

***Myotis alcathoe* in eastern Slovakia: occurrence, diet, ectoparasites and notes on its identification in the field**

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Abstract. Altogether 80 specimens of *Myotis alcathoe* were caught at 19 forest and 2 non-forest localities in southeastern Slovakia. Habitats of its occurrence were dominated by oak (mean 43.7% at 19 localities), beech (41.6% at 14 localities) and hornbeam (17.5% at 16 localities). The forest stands were 60–100 years old, situated at the altitudes of 100–540 m a. s. l. *Myotis alcathoe* was found in assemblages with other 17 bat species. The most abundant were *Myotis bechsteinii* (15.1%), *M. myotis* (12.2%) and *M. alcathoe* (11.8%). Cryptic congeners *Myotis brandtii* and *M. mystacinus* were less abundant than *M. alcathoe* at most localities and made up, on average, 7.4% and 4.9% of the total sample of all captured bats, respectively. *M. alcathoe* reached 1.6–100% dominance in the sampled localities. It was also found outside forest habitats, in the Priekopa village in the Vihorlat Mts. (7 inds. captured) and near a water reservoir in an open landscape at the foothills of the Slanské vrchy Mts. At the latter site, sixteen bat species were recorded, including all three cryptic species from the *mystacinus* morpho-group, in one riparian forest. Analysis of 111 fecal pellets sampled from 24 individuals at seven localities revealed the presence of 10 major taxonomic groups of insects in the diet of *M. alcathoe*. Moths (Lepidoptera), mainly with body length below 12 mm, were the most important prey item. Ants (Formicidae), mostly of the genus *Lasius*, were dominant only at the localities of Jovsa and Boťany in six bat individuals (25% of the total studied sample). Nematoceran flies (mostly Mycetophilidae and Tipulidae) were another regular dominant prey item (>5% in total), followed by beetles (2.5%) and brachyceran flies (2.5%). In 11 of 80 bats, we found three ectoparasite species: fly *Basilia italica* (Nycteribiidae), mite *Spinturnix mystacinus* (Spinturnicidae) and tick *Ixodes vespertilionis* (Ixodidae).

***Myotis alcathoe*, eastern Slovakia, habitat, diet, ectoparasites, accompanying species**

Introduction

The Alcathoe bat (*Myotis alcathoe*) was described in 2001 (von Helversen et al. 2001), based on individuals coming from Greece and northern Hungary. In the following years, records of the species were reported from France (Ruedi et al. 2002), Slovakia (Benda et al. 2003), Spain (Agirre-Mendi et al. 2004), Bulgaria (Schunger et al. 2004), Switzerland (Stadelmann et al. 2004), Czech Republic (Lučan et al. 2007) and Austria (Spitzenberger et al. 2008). The review of all records in Europe, including the European part of Turkey, was given by Niermann et al. (2007). From Slovakia, only the data from the Cerová vrchovina hills have appeared in the literature (Benda et al. 2003, Uhrin et al. 2008).

The aims of this work were: (1) to obtain new data on distribution and habitats of this species outside its hibernation period in southeastern Slovakia, (2) to analyse its diet, (3) to identify its ectoparasites, and (5) to contribute remarks on identification of the species in the field.

Methods and material

The bats were sampled in forest habitats above small water bodies, both permanent and periodic. The animals were captured in a white 10 m mist net. The sampling was conducted over the whole breeding season (May–August) in 2005–2009. Only the localities and habitats with at least one captured specimen of *M. alcaethoe* are mentioned in this paper. Except for localities No. 20 and 21, netting of bats was conducted in forest habitats only. In each habitat we selected small water bodies where high activity of bats could be expected. The netting was carried out from twilight to 11:00 pm (summer time) when the flying activity of bats began to decrease. In 2006, we collected DNA samples from several individuals using wing biopsy punch to confirm species identification by genetic methods. The samples were stored in 96% ethanol. In most of the captured individuals we measured the length of forearm (LAt) and tibia (LTib), i.e. traits known from literature to be most credible for species identification (Dietz & von Helversen 2004). External distinguishing features were also observed – in *M. alcaethoe* primarily brown ear lobes and pale face (Le Bris & Le Houédec 2005). For two individuals we also report skull dimensions: LCr – greatest length of skull; LCb – condylobasal length of skull; LaZ – zygomatic width; LaI – width of interorbital constriction; LaInf – rostral width between foramina infraorbitalia; LaN – neurocranium width; ANc – neurocranium height; CC – rostral width between canines (incl.); M³M³ – rostral width between 3rd upper molars (incl.); CM³ – length of upper tooth-row between canine and 3rd molar (incl.); LMd – mandible length; ACo – height of coronoid process; CM₃ – length of lower tooth-row between canine and 3rd molar (incl.). Reproduction in females was confirmed based on the presence of a palpable foetus or an evidence of lactation (enlarged nipples and absence of fur in their surroundings). Juveniles were recognized according to incomplete ossification of interphalangeal and metacarpal joints. To collect fecal samples for diet analysis, bats were placed in bags for about half an hour. Parasites were collected by carefully inspecting fur and wing membranes of the bats. All pellets and ectoparasites were preserved in ethanol.

Particular prey categories were identified using comparative slides, methodological papers (McAney et al. 1991) and common entomological keys. In total, we collected data on prey composition in 24 individuals of *M. alcaethoe* (altogether 111 fecal pellets) from seven localities in southeastern Slovakia. They included ten individuals from Jovsa (45 pellets), five individuals in Byšta (25 pellets), four in Ďurkov (17 pellets), two individuals in Bořany (9 pellets) and by one individual each in Brestov, Strážske and Pozdišovce (altogether 15 pellets). All samples were collected between 28 June and 10 August (2007 and 2009). To express the results of diet analysis, we modified formulas of McAney et al. (1991). Percentage volume is expressed as the sum of all relative volumes of particular prey category in individual pellets in the studied set of fecal samples divided by the number of fecal pellets in the analysed set of samples. Percentage volume shows what proportion of volume represents the particular prey in the set of fecal samples analysed.

Parasites were identified in the following way: flies using a binocular microscope, mites and tick were conserved in Liquide de Swann to obtain permanent slides, and identified using a microscope.

The data on species composition and age structure of forest stands were obtained from forest management plans and forest stand maps (valid for the period 2000–2006) and processed in GIS. The areas of interest were circles with a diameter of 500 m centered at the capture point.

Description of localities in the following list: the locality name is followed by the geomorphological unit, mapping square code from the Databank of the Slovakian fauna, geographic coordinates, altitude, exposure and capture dates. The localities are listed chronologically, according to the first capture date.

Forest habitats

1. Rákoš, Standorina (Slanské vrchy Mts., 7394, 48° 38' 45.3" N, 21° 26' 49.7" E, 460 m, SW; 14 July 2005). The net was placed over a small marsh located within a forest stand, about 100 m from a large meadow, near a waterlogged alder stand with a water spring. The stand lacks shrub layer and consists mainly of beech (79%), oak (15%) and admixed hornbeam (2%), 40–200 years old.
2. Slanská Huta (Slanské vrchy Mts., 7494, 48° 34' 59.5" N, 21° 29' 07.7" E, 540 m, NW; 22 July 2005). Mist nets were set over a small marsh located within a forest stand, about 250 m from the nearest meadow. The stand lacks shrub layer, and consists of beech (64%), oak (23%), hornbeam (3%) and other broadleaved species (7%); its age is 40–80 years. The closest water body is lake Izra at a distance of 1400 m; the closest running water is a small stream at a distance of 1000 m.
3. Jovsa (Fig. 1; Vihorlatské vrchy Mts., 7198, 48° 50' 07.7" N, 22° 04' 55.5" E, 210 m, SE; 15 June 2006, 14 May, 28 June, and 21 July 2007, 13 and 20 May, 20 July, and 2 August 2009). The net was situated on the bank of a small water body about 8×15 m in size, created by obstruction of a small stream located in a forest stand, about 1100 m from its edge. The stand consists of hornbeam (60%) and oak (40%) aged 110 years.

4. Priekopa (Vihorlatské vrchy Mts., 7299, 48° 45' 22.9" N, 22° 16' 59.7" E, 360 m, SW; 5 August 2006). Mist nets were set over a stream in an ecotone between a meadow and forest consisting of oak (40%), hornbeam (30%), beech (23%), aged 20–80 years. Stream banks were bordered with alders and willows.
5. Čaklov-Hámre (Východoslovenská pahorkatina hills, 7195, 48° 53' 26.4" N, 21° 35' 36.4" E, 200 m, N; 21 May 2007). The net was placed over a pool at a small stream crossing a forest stand, about 350 m from its edge adjacent to a field. The stand is composed of oak (70%), hornbeam (11%), other broadleaved species (10%) and conifers (9%), its age is 100–120 years.
6. Ladmovce (Zemplínske vrchy Mts., 7596, 48° 25' 53.5" N, 21° 46' 41.3" E, 180 m, SE; 8 June 2007). The net was installed over a pool near a forest road in an ecotone between the forest and a vineyard. The forest is single-layered, consisting mainly of oak (88%) and black locust (6%), 40–100 years old. The nearest river is Bodrog, at a distance of 1500 m.
7. Dargov-Holá hora (Slanské vrchy Mts., 7295, 48° 45' 14.4" N, 21° 33' 24.1" E, 420 m, SE; 2 July 2007). The net was placed on the dam of a water body about 10×20 m in size, at a small stream in a forest stand with disperse clearings, the nearest meadow is about 450 m distant. A small clearing with a cottage is situated about 50 m from the netting place. The stand is composed of oak (42%), beech (28%), hornbeam (25%) and other broadleaved species (5%), its age is 80–120 years.
8. Byšta (Slanské vrchy Mts., 7495, 48° 31' 48.7" N, 21° 31' 34.1" E, 380 m, E; 14 July 2007). Two mist nets were set over a marsh in a forest stand, about 430 m from its edge adjacent to meadows. The nearest water body is about 2 km distant. The stand is composed of oak (50%), beech (44%), hornbeam (6%), its age is 60–100 years.
9. Ďurkov (Slanské vrchy Mts., 7394, 48° 41' 44.5" N, 21° 29' 11.7" E, 450 m, W; 19 July 2007, 15 July and 10 August 2009). The capture site was situated on a bank of a small marsh in a forest stand. The nearest meadow is at the distance of about 600 m, the nearest forest edge 2200 m, a larger stream 5.3 km. The



Fig. 1. Netting site in a forest near the Jovsa village (locality No. 3). All photos by Š. Danko.
 Obr. 1. Odchytové miesto v lese pri Jovse (lokalita č. 3). Všetky fotografie Š. Danko.



Fig. 2. Netting site in the interior of the Priekopa village (locality No. 21).
Obr. 2. Odchytové miesto v intraviláne obce Priekopa (lokalita č. 21).

stand is composed of oak (56%), beech (23%), hornbeam (17%), and other broadleaved species (4%), its age is 60–120 years.

10. Boťany (Východoslovenská rovina lowland, 7598, 48° 28' 02.0" N, 22° 06' 22.7" E, 100 m, 22 and 24 July, and 7 and 2 August 2007). The net was set over a water body covering a long narrow depression in a floodplain forest, about 950 m from the Latorica River. The stand consists of oak (63%), ash (34%), with little admixture of elm and hornbeam, its age is 120 years. The terrain is plain.
11. Strážske (Východoslovenská pahorkatina hills, 7196, 48° 52' 03.1" N, 21° 47' 51.8" E, 182 m, SE; 25 July 2007). A forest road with tracks made by lorries and filled with water. The nearest forest edge is about 250 m distant. The stand is single-layered, consisting of hornbeam (36%), beech (31%), oak (17%), birch (7%) and pine (6%), aged 60–100 years.
12. Brestov (Ondavská vrchovina Mts., 7097, 48° 59' 02.6" N, 21° 53' 28.3" E, 235 m, 6 August 2007). Two nets were set on the bank of a small fishpond in a garden in a forest cottage settlement near a SW-oriented valley with several clear cuts and two larger fish pond. The surrounding forest consists of beech (66%), oak (15%) and hornbeam (16%), 80–100 years old.
13. Juskova Voľa 1 (Slanské vrchy Mts., 7195, 48° 52' 02.7" N, 21° 33' 14.3" E, 335 m; 2 July 2008). NE-oriented valley, the net was installed above a stream pool in a forest composed of beech (64%), oak (10%), alder (6%), birch (5%), hornbeam (5%) and pine (4%), aged 20–120 years.
14. Juskova Voľa 2 (Slanské vrchy Mts., 7195, 48° 52' 29.5" N, 21° 35' 42.4" E, 260 m, N; 28 June 2009). The net was situated on the bank of a large marsh in a forest, near to a large clear cut. The nearest forest edge is about 300 m distant, adjacent to meadows crossed by a water stream. The stand consists of oak (69%), hornbeam (18%), beech (10%) and pine (3%), aged 40–120 years
15. Koňuš (Vihorlatské vrchy Mts., 7299, 48° 46' 26.1" N, 22° 16' 56.1" E, 350 m, W; 16 July 2008). A forest road in a forest stand, with car tracks filled with water. The nearest stand edge is adjacent to a meadow, about 230 m and 440 m from a stream. The forest stand is composed of oak (74%), beech (17%) and hornbeam (11%), aged about 80 years.
16. Brezina-Torkoš (Slanské vrchy Mts., 7495, 48° 34' 23.0" N, 21° 30' 36.0" E, 360 m, SE; 30 July 2008). Sampling over a stony road with tracks made by lorries and filled with water, in a connected forest stand

960 m from its edge and on the border of a meadow 180×100 m in size. The stand consists of oak (50%), beech (28%), conifers (mainly pine; 13%) and hornbeam (8%), its age is 60–80 years.

17. Oreské (Vihorlatské vrchy Mts., 7197, 48° 51' 47.7" N, 21° 55' 46.0" E, 230 m; 6 August 2008). The net was placed over a pool on a small stream in a forest stand, 550 m from its nearest edge adjacent to meadows. The forest stand is composed of beech (44%), oak (31%) and hornbeam (19%), mostly over 100 years in age.
18. Remetské Hámre (Vihorlatské vrchy Mts., 7199, 48° 51' 18.8" N, 22° 11' 19.7" E, 302 m, S; 26 August 2008). The netting site was a small water stream at the edge of a forest stand adjacent to the interior of a village. It is situated about 10 m from the mouth of a mine gallery formerly discharging water from a water energy plant. The forest stand consists of beech (62%), hornbeam (13%), oak (8%) and alder (4%), aged 40–100 years.
19. Pozdišovce (Východoslovenská pahorkatina Mts., 7297, 48° 44' 44.7" N, 21° 50' 14.7" E, 165 m; 17 July 2009). A periodic stream heading to SW, located in a flat ravine with a small water body created by damming the stream. The site is situated in a connected forest stand, 420 m from the nearest meadow, and about 900 m from a water reservoir. The stand consists of oak (70%), pine (20%) and linden (4%), 40–80 years old.

Non-forest habitats

20. Kalša, water reservoir (Slanské vrchy Mts., 7395, 48° 36' 14.6" N, 21° 31' 14.2" E, 260 m, NE; 19 June 2006). A water body, 65×30 m in size, surrounded by meadows, the influx area adjacent to a connected forest stand, the discharge area covered with a riparian stand.
21. Priekopa, garden (Fig. 2; Vihorlatské vrchy Mts., 7299, 48° 45' 06.4" N, 22° 16' 43.1" E, 306 m, SW; 5 and 20 August 2006, 19 July and 8 August 2008, 30 June and 24 July 2009). A ground in the upper part of the village, with a small garden water pool and fruit trees, 380 m from the nearest connected forest stand.

Results

Occurrence and habitat

In 2005–2009, we captured 80 individuals of *M. alcaethoe* (27 adult males, 10 juvenile males, 29 adult females of which 14 were lactating and two pregnant, two subadult females, 9 juvenile females and three individuals of unidentified sex).

The most abundant tree species in the above listed 19 forest localities was oak (average abundance 43.7%), followed by beech (41.6%) and hornbeam (17.5%). From the admixed species, the most abundant were ash, alder, linden and pine. In general, the localities can be characterised as mixed broadleaved forests with dominant oak, beech and hornbeam, situated at 100–540 m a. s. l. Beech-oak, oak-beech and hornbeam-beech forests were the most frequent; in the floodplain forest, it was an ash-oak forest. The age of the forest stands was 60–100 years; with 80-year-old trees being the most frequent. The slope orientation varied considerably, but SE and SW oriented slopes prevailed.

Besides *M. alcaethoe*, we captured other 17 bat species (Table 1). The most abundant was *Myotis bechsteinii* (15.1%), followed by *Myotis myotis* (12.2%) and *M. alcaethoe* (11.8%). Among the species of the *mystacinus* morpho-group (sensu Benda & Karataş 2005), *M. alcaethoe* was the most abundant, followed by *M. brandtii* (ranked as the sixth with 7.4%), and *M. mystacinus* (the eighth with 4.9%). In the floodplain forest near Boľany, where we trapped even 16 species, we recorded syntopic occurrence of all three cryptic species of the *mystacinus* morpho-group (18.8% *M. alcaethoe*, 14.5% *M. brandtii* and 2.9% *M. mystacinus*). The captures of *M. alcaethoe* outside of forest habitats suggest that the species also forages in non-forest environments. The six capture events made near the small garden water pond in the Priekopa village in the Vihorlatské vrchy Mts.

Table 1. Species spectrum and number of netted bats at the particular localities.

Tab. 1. Druhové zloženie a počty odchytených netopierov na jednotlivých lokalitách.

Explanations / vysvetlivky: Mal = *Myotis alcaethoe*; Mbr = *Myotis brandtii*; Mms = *Myotis mystacinus*; Mbe = *Myotis bechsteinii*; Mmo = *Myotis myotis*; Bba = *Barbastella barbastellus*; Ppi = *Pipistrellus pipistrellus*; Par = *Plecotus auritus*; Mha = *Myotis nattereri*; Nle = *Nyctalus leisleri*; Ese = *Eptesicus serotinus*; Mda = *Myotis daubentonii*; Nno = *Nyctalus noctula*; Ppy = *Pipistrellus pygmaeus*; Mem = *Myotis emarginatus*; Pna = *Pipistrellus nathusii*; Ppa = *Plecotus austriacus*; Mbl = *Myotis blythii*; Nni = number of individuals / počet jedincov; Ns = number of species / počet druhov; %Ma = percentage of *Myotis alcaethoe* within the catch / percentuálne zastúpenie *Myotis alcaethoe* v odchyte

site / lokalita	Mal	Mbr	Mms	Mbe	Mimy	Bba	Bpi	Pau	Mna	Nle	Ese	Mda	Nno	Ppy	Mem	Pna	Pau	Mbl	Ni	Ns	%Ma
1 Rákoš	1		2	1	3	6			1										14	6	7.1
2 Slanská Huta	1	2	3	3	1														10	5	10.0
3 Jovsa	22	13	6	35	12	7	2	12	3		5	13	1			4		135	13	16.3	
4 Priekopa	1					2	1	1		1									5	4	20.0
5 Čaklov-Hámre	1		2	10	1	1	1			1					1				18	8	5.5
6 Ladmorce	2		2																4	2	50.0
7 Dargov, Holá hora	1		2		16	3	24	1		1	2	1	11					62	10	1.6	
8 Byšta	7	2	3	6	8	2	1	4	2	12	9		2		1	1		60	14	11.6	
9 Ďurkov	9	13	4	21	13	13	23	14	14						2			126	10	7.1	
10 Boňany	13	10	2	9	6	4	1	1	7	2	1	1	1	8	2		1	69	16	18.8	
11 Strážske	1	2	3	2		1	2	1	4	1	2	2	1		1			16	8	6.2	
12 Brestov	1				1	2	1		4	1	4	1	5					20	8	5.0	
13 Juskova Voľa	3	1	4	3	10	1			1					2				18	6	16.6	
14 Juskova Voľa	1					3	6			1								19	7	5.2	
15 Koňuš	1																		1	1	100.0
16 Brezina-Torkoš	2																		2	1	100.0
17 Oreské	2	1			1													4	3	50.0	
18 Remetské Hámre	2	1				15		1										19	4	10.5	
19 Pozdišovce	1			2				1	1					2				7	5	14.2	
Σ	72	45	30	92	74	60	59	39	30	22	21	20	20	10	9	4	1	609	18		
%	11.8	7.4	4.9	15.1	12.2	9.9	9.7	6.4	4.9	3.6	3.5	3.3	3.3	1.6	1.5	0.7	0.2	0.2			
20 Kališa	1	1				1	4			1	27								31	5	3.2
21 Priekopa	7					1	4										9		21	4	33.3
Σ	8	1				1	5			1	27						9		52	8	
%	15.4	1.9				1.9	9.6			1.9	51.9						17.3				

resulted in seven caught individuals, of which one was a lactating female (19 July 2008), and one was a juvenile female (8 August 2008). The closest forest edge is 380 m distant. One individual was trapped at a water reservoir in the open land at the border of the Slanské vrchy Mts.

Ringing results

The adult male ringed at the locality No. 4 on 5 August 2006 was recaptured in Priekopa at the locality No. 21 on 19 August 2006 (distance between the two localities being 580 m). The adult female ringed in the garden in Priekopa on 24 July 2009 was recaptured at the same site on 14 August and 4 September 2009. Therefore, we assume that this particular individual was using the locality inside the village as its permanent foraging site over the time between the subsequent captures.

Diet Analysis

Altogether 10 taxonomic categories were identified in the diet, those with the volume percentage larger than 5% in a particular individual/pellet sample are summarized in Fig. 4. Moths (Lepidoptera), mainly with body length below 12 mm, were the most important prey item. Ants (Formi-

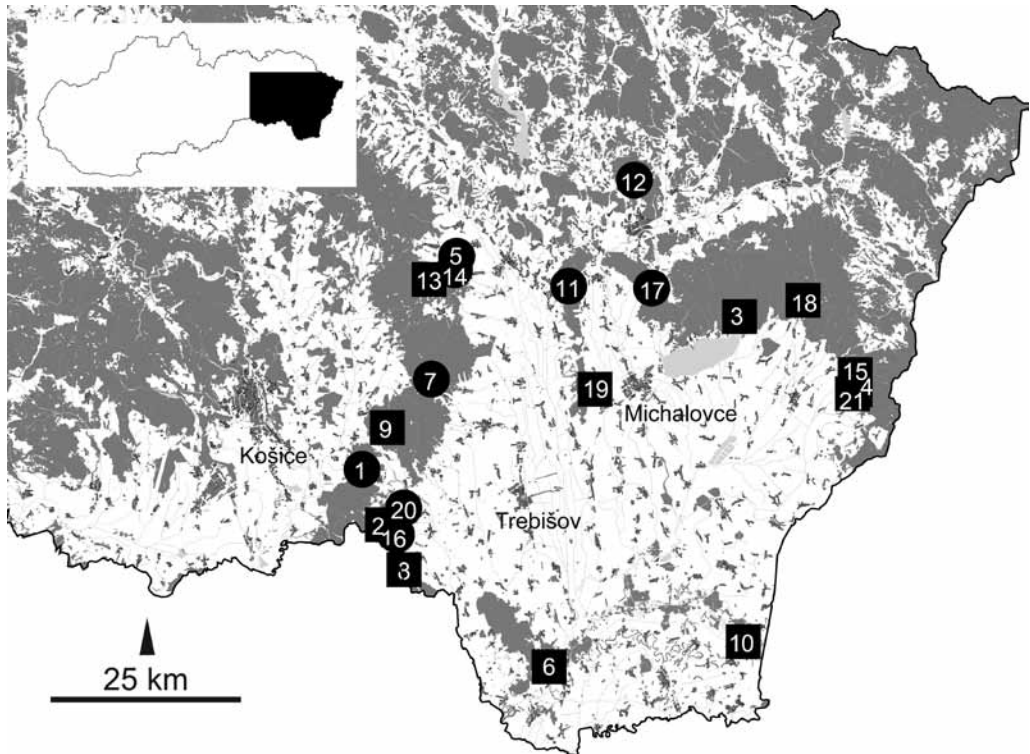


Fig. 3. Known occurrence of *Myotis alcathoe* in eastern Slovakia till the end of 2009.

Circle – netting site; square – reproduction site; dark grey areas – forests.

Obr. 3. Zistený výskyt *Myotis alcathoe* na východnom Slovensku do konca roku 2009.

Kružok – miesto odchyty; štvorec – miesto doloženej reprodukcie; tmavosivá plocha – lesy.

cidae), mostly of the genus *Lasius*, were dominant only at the localities of Jovsa (2 August 2009) and Boľany (27 July 2007) in six bat individuals (25% of the total studied sample). Nematoceran flies (mostly Mycetophilidae and Tipulidae) were another regular dominant prey item (>5% in total), followed by beetles (Coleoptera, 2.5%) and brachyceran flies (Brachycera, 2.5%). Considerable differences were also identified in percentages of the main prey groups among different localities, yet the sample is too small to allow a detailed statistical analysis. Macrolepidoptera and Formicidae were dominant at the Jovsa locality, Microlepidoptera and partly also Nematocera at the other localities (Fig. 5).

Parasites

We collected ectoparasites in 11 of 80 captured *M. alcahoë*. Only three ectoparasite species were identified. Two individuals captured in Jovsa on 20 July 2009, and one in Ďurkov on 10 August 2009 did not show parasite presence, the other bats captured at these sites were not checked. In six bats we collected 14 mites *Spinturnix mystacinus* Kolenati, 1857 (Spinturnicidae), in one bat we took larvae of the tick *Ixodes vespertilionis* Koch, 1844 (Ixodidae). Seven individuals of the fly *Basilia italica* Theodor, 1954 (Nycteribiidae) were found in four bats (Table 2).

Notes on species identification

In three individuals captured in 2006 at the localities No. 4 and 21 and identified as *M. alcahoë*, tissue samples were taken for genetic examination. In all of them correct species identification was ascertained (Hulva in litt.). Additional two individuals from the locality No. 10 were stored in the collections of the National Museum in Praha (NMP pb3499, 3500, alcoholic specimens with skulls extracted). Subsequent genetic analysis again confirmed correct identification of *M. alcahoë*

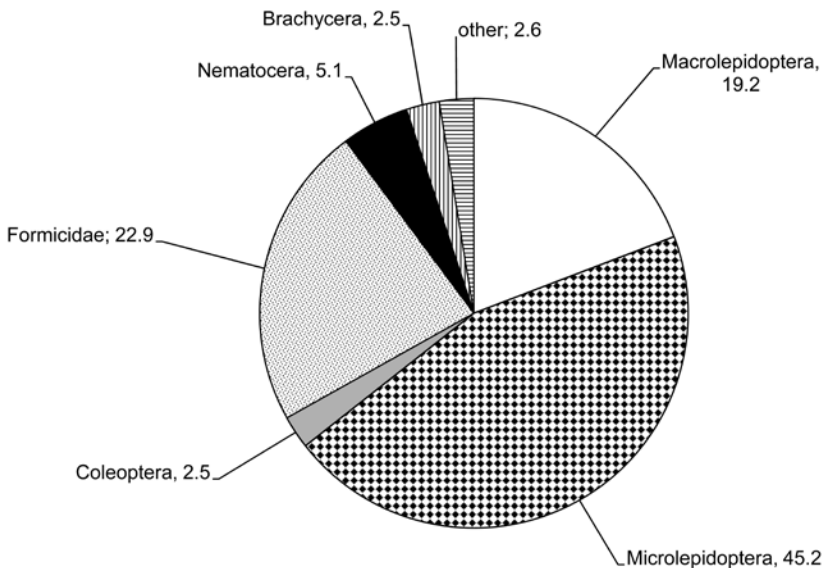


Fig. 4. Diet composition (volume percentages) based on fecal samples of 24 individuals of *M. alcahoë* from seven sites in eastern Slovakia.

Obr. 4. Zloženie potravy (objemové percentá) zistené rozborom trusu 24 jedincov zo siedmich lokalít východného Slovenska.

Table 2. Ectoparasites of *M. alcaethoe* at the particular localities (species and number of specimens)
 Tab. 2. Druhové zloženie a počty ektoparazitov z *M. alcaethoe* na jednotlivých lokalitách

parasite parazit	number počet	site lokalita	date dátum	number of bats počet netopierov
<i>Spinturnix mystacinus</i>	1 ♂, 2 ♀♀	Boľany	24 July 2007	1
	2 ♀♀	Boľany	2 August 2007	1
	3 ♂♂	Brestov	6 August 2007	1
	3 ♂♂	Jovsa	2 August 2009	2
	1 ♂, 2 ♀♀	Ďurkov	10 August 2009	1
<i>Ixodes vespertilionis</i>	1 larva	Boľany	24 July 2009	1
<i>Basilisia italica</i>	1 ♂, 1 ♀	Boľany	24 July 2009	1
	2 ♂♂	Boľany	2 August 2009	1
	3 ♀♀	Ďurkov	10 August 2009	2

(Vallo in litt.). In the meantime, our own field experience together with published information (cf. Le Bris & Le Houédec 2005, Dietz et al. 2007) and biometric data obtained allowed us to conclude that species identification can be carried out in the field without genetic analysis.

Until recently, several authors have accepted species identification in the field based on morphological traits only, without the necessity of genetic analysis (France, Hungary, Greece, Bulgaria – Niermann et al. 2007; Czech Republic – Lučan et al. 2009). In our opinion, the species can be determined visually, based on a series of qualitative and quantitative traits, such as the colour of

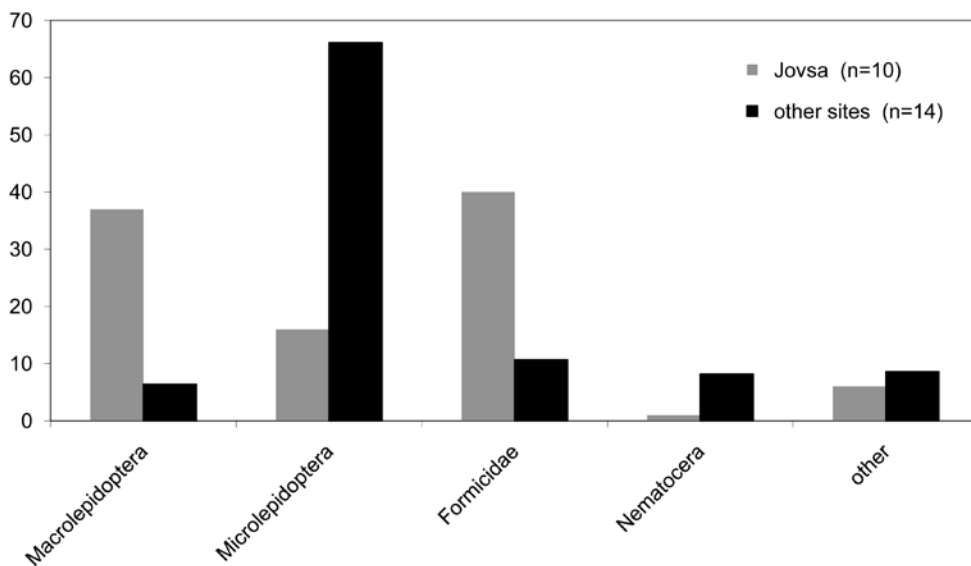


Fig. 5. Diet composition (volume percentages) based on fecal samples of *M. alcaethoe* from Jovsa (grey columns) and other six sites in eastern Slovakia (black columns).

Obr. 5. Zloženie potravy (objemové percentá) na základe rozboru trusu *M. alcaethoe* z Jovsy (sivé stĺpce) a z ostatných šiestich lokalít východného Slovenska (čierné stĺpce).

Table 3. Biometric data (ranges [in millimetres and grams] are given without differentiation of sex and age)
 Tab. 3. Biometrické údaje (rozsahy [v mm a g] sú uvedené bez rozlíšenia pohlavia a veku)

	forearm length dĺžka predlaktia	tibia length dĺžka holene	weight hmotnosť
this paper / táto práca	29.7–33.7	12.7–15.5	3.8–5.8
Niermann et al. (2007)	28.4–33.4		3.2–4.7
Benda et al. (2003)	32.5; 32.9	14.0; 14.3	
Agirre-Mendi et al. (2004)	32.5–33.0		
Řehák et al. (2008)	31.2–33.7	14.0–14.8	
Spitzenberger et al. (2008)	31.8–32.6		
Dietz et al. (2007)	30.8–34.6	13.5–15.9	3.5–5.5

auricles and face fur and skin (see Fig. 6), the lengths of tibia and forearm. Photos of the captured individuals are useful as evidence material as well as a material for studying differences, especially in the coloration. By comparing the forearm lengths and body masses between adult males and females we concluded that females were generally larger (32.1 ± 0.7 mm, vs. 31.9 ± 0.6 mm, $n=42$: 21 females and 21 males) and heavier than males (4.95 ± 0.5 g vs. 4.3 ± 0.3 g, $n=25$: 11 females,



Fig. 6. Differences in appearance between *Myotis mystacinus* (above) and *Myotis alcaethoe* (below) – light brown ear, light face and shorter tragus. Ďurkov, 10 August 2009.

Obr. 6. Vzhľadové rozdiely medzi *Myotis mystacinus* (hore) a *Myotis alcaethoe* (dole) – svetlohnedé ucho, svetlá tvár a kratší tragus. Ďurkov, 10. 8. 2009.

14 males). On the contrary, the tibia was somewhat longer in males than in females (14.5±0.7 mm, vs. 14±0.8 mm, n=37: 19 females and 18 males). At the same time, the measured individuals of *M. mystacinus* had a longer forearm 33.0–36.0 mm and tibia 15.3–17.0 mm. As for the general appearance, more similarity was found between *M. alcaethoe* and *M. brandtii* than between the former one and *M. mystacinus*. The males of *M. brandtii* can be identified based on the shape of penis, while in females, it is necessary to measure the forearm length (mostly exceeding 35 mm) and to check, with a magnifying glass, the cusp on the lingual side of cingulum in the third upper premolar (P⁴). Cranial measurements (in millimetres) of the two individuals of *M. alcaethoe* from the locality No. 10 were as follows: LCr 13.31 and 13.08; LCb 12.60 and 12.54; LaZ 8.17; LaI 3.13 and 3.31; LaInf 3.26 and 3.16; LaN 6.48 and 6.35; ANc 4.67 and 4.61; CC 3.41 and 3.21; M³M³ 5.22 and 5.16; CM³ 4.94 and 4.94; LMd 9.42 and 9.46; ACo 2.74 and 2.66; CM₃ 5.37 and 5.31.

Discussion

Occurrence and habitat

In Europe, *M. alcaethoe* was recorded in various habitats. In Albania, the species was mist-netted above a small river branch, in a riparian forest consisting of plane trees and poplars; in Bulgaria in a similar habitat, but also in mountain forests and at underground swarming sites in autumn; in Germany in an old wet broadleaved forest dominated by oak, and in a xerotherm forest with oak trees. The authors reported that the species prefers natural wet and broadleaved deciduous forests with old trees and watercourses. It may also occur in canyons, alluvial forests, or stream valleys, marshes, hedged farmlands, wooded grounds, mixed and deciduous forests close to water (Niermann et al. 2007). In France, the species was captured in a forest composed of old oak and plane trees, with admixed maple, ash and willows, close to a stream and pasture land (Ruedi et al. 2002). There are about 30 localities with confirmed occurrence of the species in Hungary, all of them being situated in forests in the northern part of the country (Estók 2007).

The discussed bat species can be characterised as an exclusively forest species, living at 300–700 m a. s. l., preferring colder climate, wet valleys with permanent water springs, percolating water, smaller streams and artificial water pools. Predominant habitats of its confirmed occurrence include oak, hornbeam-oak and beech forest stands, and also cave entrances in woodlands (Estók 2007, Niermann et al. 2007). The capture locality in the Zemplén Mts. was a small lake surrounded by birch, beech and hornbeam forests (Estók et al. 2006). In Moravia (Czech Rep.), the species was recorded in a flat area in an old mixed forest stand with a fishpond; in an industrial lowland with fishponds and broadleaved grooves near Ostrava, and in an agrocoenosis with broadleaved woods and human settlements (Řehák et al. 2008). There, the species seems to prefer alluvial or mesic broadleaved forests; on the other hand, the most frequent habitat in the Czech Republic was a full-grown oak-hornbeam forest (Lučan et al. 2009). In the Austrian locality, oak and hornbeam forests with water bodies of a different size were the dominant habitat type (Spitzenberger et al. 2008). Dietz et al. (2007) reported the species' habitat as dense broadleaved forests along water streams in mountain areas, consisting of alder, plane trees, oak and hornbeam. Besides our records, *M. alcaethoe* was further captured during the reproductive period in Slovakia in an unforested plot near a small fishpond close to the Baňa settlement (250 m a. s. l.), about 300 m from a connected forest stand, and in the locality Pohanský hrad (560 m a. s. l.) in the Cerová vrchovina hills (Uhrin et al. 2008). The literature survey shows that the habitat of *M. alcaethoe* is most frequently characterised by the vicinity of water bodies, streams and rivers. We did not find an association with wetland environment (except the floodplain forest by the Latorica river), but we obtained

an evidence of its occurrence in an old broadleaved forest far from larger watercourses, although small water bodies or pools were usually present at the sites of its capture.

As for the altitude, our research was conducted at 100–540 m a. s. l., however, occurrence of the species at higher altitudes in Slovakia may not be excluded and requires further study. The altitudinal distribution of the species in other European countries is as follows: Germany 130 and 170 m a. s. l., Hungary 230–670 m a. s. l., Bulgaria 5–1450 m a. s. l., France even above 2000 m a. s. l. (Niermann et al. 2007), Czech Republic 240–390 m a. s. l. (Lučan et al. 2009), Spain 790 and 1390 m a. s. l. (Agirre-Mendi et al. 2004). It is obvious that the species can occur at significantly higher elevations in the warmer Mediterranean regions than in Central Europe.

In our study, the highest bat diversity was observed in the floodplain forest near Bořany (16 species), with syntopic occurrence of all three species of the *mystacinus* morpho-group. Similarly, 14 bat species were recorded in the floodplain forest locality of Rheinau in Germany, including *M. alcaethoe*, *M. brandtii* and *M. mystacinus*. Syntopic occurrence of *M. alcaethoe* with *M. mystacinus* and *M. brandtii* was also recorded in France, Spain, Balkans, Hungary, Poland (Niermann et al. 2007), and in the Czech Republic (Lučan et al. 2009).

Similarly to the Czech localities (Lučan et al. 2009), relative abundance of the species is also high in SE Slovakia. The literature mostly reports patchy occurrence, however, our research in the Slanské and Vihorlatské vrchy Mts. suggests widespread occurrence across the study area. The species abundance in other geomorphological units requires a targeted research.

Diet

The diet analysis resulted in findings somewhat different from those obtained in the Czech Republic, where Nematocera, Trichoptera and Araneidea were dominant prey items (Lučan et al. 2009). The differences may have been caused by sampling near water habitats in which these invertebrate groups are dominant and also by the sampling date in September when the evening flying activity is lower in some insect groups compared to early summer (from June to the beginning of August). The composition of *M. alcaethoe* diet reported by us quite resembles the summer diet of its cryptic congeners *M. mystacinus* and *M. brandtii* reported by Andreas (2002). For instance, the dominant items in the summer diet of *M. mystacinus* and *M. brandtii* (*M. alcaethoe* not distinguished) were moths (frequency 83% in *M. mystacinus* and 77% in *M. brandtii*) (Andreas 2002).

Parasites

The mite *Spinturnix mystacinus* parasitises especially *M. mystacinus* and *M. brandtii*, it was also found on *Eptesicus serotinus* (Stanyukovich 1997), *Myotis myotis*, *M. dasycneme*, *Vespertilio murinus*, *Nyctalus noctula*, and *Plecotus auritus* (Dusbábek 1962). Occurrence of this mite on *M. alcaethoe* was reported from the Switzerland by Bruyndonckx et al. (2009). The tick *Ixodes vespertilionis* was found parasitising almost all bat species in the Palearctic region (Filippova 1977). *Basilisa italica* is a relatively rarely found ectoparasite, it was recorded mainly on *Myotis mystacinus* and *M. brandtii* (Hůrka 1980). It was also observed individually on *Myotis emarginatus*, *M. myotis*, *M. nattereri* (Theodor 1954), *Eptesicus serotinus*, and *Barbastella barbastellus* (Czuppon & Molnár 2001).

Identification

Our results confirmed present knowledge concerning the species identification. The shortest forearms and the lowest body masses were recorded in Poland. The data reported from Hungary for forearm length up to 36 mm and body mass up to 8 g (Estók 2007) are not consistent with the biometric data for this species.

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Súhrn

Netopier *Alcathoe* (*Myotis alcathoe*) na východnom Slovensku: výskyt, potrava, ektoparazity a poznámky k jeho určovaniu v teréne. Cieľom práce bolo: (1) získať nové údaje o rozšírení a biotopoch druhu v lesnom prostredí v mimohibernačnom období na juhovýchodnom Slovensku, (2) analyzovať jeho potravu, (3) analyzovať druhové zloženie ektoparazitov a (4) prispieť k poznatkom o identifikácii druhu v teréne.

Do konca leta 2009 bolo odchytených 80 jedincov netopiera *Alcathoe*, z toho 27 dospelých samcov, 10 juvenilných samcov, 29 dospelých samíc (z nich 14 laktujúcich a dve gravidné), dve subadultné samice, 9 juvenilných samíc a tri jedince neurčeného pohlavia. Výskyt netopiera *Alcathoe* na 19 lesných lokalitách bol zistený v biotopoch, kde dominoval dub (priemerné zastúpenie 43,7 % na 19 lokalitách), potom buk (priemerné zastúpenie 41,6 % na 14 lokalitách) a hrab (priemerné zastúpenie 17,5 % na 16 lokalitách). Z prímiesových druhov s vyšším zastúpením to boli ešte jaseň, jelša, lipa a borovica. Najčastejšími boli bukovo-dubové, dubovo-bukové a hrabovo-dubové porasty, v lužnom lese to bol jaseňovo-dubový porast v nadmorských výškach 100–540 m. Ich vek bol najčastejšie v rozmedzí 60–100 rokov. Orientácia lokalít bola na všetky svetové strany, ale najčastejšie na juhovýchod alebo juhozápad (po 21 % prípadov). V každom biotope boli netopiere odchyťované do sietí nad malými vodnými plochami, pri ktorých sa predpokladal ich zvýšený výskyt.

Druh bol zistený na sledovaných lokalitách v spoločenstve s ďalšími 17 druhmi netopierov. Z 18 odchytených druhov najpočetnejšími boli *Myotis bechsteinii* (15,1 %), *M. myotis* (12,2 %) a *M. alcathoe* (11,8 %). V porovnaní s druhmi morfo-skupiny *mystacinus* bol *Myotis alcathoe* najpočetnejší, menej početný bol *M. brandtii* (v poradí šiesty, 7,4 %) a najmenej početný bol *M. mystacinus* (v poradí ôsmy, 4,9 %). V lužnom lese pri Boľanoch, kde sa odchytilo až 16 druhov, sa syntopicky vyskytovali všetky 3 druhy morfo-skupiny *mystacinus* (18,8 % *alcathoe*, 14,5 % *brandtii* a 2,9 % *mystacinus*). Počas odchyty mimo lesných biotopov bolo zistené, že druh sa vyskytuje aj v intraviláne obce Priekopa vo Vihorlatských vrchoch, kde bolo odchytených 7 jedincov, najbližšia vzdialenosť k okraju lesa je 380 m. Jeden jedinec bol odchytený pri vodnej nádrži v otvorenej krajine na okraji Slanských vrchov.

V potrave 24 jedincov *M. alcathoe* (spolu 111 vzoriek trusu) zo 7 lokalít JV Slovenska sa zistilo v júli – auguste 2007 a 2009 celkom 10 taxonomických skupín bezstavovcov. Motýle (Lepidoptera), hlavne s dĺžkou tela <12 mm, boli najvýznamnejším typom koristi. Mravce (Formicidae), hlavne rod *Lasius*, boli dominantné iba na lokalitách Jovsa a Boľany, a to u 6 jedincov (25 % zo študovaných). Komáre Nematocera (hlavne Mycetophilidae a Tipulidae) boli ďalšou pravidelne konzumovanou zložkou potravy (>5 %), nižšiu dominanciu dosiahli chrobáky (Coleoptera) a muchy (Brachycera) (2,5 % každá skupina).

Na 11 jedincoch *M. alcathoe* boli zistené tri druhy ektoparazitov. Tri prezreté jedince neboli zaparazitované, ostatné neboli kontrolované. Na štyroch netopieroch bolo nájdených 7 jedincov múch *Basilia italica* z čeľade Nycteribiidae. Na 6 jedincoch bolo zistených 14 jedincov roztočov *Spinturnix mystacinus* z čeľade Spinturnicidae a aj jedna larva kliešťa *Ixodes vespertilionis* z čeľade Ixodidae.

Druh sa dá určiť v teréne najmä podľa farby ušnic a srsti na tvári (viď obr. 6, podobný rozdiel v zafarbení tváre je napr. medzi *Plecotus austriacus* a *P. auritus*) a potvrdiť zistením biometrických údajov, najmä dĺžky antibrachia a tibie. Tak ako sa dajú po získaní skúseností rozlíšiť v teréne odchytené netopiere rodu

Pipistrellus (najmä *P. pipistrellus* od *P. pygmaeus*) alebo *M. myotis* od *M. blythii*, po odchytení viacerých jedincov nie je obtiažné rozlíšiť aj *M. alcaethoe* od ostatných druhov morfo-skupiny *mystacinus*. Vhodné je odchytené jedince dokladovať fotograficky, čím sa umožní štúdium rozdielov najmä v zafarbení jedincov. Na základe porovnania dĺžky antebrachia adultných samcov a samic sme zistili nevýznamne väčšie hodnoty u samic (32,1±0,7 mm, vs. 31,9±0,6 mm, n=42: 21 samíc a 21 samcov) a výraznejšie rozdiely v hmotnosti (4,95±0,5 g vs. 4,3±0,3 g, n=25: 11 samíc, 14 samcov). Dĺžka tibie bola naopak mierne väčšia u samcov (14,5±0,7 mm, vs 14±0,8 mm, n=37: 19 samcov a 18 samíc). Súčasne premerané jedince *M. mystacinus* mali dĺžku predlaktia 33,0–36,0 mm a tibie 15,3–17,0 mm, čiže boli všeobecne väčšie. Vzhľadovo podobnejší netopierovi *Alcaethoe* v porovnaní s *M. mystacinus* je *M. brandtii*, kde u samcov je určenie druhu jednoznačné podľa penisu, ale u samic je potrebné premerať dĺžku antebrachia, ktorá je väčšinou nad 35 mm a skontrolovať lupou tretí horný premolár (P⁴). Pre istotu je zo začiatku vhodné odchytené samce (gravidné a laktujúce samice treba pustiť hneď po determinácii) morfo-skupiny *mystacinus* počas večerného odchytu odložiť do pláteného sáčka a porovnávať ich s ďalšími odchytenými jedincami.

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