

## On the Greater noctule (*Nyctalus lasiopterus*) in central Slovakia

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**Abstract.** Recent records of *Nyctalus lasiopterus* in central Slovakia are presented. Altogether, seven individuals were mist-netted in three sites there in 2005 and 2006. Data on the food composition and ectoparasites are added and the population status of the species in Slovakia is discussed.

***Nyctalus lasiopterus*, distribution, diet, parasites, Slovakia**

### Introduction

The greater noctule *Nyctalus lasiopterus* (Schreber, 1780) belongs to the largest and the less known European bat species. Present distribution data cover mainly the Mediterranean Region and Central Europe up to 55° N, as well as central and southern parts of European Russia (Ibáñez et al. 2004). At the end of the 20th century, the estimated number of European records was 120–130 (Benzal 1999).

Until 2005, five records were documented in Slovakia. Besides three skeletal remains (Schaefer 1973, Obuch 1985, Obuch & Chavko 1997), only two live individuals were mist-netted (reviewed by Matis et al. 2003 and Danko et al. 2004). After an interval of more than 30 years since the first live specimen was recorded (Danko 1975, 2005, Hanák & Danko 1975), a young female was mist-netted on 3 August 2003 at the Slovak-Hungarian border (the western edge of the Slovak Karst National Park), near to the sites of several recent records of the species in Hungary (see Dobrosi 1993, Gombkötő et al. 1996, Topál 1996, Czajlik & Harnos 1997, Bihari et al. 2000, Matis et al. 2003). Another additional record from Slovakia (1 July 2000, Poprad) without details was reported by Skiba (2003).

Here we present several new observations on the greater noctule, recorded in central Slovakia in 2005 and 2006, with some comments on the species' ecology.

## Methods

Bats were mist-netted (mist-net size 2.5×7–14m, with respect to the mist-netting place) over water bodies (brook, pool and small water reservoir) in summer and autumnal seasons of 2005 and 2006 in the Veporské vrchy Mts and the Horehronské podolie Basin (Central Slovakia). Apart from body measurements of the captured bats (Table 1), ectoparasites and droppings were also collected. The diet of the mist-netted bats was investigated using faecal pellet analyses; along with droppings of *N. lasiopterus*, those of jointly captured *Nyctalus noctula* (Schreber, 1774) were analysed for a comparison ( $n = 5$  *N. lasiopterus* [one recaptured bat was analysed twice], 137 pellets, 2 *N. noctula*, 45 pellets) and digestive tract contents analyses ( $n = 2$  *N. lasiopterus*, 2 *N. noctula*). Food composition was estimated through the volume of prey category in one sample.

## Records\*

- (1) Kamenistá dolina Valley – a small water reservoir in the valley surrounded by beech and spruce forests (Veporské vrchy Mts; 48° 42' N, 19° 32' E; 657m a. s. l.; mapping square DFS 7383), 31 July 2005 – 1 adult post-lactating female (ring code: Slovakia B0266).
- (2) Za Havraník – ford on the brook crossing open meadows, several hundred meters away from spruce forests (Horehronské podolie Basin; 48° 49' N, 20° 04' E; 760m a. s. l.; DFS 7186), 2 August 2005 – 2 subadult males (deposited in the National Museum Praha, the collection numbers NMP 90628, 90629 [alcohol specimens with skulls extracted]).
- (3) Za Havraník (ibid.), 17 August 2005 – 1 juvenile male (B0267). The bat was kept in captivity for one day (and was fed with bush crickets) and released the following day at 10:00 pm in the dolina Hronec Valley (Veporské vrchy Mts; 48° 49' N, 19° 51' E; 726m a. s. l.; DFS 7185), cf. Cordes (2005). This action was to avoid a double detection with ultrasound bat-detector, which was performed simultaneously at the following site.
- (4) Sosninky – water pool in a small abandoned limestone-quarry (Horehronské podolie Basin; 48° 50' N, 20° 02' E; 732m a. s. l.; DFS 7186), 18 August 2005 – 1 juvenile female (B0268).
- (5) Za Havraník (ibid.), 6 August 2006 – 1 post-lactating female (B0270) and 1 juvenile female (B0271). One more bat, of the greater noctule appearance, flying around the site was not mist-netted.

The subsequent mist-nettings were performed in the Kamenistá dolina Valley (eastern part of the area) and in the Za Havraník Valley (western part) with negative results, on 25 August 2005, 2 August 2006 and on 27 October 2005, 24 and 27 July 2006, 20 August 2006, respectively (Fig. 1).

## Results and Discussion

Altogether, seven individuals were mist-netted in three sites of Central Slovakia in July – September 2005 and August 2006. The area is situated on the upper part of the Hron River catchment. Common habitat features of the sites could be characterised as a mosaic landscape located in sub-mountain Carpathian basins, even mountain valleys (ca. 600–800m a. s. l.). Habitats are represented mostly by coniferous forests (*Picea abies*, *Larix decidua*, *Pinus sylvestris*) with open parts being meadows, mountain wetlands and riparian stands (e.g. with *Salix* spp., *Alnus* spp.) along the Hron River.

Although in *N. lasiopterus* migratory behaviour has not been confirmed yet by recaptures of marked animals (Hutterer et al. 2005), it has been suggested by several authors (Abelencev & Popov 1956, Strelkov 1969, Ibáñez et al. 2004). The hypothesis of migrational phenology is well conformed with field observations (see e.g. Abelencev & Popov 1956). This premise is supported by the fact that the initial records of this bat in Slovakia considered it a vagrant (Danko 1975, Hanák & Danko 1975). However, the concentrated records in central Slovakia presented here,

\* Some of the presented records were also anecdotically published in newspapers (Anonymous 2005a, b, c, Vražda 2005) and also mentioned in an unpublished report (Cordes 2005).

Table 1. Body and skull measurements of the *Nyctalus lasiopterus* in central Slovakia (for sex, age and sites of the respective individuals see the text). Abbreviations: G – weight; LC – head and body length; LcD – tail length; LAT – forearm length; LA – ear length; LTr – tragus length; Ill.D – third finger length; VD – fifth finger length; LCr – greatest length of skull; LcB – condylobasal length; Lal – width of interorbital constriction; LaN – neurocranium width; LaM – mastoidal width; ANc – neurocranium height; CC – rostrum width across upper canines; M<sup>2</sup>M<sup>3</sup> – rostrum width across third upper molars; CM<sup>3</sup> – length of upper toothrow; LMD – mandible length; ACo – coronoid height of mandible; CM<sub>3</sub> – length of lower toothrow  
 Tab. 1. Telesné a lebečné rozmery *Nyctalus lasiopterus* zo stredného Slovenska (pohlavie, vek a lokality sú uvedené v texte). Skratky: G – hmotnosť; LC – dĺžka tela; LcD – dĺžka chvosta; LAT – dĺžka ucha; LTr – dĺžka tragu; Ill.D – dĺžka tretieho prsta krídla; VD – dĺžka piateho prsta krídla; LCr – najväčšia dĺžka lebky; LcB – kondylobazálna dĺžka lebky; Lal – šírka medziorbitálneho zúženia; LaN – šírka mozgovne; LaM – mas-toidálna šírka; ANc – výška mozgovne; CC – šírka rostra cez horné očné zuby; M<sup>2</sup>M<sup>3</sup> – šírka rostra cez tretie horné stoličky; CM<sup>3</sup> – dĺžka hornej zubnej rady; LMD – dĺžka mandibuly; ACo – koronoidná výška mandibuly; CM<sub>3</sub> – dĺžka dolnej zubnej rady

individual	G	LC	LcD	LAT	LA	LTr	Ill.D	VD	LcCr	LcB	Lal	LaN	LaM	ANc	CC	M <sup>2</sup> M <sup>3</sup>	CM <sup>3</sup>	LMD	ACo	CM <sub>3</sub>
NMP 90628	42.2	104	64.0	65.4	25.4	9.2	–	–	21.65	22.33	5.62	11.76	13.98	7.96	9.04	10.24	8.88	16.92	5.48	9.53
NMP 90629	34.2	95	61.0	62.5	24.6	8.5	–	–	20.60	21.58	5.72	11.59	13.45	7.66	8.90	10.31	8.59	16.44	5.07	9.35
B0266	58.7	103	63.1	65.3	–	–	111.2	75.1	–	–	–	–	–	–	–	–	–	–	–	–
B0267	35.3	94	57.0	64.6	–	–	111.4	70.7	–	–	–	–	–	–	–	–	–	–	–	–
B0268	–	92	55.3	66.8	–	–	112.3	70.3	–	–	–	–	–	–	–	–	–	–	–	–
B0270	49.0	95	58.8	63.2	–	–	107.4	96.0	–	–	–	–	–	–	–	–	–	–	–	–
B0271	40.5	99	62.3	60.6	–	–	110.6	70.5	–	–	–	–	–	–	–	–	–	–	–	–

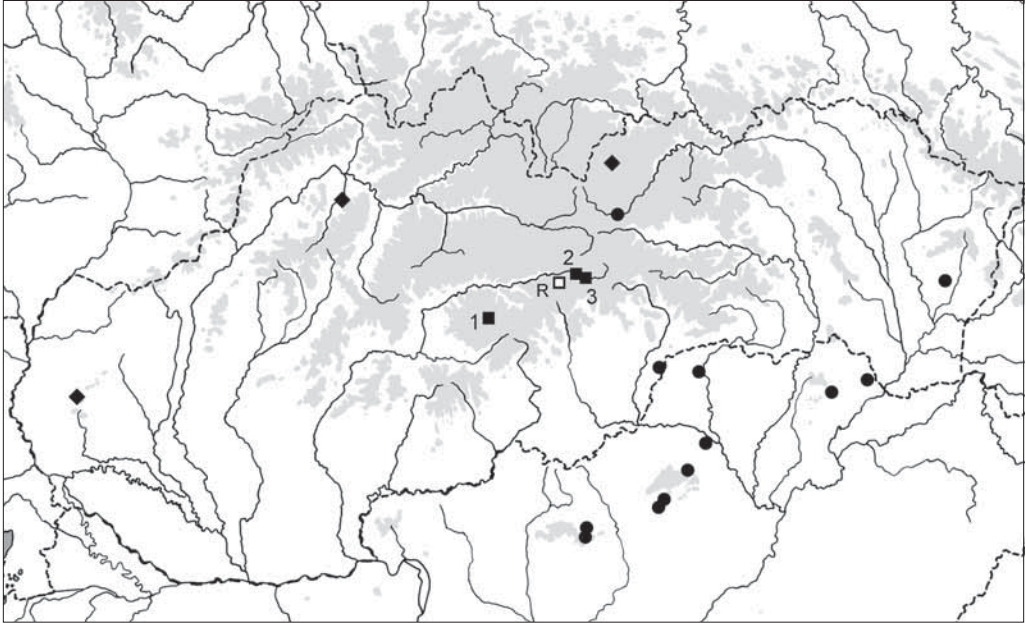


Fig. 1. Sites of the *Nyctalus lasiopterus* records in Slovakia and northern Hungary (squares – records from 2005 and 2006: 1 – Kamenistá dolina Valley, 2 – Sosninky Valley, 3 – Za Havraník Valley, R – dolina Hronec Valley, releasing site of one individual, for details see text; circles – previous records of living bats; diamonds – bone remains findings).  
 Obr. 1. Lokality nálezov *Nyctalus lasiopterus* na Slovensku a v severnom Maďarsku (štorce – nálezy z rokov 2005 a 2006: 1 – Kamenistá dolina, 2 – Sosninky, 3 – Za Havraník, R – dolina Hronec, miesto vypustenia jedného jedinca, detaily v texte; krúžky – predchádzajúce nálezy živých netopierov; kosoštvorce – nálezy kostrových zvyškov).

rather apart from the main area of species distribution, in a very short time period (two consecutive summer seasons), could indicate the presence of a local population. However, the records came from up-to-time poorly investigated area (with the exception of cave-dwelling bats; reviewed by Uhrin et al. 2002). Moreover, two post-lactating females and five juveniles/subadults corroborate our hypothesis. Temporal residency, and possible individual territory in this species is suggested by the record of a young male (ring No. B0267, Fig. 2), recaptured again in its ringing site on 21 September 2005; ten kilometres west of the spot at which it was released (Fig. 1).

The seven records of *N. lasiopterus* in Slovakia in 2005 and 2006 increased significantly the number of its records in Central Europe. The general rarity of the species' occurrence in Slovakia could also be documented by owl food remnants analysis. In Slovakia, the remnants of only one individual of *N. lasiopterus* were found in the pellets of *Strix aluco* (number of recorded food items = 45,650, data from 1976–1998; Obuch 1998). The Tawny owl is described as a well specialised predator of bats (Obuch 1992, 1998).

However, the recent surprising “mass” records of *N. lasiopterus* in Central Slovakia miss an easy and unquestionable explanation. For the first time, the observations indicate the likelihood that some population of *N. lasiopterus* is breeding in Slovakia. In Hungary, records that a reproductive population of the species existed based on inconclusive observations (records of young male on September, 1933 or of a pregnant female on April, 1960) were supposed by Topál (1976). During the last years in the northern Hungary, several observations were collected of the Greater

noctules (Dobrosi 1993, Gombkötő et al. 1996, Czájlik & Harnos 1997, Bihari et al. 2000, Matis et al. 2003). Some of these records could indicate the existence of a reproductive population of *N. lasiopterus* in the region. In the period 1993–2003, tens of individuals, nursing and/or lactating females included, during the breeding season (June–August) were recorded there. An evidence of one tree-hollow roost was also reported (Czájlik & Harnos 1997). All these data originate from the mountain regions (Mátra Mts, Zemplény Mts, Bükk Mts) in proximity to the territory of southern Slovakia. It is interesting, that in southern Slovakian regions (e.g. Slovenský kras Mts, Slanské vrchy Mts, Cerová vrchovina Mts, Východoslovenská rovina Lowland) only one greater noctule was recorded (Matis et al. 2003), despite the fact that extensive bat surveys were conducted here (e.g. Danko et al. 2000, Matis et al. 2002, own unpublished data). The last observations could indicate that central Slovakian bats can belong to a separate breeding population. Alternatively, the area represents only the migrating or mating part of the species distribution range. The period in which the records were collected, i.e. the second half of summer, could also support the original interpretation of the occurrence of *N. lasiopterus* in Slovakia, i.e. as the migratory vagrants (Danko 1975, Hanák & Danko 1975).



Fig. 2. Recaptured subadult male of the *Nyctalus lasiopterus* on 21 September 2005, Za Havraník, central Slovakia (photo by P. Kaňuch).

Obr. 2. Subadultný samec *Nyctalus lasiopterus*, opätovne odchytený 21. 9. 2005, Za Havraník, stredné Slovensko (foto P. Kaňuch).



Table 2. Ectoparasites of *Nyctalus lasiopterus* in central Slovakia (m = male, f = female, n = nymph; sex, age and sites see in text).

Tab. 2. Ektoparazity *Nyctalus lasiopterus* na strednom Slovensku (m = samec, f = samica, n = nymfa; pohlavie, vek a lokalitu pozri v texte).

individual	date	<i>Macronyssus flavus</i>	<i>Spinturnix acuminatus</i>	<i>Ischnopsyllus elongatus</i>
B0266	31 July 2005	9 m, 18 f, 2 n	1 m, 1 n	
B0267	17 Aug. 2005		5 m, 5 f, 14 n	
B0268	18 Aug. 2005	1 m, 4 f	5 m, 3 f, 1 n	
B0267	21 Sep. 2005		2 m, 3 f, 2 n	
B0270	6 Aug. 2006	1 f	3 m, 4 f	1 f
B0271	6 Aug. 2006		2 m, 4 f, 2 n	

Ectoparasites were looked for and found on five individuals (one of them was recaptured) of *N. lasiopterus*. These comprised two mite species (Acari) of two families, viz. Macronyssidae: *Macronyssus flavus* (Kolenati, 1856) and Spinturnicidae: *Spinturnix acuminatus* (Koch, 1836) and one flea of the family Ischnopsyllidae: *Ischnopsyllus elongatus* (Curtis, 1832). All studied bats were parasitised by *S. acuminatus* and one adult female was heavily infested by *M. flavus* (Table 2). All ectoparasite species were already described in *N. lasiopterus* from other European countries (reviewed by Lanza 1999 and Ibáñez et al. 2004).

Poor knowledge about the species' ecology was particularly challenged by discoveries of feathers and supposed bone fragments in fecal pellets in recent years (Dondini & Vergari 2000, Ibáñez et al. 2001). These findings were interpreted as a confirmation of temporal carnivory in this species (Dondini & Vergari 2000, 2004, Ibáñez et al. 2001, 2003) but this conclusion, however, was not accepted absolutely (Bontadina & Arlettaz 2003). Since the possible signs of this unexpected feeding strategy in a European bat were found only during the bird migratory period, including August and September, we could contribute to this discussion (see Bontadina & Arlettaz 2003, Ibáñez et al. 2003, Dondini & Vergari 2004).

We did not find feathers or bone remains in the bat droppings or the digestive tracts. The most frequent prey items were moths (probably larger species of Noctuidae, Tortricidae, Geometridae, even Sphingidae), dipterans (Tipulidae and some species of Brachycera) and lacewings (Hemero-biidae) (Table 3). The first data on the natural diet of *N. lasiopterus* were provided by Dondini & Vergari (2000). They identified in the droppings the fragments of Odonata, Lepidoptera, Araneida, and Opiliones. High variation of even few data can indicate general foraging opportunism in the species as well as in its relative *N. noctula* (e.g. Beck 1995, Vaughan 1997). The close foraging strategy rather confirm also the diet analyses of both species in the same capture (Table 3).

The absence of bird remnants in the diet of Slovakian individuals of *N. lasiopterus* can be explained as caused by (1) mere different conditions of bird migration in Slovakia and in the Mediterranean (e.g. its timing and/or its geographical pattern) or (2) possible different strategy in the Slovakian populations from the Mediterranean ones, or (3) an opportunism in the searching of a possible prey (which resulted in the presence of bird feathers in the Mediterranean diet samples as suggested by Bontadina & Arlettaz 2003). In summary, our findings did not help significantly in the understanding of possible exclusivity in the feeding behaviour in this bat, but certainly tried to contribute to a description of its ecology on the margin of this species' range.

Table 3. Food composition (volume in %) of the *Nyctalus lasiopterus* and simultaneously captured *N. noctula* in central Slovakia; based on analyses of faecal pellets and/or from digestion tract contents (DT). size = average prey size in mm (for sex, age and sites of the respective individuals see the text)

Tab. 3. Zloženie potravy (objem v percentách) *Nyctalus lasiopterus* a súčasne chytených *N. noctula* zo stredného Slovenska; založené na analýze trusu alebo obsahu tráviaceho traktu. size = priemerná veľkosť koristi [mm] (pohlavie, vek a lokalitu pozri v texte)

species / druh individual / jedinec date / dátum	<i>Nyctalus lasiopterus</i>										<i>Nyctalus noctula</i>		
	B0266 31/07/05	B0267 17/08/05	B0268 18/08/05	B0267 21/09/05	90629 02/08/05	90628 02/08/05	90629 02/08/05	90627 06/08/06	B0270 06/08/06	B0271 06/08/06	90626 02/08/05	90627 02/08/05	90626-7 02/08/05
number of pellets / počet bobkov	42	21	4	9	20	20	DT	28	13	DT	DT	DT	45
prey category	size												
Heteroptera, Pentatomidae	12	10			6		10			10		10	12
Neuroptera, Hemerobiidae	14	5	5		11		10			20		10	30
Neuroptera, Chrysopidae	18				11		10			10		10	3
Coleoptera, Carabidae	17	15	5		17		20			20		20	36
Coleoptera, Curculionidae	12			5									
Coleoptera, Silphidae	18								1				
Hymenoptera, Ichneumonidae	15	10		20	2		10						
Hymenoptera, Formicidae	10	5		5						10		5	5
Lepidoptera	18	40	70	25	31		30		87	10		20	2
Lepidoptera (small repres.)	6							5					
Diptera, Nematocera	7								10				
Diptera, Nemat., Tipulidae	20			10	20		50		2	40		30	30
Diptera, Brachycera	12	15	10	35					20	20			
Thysanoptera	3												
Trichoptera	20				2								1

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## Súhrn

**O raniakovi veľkom (*Nyctalus lasiopterus*) na strednom Slovensku.** V júli až septembri 2005 a v auguste 2006 bolo do nárazových sietí odchytených sedem jedincov *N. lasiopterus* na troch lokalitách stredného Slovenska v hornom povodí rieky Hron (Veporské vrchy: Kamenistá dolina – 1 fa, 31. 7. 2005; Horehronské podolie: Za Havraník – 2 ms, 2. 8. 2005, 1 mj, 17. 8. 2005, 1 fa, 1 fj 6. 8. 2006, Sosninky – 1 fj, 18. 8. 2005). Lokality ležia v nadmorskej výške 600–800 m n. m. v krajine s prevahou ihličnatých lesov (*Picea abies*, *Larix decidua*, *Pinus sylvestris*) s plochami lúk, mokradí a aluviálnej vegetácie (napr. *Salix* spp., *Alnus* spp.). Diskutuje sa možný status zistenej populácie raniaka veľkého na strednom Slovensku. Zistila sa parazitácia raniaka veľkého roztočmi z čeľadi Macronyssidae (*Macronyssus flavus*) a Spinturnicidae (*Spinturnix acuminatus*) a jedným druhom blchy z čeľade Ischnopsyllidae (*Ischnopsyllus elongatus*). Analýzou trusu a obsahu žalúdkov sa stanovilo zloženie potravy (väčšie druhy čeľadi Noctuidae, Tortricidae, Geometridae, Spingidae; Tipulidae, Brachycera a Hemerobiidae).

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