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SUMMER BAT FAUNA OF THE CARPATHIAN BIOSPHERE RESERVE (THE MALA AND VELYKA UHOLKA VALLEYS)

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Summer bat fauna of the Carpathian Biosphere Reserve (the Mala and Velyka Uholka Valleys). The research was carried out in the second half of July in two valleys: Mala & Velyka Uholka (Karpatski Biosferny Zapovidnyk). The following methods were used: netting, check-up of caves and detectoring (D–100, D–200 Pettersson). Detectoring was carried out at linear transects in different environments (transect length was about 2 km), as well as cave entrances. Differences in species composition and density of chosen bat species were recorded. Bottom of Mala Uholka valley appeared to be the most varied environment, followed by the cultivated part of the valley and then village Mala Uholka. The lowest density occurred at the slopes of Mala Uholka valley. 11 bat species were recorded.

Key words: *Chiroptera*, Carpathian Biosphere Reserve, species composition.

1. Introduction

The Carpathian Biosphere Reserve was created in 1993. Its area comprised 38 930 ha, including a 19 980 ha barrier zone, an 8 049 ha buffer zone and an 8 071 antropogenic zone. In 1997, the area of the Reserve was extended up to 57 880 ha. At present, the Reserve includes the following seven massifs Chornohirskiy, Kevelivskiy, Kuziy-Svidovetskiy, Marmaroskiy, Shyrokoluzhanskiy, Uholskiy and Trebushanskiy; Landscape Park 'Stuzhytsia' and two reserves — "Chorna Hora" and "Yulivska Hora".

Forests cover 90 % of the Reserve. Up to now, one thousand species of vascular plants, 65 species of mammals, 179 species of birds, 9 species of reptiles and 13 species of amphibians have been recorded in this area. Protected territory spreads out from 180 to 2061m a.s.l. (LEONENKO *et al.* 1999).

Karstic forms occur only in Uholskiy Zapovidnyk. Up to now, over 30 caves and rock shelters have been described. (CHIZHMAR, DOVGANICH 1988). In some caves regular wintering of bats was observed (POKYNCHEREDA 1993, 1997; POKYNCHEREDA, POKYNCHEREDA 1997, 1998). Research was carried out in two valleys: the Mala Uholka Valley and the Velyka Uholka Valley in the second half of June 1996 (Fig. 1).

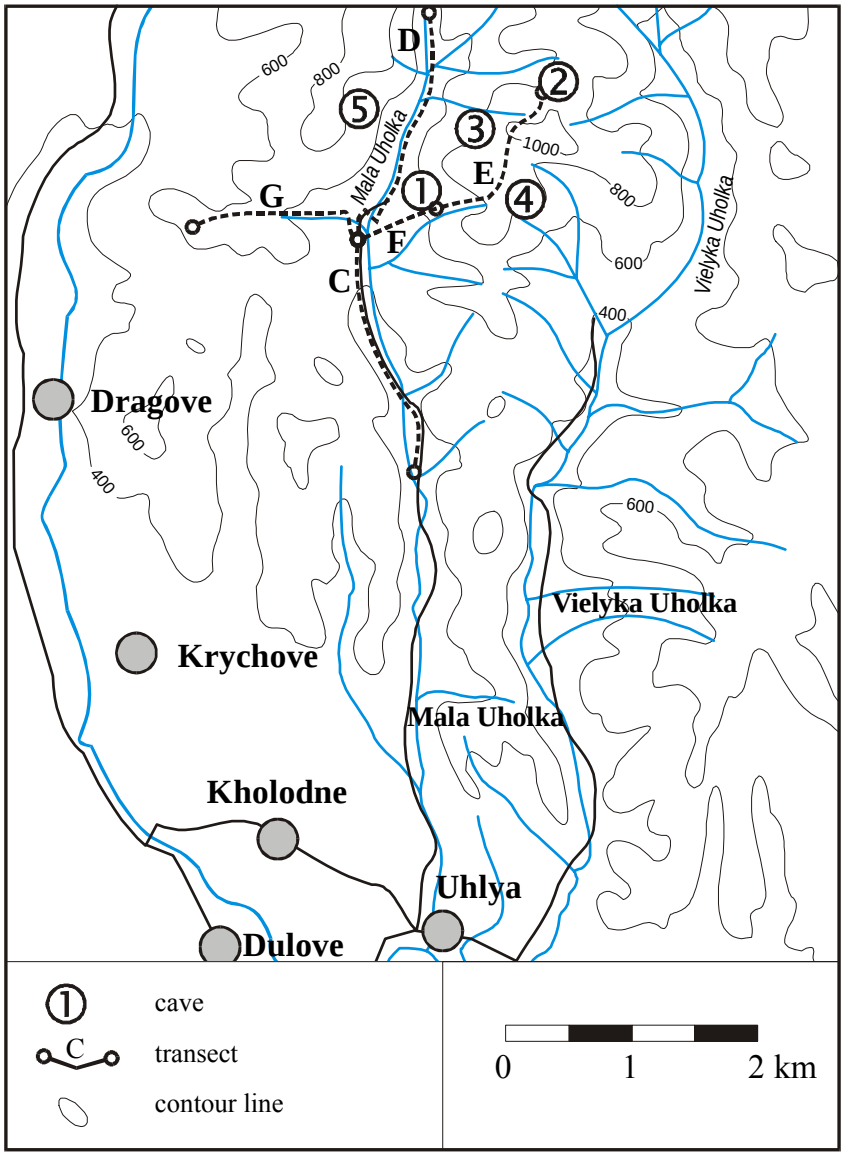

Fig. 1. Distribution of the caves (open circles 1–5) and lines of the transects in the territory of the Carpathian Biosphere Reserve (Mala Uholka and Velyka Uholka).

2. Methods

During field research in the Carpathian Biosphere Reserve the following methods were used:

— **nettings:** special chiropterological nets were set on streams, near cave entrances or on rocks. The species of the specimens caught were identified, the animals were measured, weighed and set free. Nettings were performed from twilight till about 1.00 a.m.

— **detectoring:** ultrasonic detectors D–100 and D–200 Petersson: the identification of bats was based on the characteristic frequency and sound sequences (AHLEN 1988). In this research the following bat species were recorded:

Species	**Frequency**
Eptesicus nilssonii (Keyserling et Blasius 1838)	30 kHz
Eptesicus serotinus (Schreber, 1774)	25 kHz
Nyctalus noctula (Schreber, 1774)	20 kHz
Rhinolophus hipposideros (Bechstein, 1800)	105–115 kHz
Rhinolophus ferrumequinum (Schreber, 1774)	80–85 kHz
Myotis daubentonii (Kuhl, 1817)	55 kHz
Myotis myotis (Borkhausen, 1797) / *Myotis blythii* (Tomes, 1857)	35 kHz
Myotis spp.[1]	40–45 kHz

Detectoring was made in approx. 2 km long line transects in different types of environment and near the cave entrances. For the comparison of stands the density of bats was and presented as from the number of bats per 1 km of the transect.

— **check-up of caves:** caves were penetrated in order to find summer bat shelters.

3. Results

3.1. Nettings

Nettings near cave entrances: nets for bats were set in front of the cave entrances in the Mala Uholka and Velyka Uholka valleys (Fig. 1): the Druzhba cave (1), Karstovi Mosty (2), the Czur cave (3), the Grebin' cave (4), and caves which lay on the western bank of the Mala Uholka river (5).

Table 2. Results of nettings near cave entrances

Stand	Date	RHF	MDA	PAS	BAR	MBO/MYM	MBE	MYS/MYB	Total *
Druzhba cave	21.06.96	1	1	1	–	–	–	–	3
	24.06.96	1	–	–	1	–	–	–	2
	25.06.96	–	–	–	–	1	–	–	1
Karstovi Mosty	28.06.96	–	–	–	1	1	1	–	3
Mala Uholka river,	27.06.96	–	2	–	–	–	–	–	2
forester's lodge	29.06.96	–	–	–	–	–	–	1	1
Total		2	3	1	2	2	1	1	12

* 10 males and 2 females were caught: sex ratio of the bats caught was 5:1.

3.2. Detectoring

Results of the detectoring are shown in Table 3.

[1] Other species from the *Myotis* group were not identified due to the similarity of the emitted ultrasounds.

Table 3. Results of the detectoring performed in Rakhiv region and in the Mala Uholka and Velyka Uholka valleys

	Transect	Date	MBO/ MYM	ESE	MDA	ENI	NYN	Pl. sp.	M. sp.	Total
A	Rakhiv (Reserve manager's office) – Swidowiec slopes – Rakhiv (Reserve manager's office)	18.06.1996	–	5	–	–	–	1	1	7
B	Rakhiv (Reserve manager's office) – road along the Tisza river – Rakhiv (Reserve manager's office)	19.06.1996	–	10	4	–	–	–	–	14
C1	Mala Uholka (forester's lodge) – cottage	23.06.1996	–	7	–	1	–	–	1	9
C2	Mala Uholka (forester's lodge) – cottage	24.06.1996	–	5	–	–	–	–	1	6
D1	Mala Uholka (forester's lodge) – cottage – Mala Uholka (forester's lodge)	25.06.1996	–	9	8	–	1	–	3	21
E	Mala Uholka (forester's lodge) – Karstovi Mosty – Mala Uholka (forester's lodge)	26.06.1996	–	–	–	–	–	–	1	1
D2	Mala Uholka (forester's lodge) – up the river – Mala Uholka (forester's lodge)	27.06.1996	2	8	11	–	1	–	–	22
F	Mala Uholka (forester's lodge) – the Druzhba cave – Mala Uholka (forester's lodge)	28.06.1996	–	3	–	–	–	–	1	4
G	Mala Uholka (forester's lodge) – valley in the western direction – Mala Uholka (forester's lodge)	29.06.1996	1	6	–	–	–	–	5	12

3.3. Check-up of caves

Results of the check-up of the caves are shown in Table 4.

Table 4. Results of the day check-ups of caves

Stand	Species	Total
the Czur cave	*Rhinolophus hipposideros*	1
the Druzhba	Vespertilionidae gen. sp.	5

4. Discussion

4.1. Detectoring

We found differences in the composition and the density of the bat species in the environments examined (Fig. 2). In order to compare the results from different types of environments we used the matrix of Pearson's correlation coefficients (Tab. 5) and proved a similarity among the en-

vironments (Fig. 3). The most similar were transects in an anthropogenic environment, more distant similarity show ad the transects placed along streams. The biggest differences exist ad among transects in dense beech forests, where we observed the lack of bat species present near settlements species of the genus *Myotis* and water.

Similarity in the frequencies of ultrasounds emitted by unable their identification without a computer analysis. That is the why the species were put into one category — *Myotis* sp.

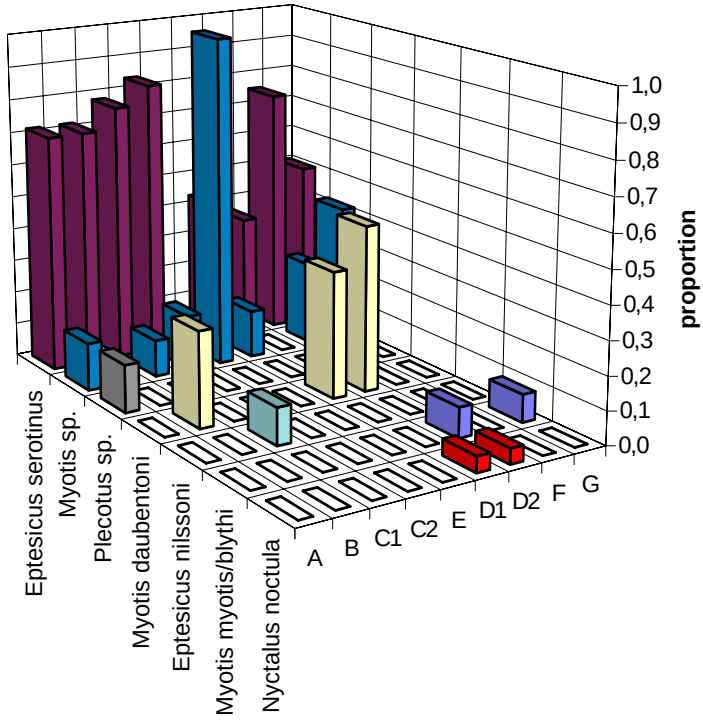

Fig. 2. Density and bat species composition at Carpathian Biosphere Reserve transects.

The bottom of the Mala Uholka valley appeared to be the richest. The results of the nettings and the detectoring show the highest density and variety of species present there. It is probably connected with the biodiversity of the environment which leads to a significant food abundance.

In the valley, along the Mala Uholka river *Myotis daubentonii* (1.6–2.2 specimen/km) and *Eptesicus serotinus* (1.6–1.8 specimen/km) were dominant. Single flights of *Nyctalus noctula, Myotis myotis/blythii* (0.4 specimen/km) and bats from the *Myotis* group (0.6 specimen/km) were recorded.

In the cultivated part of the valley (Mala Uholka cottage) we noted the high density of *Eptesicus serotinus* (1.25–4.7 specimen/km). Bats from the *Myotis* group were rarely recorded (0.25–0.7 specimen/km). The detection of *Eptesicus nilssonii* was a very interesting fact.

On the slopes of the Mala Uholka valley only of *Myotis* was recorded and its density was very low (0.4 specimen/km).

Table 5. Matrix of Pearson's correlation coefficients, correlation coefficients with p<0,05 are printed bold.

Symbol of transect	A	B	C	G	E	F	D
A		**r=0.858** p=0.013	**r=0.972** p.=0.000	**r=0.799** p=0.031	r=0.00 p=1.00	**r=0.966** p=0.000	r=0.501 p=0.252
B			**r=0.887** p=0.008	r=0.596 p=0.158	r=-0.230 p=0.619	**r=0.844** p=0.017	**r=0.850** p=0.015
C				**r=0.809** p=0.028	r=-0.014 p=0.976	**r=0.980** p=0.000	r=0.543 p=0.208
G					r=0.551 p=0.199	**r=0.903** p=0.005	r=0.350 p=0.441
E						r=0.167 p=0.721	r=-0.169 p=0.717
F							r=0.528 p=0.223
D							

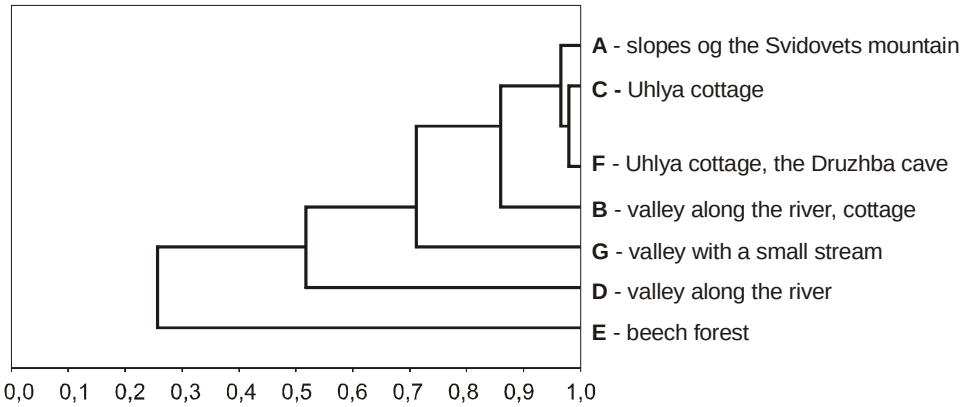

Fig. 3. Dendrogram of similarity (based on Pearson's correlation coefficient) among particular types of environment, where detectoring was performed.

4.2. Netting

Although a small number of bats caught makes impossible to run a proper statistical, following results are worth monitoring:

— specimens of *Rhinolophus ferrumequinum* were caught only near the entrance of the Druzhba cave, where they are present also during the hibernation period,

— *Barbastella barbastellus* was recorded in two stands. It is the first record of this species in the summer season,

— *Myotis bechsteinii:* one pregnant female was caught. It is the first record of the reproduction of the species in this area.

4.3. Comparison between the summer and the winter fauna

The summer season was compared with the 1995/96 winter season (POKYNCHEREDA 1997). There are differences in the species composition and the proportion of the particular species (Tab. 6).

Table 6. The results of the summer and winter check-ups in the Carpathian Biosphere Reserve. Species that usually do not hibernate in caves are printed bold.

Species	Summer season					Winter season: the Druzhba cave, the Grebin' cave	
	Caves	Detec-toring	Netting	Total	%	N	%
Myotis daubentonii	–	23	3	26	22,8	11	0,85
Myotis myotis/blythii	–	3	2	5	4,39	1129	87,52
Rhinolophus hipposideros	1	+	–	1	0,88	91	7,05
Rhinolophus ferrumequinum	–	+	2	2	1,75	37	2,87
Plecotus austriacus	–	–	1	1	0,88	0	0,00
Barbastella barbastellus	–	–	2	2	1,75	7	0,54
Myotis bechsteinii	–	–	1	1	0,88	0	0,00
Myotis brandtii/mystacinus	–	–	1	1	0,88	1	0,08
Eptesicus serotinus	–	53	–	53	46,5	0	0,00
Eptesicus nilssonii	–	1	–	1	0,88	0	0,00
Nyctalus noctula	–	2	–	2	1,75	0	0,00
Plecotus sp.	–	1	–	1	0,88	0	0,00
Myotis sp.	5	13	–	18	15,8	14	1,09
Total	6	96	12	114	100,0	1290	100,00

To make the comparison sensible it is necessary to omit species which hibernate in caves only occasionally — i.e. *Eptesicus serotinus* and *Nyctalus noctula* (Tab. 7). In the summer season *Myotis daubentonii* is the dominant species whereas *Myotis myotis/blythii* predominate in the hibernation period. Differences come from the character of the environment investigated (a bottom of a valley with a stream is a typical environment of *Myotis daubentonii),* and the lack of winter colonies of *Myotis daubentonii* in Eastern Carpathians (below 1 % in familiar caves). Specimens of *Myotis daubentonii* probably migrate to other winter shelters.

A small number of *Myotis myotis/blythii* may be connected with seasonal migrations: the species can winter here but summer colonies are formed in lower placed regions.

The similar fauna composition has been observed in the Bieszczady mountains. In summer seasons *Myotis daubentonii* was dominant in river valleys, whereas *Eptesicus serotinus* dominated in forests and in anthropogenic territories (GAŁOSZ *et al.* 1996, WOŁOSZYN *et al.* 1998).

Other differences were based on the large number of *Eptesicus nilssoni* and *Nyctalus noctula* in the Bieszczady mountains, whereas these species were almost completely absent in Zakarpattya. *Pipistrellus pipistrellus* (common species in the Bieszczady mountains) has not been recorded there either.

Table 7. Confrontation of summer and winter bat fauna in Uholski Reserve; species which usually do not hibernate in caves are omitted

Species	Summer research (authors' own research)		Results without NYN and ESE		Winter counting (Druzhba cave, 1997)*	
	n	%	n	%	n	%
Myotis daubentonii	26	22.80	26	44.07	11	0.85
Myotis myotis/blythii	5	4.39	5	8.47	1129	87.52
Rhinolophus hipposideros	1	0.88	1	1.69	91	7.05
R. ferrumequinum	2	1.75	2	3.39	37	2.87
Plecotus austriacus	1	0.88	1	1.69	0	0.00
Barbastella barbastellus	2	1.75	2	3.39	7	0.54
Myotis bechsteinii	1	0.88	1	1.69	0	0.00
M. brandtii/mystacinus	1	0.88	1	1.69	1	0.08
Eptesicus serotinus	53	46.50	–	–	0	0.00
E. nilssonii	1	0.88	1	1.69	0	0.00
Nyctalus noctula	2	1.75	–	–	0	0.00
Plecotus sp.	1	0.88	1	1.69	0	0.00
Myotis sp.	18	15.80	18	30.51	14	1.09
Total	114	100.0	59	100.00	1290	100.00

* after POKYNCHEREDA 1997.

5. Conclusions

— the presence of 11 bat species was stated: *Myotis daubentonii, Myotis myotis/blythii, Rhinolophus hipposideros, Rhinolophus ferrumequinum, Plecotus austriacus, Barbastella barbastellus* (the first record of this species in the summer season), *Myotis bechsteinii,* (the first record of reproduction in this region), *Myotis brandtii/mystacinus, Eptesicus serotinus, Eptesicus nilssonii* (the first record of this species in the summer season), *Nyctalus noctula*;

— the richest environment was the bottoms of valleys surrounded by beech forests, followed by the cultivated valleys, the smallest number of bats was recorded on the slopes of valleys in dense beech forests;

— the most numerous species is *Myotis daubentonii* (neighborhood of streams) and *Eptesicus serotinus* (cultivated valleys).

6. Streszczenie

Badania prowadzono w drugiej połowie czerwca 1996 roku w dwóch dolinach: Mala i Velyka Uholka (Karpatski Biosferny Zapowidnyk). Wykorzystano następujace metody: odłowy nietoperzy za pomocą sieci chiropterologicznych, kontrola jaskiń, nasłuch detektorowy (D–100 i D–200 Pettersson). Nasłuch dokonywano na transektach liniowych prowadzonych w różnych środowiskach (długość transektu wynosiła ok. 2 km) oraz przy otworach jaskiń.

Najbogatszym środowiskiem okazało sie dno doliny Mala Uholka. Wyniki odłowów oraz nasłuchu detektorowego wykazują tarn największe zagęszczenie i zróżnicowanie gatunkowe. Związane jest to prawdopodobnie z dużą różnorodnością środowiska, a w konsekwencji dużą zasobnością w pokarm. W dolinie, wzdłuż rzeki Mala Uholka dominował *Myotis dubentonii* (1.6–2.2 os/km) oraz *Eptesicus serotinus* (1.6–1.8 os/km). Stwierdzono pojedyncze przeloty *Nyctalus noctula,* zarejestrowano także obecność *Myotis myotis/blythi* (0.4 os/km) oraz nietoperzy z grupy *Myotis* (0.6 os/km).

Dolina zagospodarowana, wieś Mala Uholka. Notowano duże zagęszczenie *Eptesicus serotinus* (1.25-4.7 os/km). Sporadycznie notowano nietoperze z grupy *Myotis* (0.25-0.7 os/km). Ciekawym faktem jest stwierdzenie *Eptesicus nilssonii.*

Zbocza doliny Mala Uholka. Tutaj stwierdzo jedynie niewielkie zageszczenie (0.4 os/km) *Myotis.*

— osobniki *Rhinolophus ferrumequinum* odławiano tylko przy otworze jaskini Druzhba, gdzie występuje także w sezonie hibernacyjnym,

— *Barbastella barbastellus* został odłowiony na dwóch stanowiskach. Jest to pierwsze stwierdzenie tego gatunku w sezonie letnim,

— *Myotis bechstenii:* odłowiono jedną ciężarną samicę. Jest to pierwsze letnie stwierdzenie rozrodu *Myotis bechstenii* na tym terenie,

— stwierdzono występowanie 11 gatunków nietoperzy: *Myotis daubentonii, Myotis myotis/blythii, Rhinolophus hipposideros, Rhinolophus ferrumequinum, Plecotus austriacus, Barbastella barbastellus, Myotis bechsteinii, Myotis brandtii/mystacinus, Eptesicus serotinus, Eptesicus nilssonii, Nyctalus noctula*,

— najbogatszym środowiskiem okazały się dna dolin w otoczeniu lasów bukowych, następnie doliny zagospodarowane, najniższą liczebność stwierdzono na zboczach dolin w zwartym lesie bukowym,

— najliczniejszym gatunkiem jest *Myotis daubentonii* (okolice cieków wodnych) i *Eptesicus serotinus* (doliny zagospodarowane).

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