis dasycneme, Plecotus auritus, Plecotus austriacus, Barbastella barbastellus* (Ifrim & Valenciuc, 2005; Pocora & Pocora, 2007).

Here it was also observed the individuals dynamic during hibernation as well as some microclimatic factors. The average temperature is around 6°C and the humidity is about 90%.

Conclusions

As a result of the investigations made in this part of Romania, it was discovered two artificial cavities and four natural ones that are shelters for bat's hibernation. Remarkable is that the four caves are the biggest in the country area.

Among this, only the Peştera Liliecilor from Culmea Hăghimişului has been analysed from a chiropteric point of view in the past.

Mina nr 1 from Abruptul Rarălui, Mantz Mine and The Cave No.2 from Piatra Albastră were investigated and mentions for the first time, in what it concern the bat fauna.

We succeeded in giving new informations about the chiroptera spreading in the literature of speciality, that means four new locations on the map. Thus, the *Myotis myotis* species appears in Valea Putnei and Ţibău from the Suceava and Iaşi districts; the *Myotis daubentonii* in Valea Putnei and Iaşi locality; *Myotis bechsteinii* in Iaşi locality as well as *Myotis nattereri; Eptesicus nilssoni*, at Câmpulung Moldovenesc, Suceava district; *Plecotus sp*, at Câmpulung Moldovenesc, Suceava district.

We brought informations regarding the presence of six species from the Moldavian fauna and at the same time rare to Romanian fauna, *Myotis daubentonii, Myotis nattereri, Myotis bechsteinii, Myotis dasycneme, Mytis brandtii and Eptesicus nilssoni.*

All the caves that have been described in this paper were included in the National Monitoring Programme, and we hope to bring important informations regarding the bat population in this Romanian region.

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