

Some faunistic data on the bats of Italy

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Abstract. During a spring trip across Italy in 1998, bats were surveyed using a bat detector and mist nets. The bats were recorded at seven localities, flying and foraging in various habitats or roosting in a shelter. In total, 6 bat species were netted, i.e. *Rhinolophus ferrumequinum*, *Nyctalus leisleri*, *Pipistrellus pipistrellus*, *Pipistrellus nathusii*, *Barbastella barbastellus*, and *Plecotus auritus*. At least 11 bat species were identified using the bat detector, i. e. *Myotis daubentonii*, *Vespertilio murinus*, *Eptesicus serotinus*, *Nyctalus leisleri*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. pygmaeus*, *P. nathusii*, *P. kuhlii*, *Barbastella barbastellus*, and *Plecotus* sp. *P. kuhlii* seems to be a common species preferring lower elevations, in contrast with another common species *H. savii* which was mostly recorded at higher altitudes. The latter two species along with *E. serotinus* were often found foraging around street lamps. At the time of the survey, records of five species were new to the Gargano National Park. Data concerning *V. murinus* remain very rare for the whole Italy until now.

Ultrasound detection, mist netting, flight activity of bats

Introduction

Fast development of survey techniques for bats, especially the use of bat detectors, and unification of field methods of bat study made it possible to identify the distribution of bats in various regions and understand their requirements on the quality of the environment. Therefore, in some European countries, national bat monitoring programmes have been realized in the last years (Gjerde 1999, Walsh & Catto 1999, Agnelli et al. 2006, etc.).

Although numerous data have been collected on the distribution of bats in Italy, the hitherto knowledge is still incomplete in some regions where systematic bat research has not been carried out so far (Lanza 1959, Vernier 1997, Dal Lago & Vernier 2000, Agnelli et al. 2006). Information on the occurrence of bats comes from the checks of roosts in most cases (e.g. GIRC 2004), whereas data concerning the activity of bats outside the shelters are rare. Therefore, the main aim of this paper is to contribute to the knowledge of distribution and occurrence of some bat species during their night activity.

Material and Methods

The bat survey was carried out from 8 to 14 May 1998 during a trip across Italy destined for the karstic area of the Gargano National Park. Geographical coordinates of the respective localities were obtained by Garmin GPS 45 XL.

Two basic field methods were used: (1) netting of bats by means of the Japanese mist nets, and (2) recording the bat echolocation calls on line transects or points with the D200 heterodyne bat detector and a stereo cassette recorder.

The nets were exposed during the whole night, while the echolocation calls were recorded during the first half of a particular night. All netted bats were measured (forearm length) and weighed. Further measurements (e. g. thumb length, foot length) and other morphological characteristics (e. g. shape and size of teeth, fur colour, shape and pigmentation of tragus) were taken to distinguish hardly identifiable sibling species (*Pipistrellus pipistrellus/nathusii* and *Plecotus auritus/austriacus*) (Andèra & Horáček 1982, Kryštufek 1991).

The identification of acoustically recorded bats was based mainly on the peak frequencies of their echolocation signals, viz., *Myotis daubentonii* (43–45 kHz), *Vespertilio murinus* (24 kHz), *Eptesicus serotinus* (25–28 kHz), *Nyctalus leisleri* (28–32 kHz), *Hypsugo savii* (32.5–34.5 kHz), *Pipistrellus pipistrellus* (44–50 kHz), *P. pygmaeus* (50.5–55 kHz), *P. nathusii* (38 kHz), *P. kuhlii* (40–42 kHz), *Barbastella barbastellus* (32 kHz) and *Plecotus* sp. (30–34, 50–51.5 kHz) (cf. Ahlén 1990, Schober & Grimmberger 1998, Řehák 1999, Russo & Jones 2002). The separation of *Pipistrellus pipistrellus* and *P. pygmaeus* records was made ex post according to the peak frequencies of their signals as noted in the field book. Some problematic recordings were later compared with voucher recordings, e.g. the cassettes by Richardson (1985), Ahlén (1987), Limpens & Roschen (1995) or CDs by Barataud (1996). Short (less than one second) and unclear recordings were excluded. Acoustic identification was supplied by visual observation (flight pattern) in some cases (e.g. *Myotis daubentonii*, *Vespertilio murinus*).

As a measure of flight activity of bats, the number of minutes with the presence of a particular bat species' echolocation calls (min+) related to the total number of minutes of the recording in per cent (A%) was used (cf. Zukal & Řehák 2006). The relative abundance of each species in the samples (D%) was also calculated according to their flight activity as recorded by the detection of their echolocation signals. In total, 325 minutes were spent bat-detecting at 7 localities and 1615 minutes during nettings at 3 localities (Table 1). The timing was based on the Central European Summer Time.

Study sites

Location of all sites under study is shown in the map (Fig. 1).

Locality 1. Emilia Romagna, N 43°57'54", E 11°40'07", 700 m a. s. l. between San Benedetto in Alpe and Muraglione, on the boundary of the regions of Emilia Romagna and Toscana; northern Italy), close to the boundary of Parco Nazionale delle Foreste Casentinesi Monte Falterona Campigna; habitat type: a mountain canyon with the wild mountain stream of Fiume Montone; transects: in the vicinity of the stream, on a pasture, along a road with street lamps.

Loc. 2. Lago de la Accesa, N 42°59'25", E 10°53'43", 180–225 m a. s. l., a lake close to Valpiana, ca. 6 km from Massa Marittima (western-central Italy), not far from the sea coast; habitat type: a lake, parkland with linear landscape elements; transects: across meadows, reeds, along edges of scattered vegetation, on a lake bank, negative netting across a trail between a reed stand and a grove.

Loc. 3. "Reserva Naturelle Lago di Vico", N 42°19'56", E 12°08'56", 500–620 m a. s. l., NW-bank of a lake close to San Martino al Cimino, near Viterbo and Ranciglione (western-central Italy); habitat types: a lake, parkland, woods; transects: along a road beneath tree canopy.

Loc. 4. "Parco Nazionale d'Abruzzo Lazio de Molise", N 41°52'22", E 13°44'45", 1320 m a. s. l., north of Pescasseroli, near Passo del Diavolo (central Italy); habitat type: a mountain grassland with scattered vegetation; transects: along a road crossing a meadow and at the edge of a grove.

Loc. 5. Bosco di Manfredonia, N 41°43'14", E 15°52'29", 600–680 m a. s. l., an abandoned limestone quarry and surroundings, near Masseria Cornello between San Giovanni and Monte Sant'Angelo in the "Parco Nazionale del Gargano" (Foggia region, south-eastern Italy); habitat types: cultural landscape with ruderal vegetation, a limestone quarry; transects: along a road surrounded by bushes and tree lines in the vicinity of the quarry, netting close to the foot of a rock wall of the quarry, checks of cellars situated at the bottom of the stone wall.

Loc. 6. Reserva Naturelle Foresta Umbra, N 41°49'08", E 15°59'56", 800 m a. s. l., near Sant'Antonio ("Parco Nazionale del Gargano", Foggia region, south-eastern Italy); habitat type: a forest pool, netting and ultrasound detection on the pool bank.

Loc. 7. Grotta di Montenero, N 41°43'37", E 15°40'22", 860 m a. s. l., surroundings of a cave entrance, near San Marco in Lamis ("Parco Nazionale del Gargano", Foggia region, south-eastern Italy); habitat type: a karstic landscape with forests and rocks; transect: along a road surrounded by rocks within a forest.

Results and Discussion

Netting

Netting was successful only on the bank of a forest pool in the Foresta Umbra Nature Reserve (loc. 6), where 37 individuals of 6 bat species were caught during one night, viz., *R. ferrumequinum* (1 adult male), *N. leisleri* (1 subadult male), *P. pipistrellus* (8 males and 14 females, confirmed by a bat detector), *P. nathusii* (1 subadult male), *B. barbastellus* (1 adult male), and *P. auritus*



Fig. 1. Location of the sites under study (Loc. 1 to 7, see the text).

Blue triangles – only bat detection, red squares – both successful netting and bat detection.

Obr. 1. Mapa Itálie s vyznačením studovaných lokalit (1 až 7, viz text).

Modré trojúhelníky – jen záznamy detektorem, červené čtverce – jak úspěšný netting, tak záznamy detektorem.

Table 1. List of all bat detector (D) and netting (N) records. The Central European Summer Time was used (start and end time). See the text for description of the respective localities

Tab. 1. Přehled všech detekcí (D) a odchytů do sítí (N). Počátek a konec akcí (start and end time) je uveden v letním středoevropském čase. Číslo lokalit (Loc. No.) jsou vysvětlena v textu

loc. No. č. lok.	date datum	start time počáteční čas		end time koncový čas		duration (min.) trvání (min.)	
		D	N	D	N	D	N
1	8 May 1998	21.15	–	23.55	–	65	–
2	9 May 1998	21.10	21.30	23.10	6.00	40	510
3	10 May 1998	21.35	–	22.20	–	35	–
4	11 May 1998	21.15	–	21.50	–	35	–
5	12 May 1998	21.30	21.15	23.30	6.00	65	525
6	13 May 1998	1.00	20.20	1.15	6.00	15	580
7	14 May 1998	21.45	–	22.55	–	70	–

(7 males and 4 females). The pool seems to be an important foraging area of *P. pipistrellus*, while cluttered spaces of riparian vegetation on its banks are used by *P. auritus*. High level of activity of *P. pipistrellus* was recorded during the first half of the night and then before sunrise, whereas the activity of *P. auritus* was randomly distributed over the night except the time immediately after dark and before dawn. Low flight activity of bats was recorded in the period between 2:00 and 5:00 a.m. of the Central European Summer Time.

Table 2. Flight activity of bats (A%) and proportion of individual bat species in the samples (D%) revealed by a bat detector. Loc. No. as in Table 1. For symbols min+, A%, D% see the text

Tab. 2. Letová aktivita netopýřů (A%) a poměrné zastoupení jednotlivých druhů ve vzorcích (D%) na základě záznamů bat-detektorem. Číslo lokalit (Loc. No) jako v Tab. 1. Symboly min+, A% a D% vysvětleny v textu

loc. No. / č. lok.	species / druh	min+	A%	D%
1	<i>Eptesicus serotinus</i>	2	3,1	8,3
	<i>Nyctalus leisleri</i>	5	7,7	20,8
	<i>Hypsugo savii</i>	3	4,6	12,5
	<i>Pipistrellus kuhlii</i>	14	21,5	58,3
2	<i>Vespertilio murinus</i>	25	62,5	78,1
	<i>Pipistrellus kuhlii</i>	7	17,5	21,9
3	<i>Myotis daubentonii</i>	1	2,9	10,0
	<i>Eptesicus serotinus</i>	3	8,6	30,0
	<i>Hypsugo savii</i>	2	5,7	20,0
	<i>Pipistrellus kuhlii</i>	4	11,4	40,0
4	<i>Nyctalus leisleri</i>	2	5,7	100,0
5	<i>Pipistrellus pygmaeus</i>	6	9,2	100,0
6	<i>Pipistrellus pipistrellus</i>	15	100,0	50,0
	<i>Plecotus auritus</i>	15	100,0	50,0
7	<i>Eptesicus serotinus</i>	12	17,1	31,6
	<i>Hypsugo savii</i>	3	4,2	7,9
	<i>Pipistrellus pipistrellus</i>	5	7,1	13,2
	<i>Pipistrellus kuhlii</i>	7	10,0	18,4
	<i>Pipistrellus nathusii</i>	2	2,9	5,3
	<i>Barbastella barbastellus</i>	9	12,9	23,7

Moreover, a subadult male *R. ferrumequinum* was netted in the evening, leaving its day roost – a dry abandoned cellar dug at the foot of the cliff of a limestone quarry serving now as a waste dump (loc. 5).

Bat detection

At all seven localities under study, flight activity of bats including foraging was recorded with the use of a bat detector. Distribution of particular bat species in the samples from particular localities (D%) as well as the level of flight activity of bats (A%) are given in Table 2.

The highest flight activity was recorded on the bank of a pool in the forest of the Foresta Umbra Nature Reserve (loc. 5) where *P. pipistrellus* and *Plecotus* sp. flew and hunted continuously either above water surface (the former species) or around the vegetation and among treetops (the latter species) within the 15 minute interval of detecting.

Nevertheless, in total, *P. kuhlii* was the commonest species recorded by the detector, being found at four localities and dominant at two of them (loc. 1, 3). *P. kuhlii* usually occurred around lakes and riparian vegetation, especially at lower altitudes (loc. 2, 3), where it foraged in semi-cluttered spaces close to patches of shrubs and trees. However, it was also recorded in the mountain forest (loc. 7) and around street lamps (loc. 1); its foraging around street lamps was also recorded by other authors (cf. Gaisler, 1994). Group foraging of *P. kuhlii* was observed only 1–4 m above the ground (loc. 1, 2). *H. savii* was registered at 3 localities, but its flight activity was much lower in comparison with the previous species. It also flew close to street lamps, but its flight trajectory was straight and it did not change the flight level so frequently as circling *P. kuhlii*. In addition, *H. savii* seems to prefer more elevated habitats than the former species and to avoid lowlands (loc. 2). *P. pygmaeus* was detected only at one locality (loc. 5), foraging among treetops and under tree canopy along a local road in the vicinity of the stone wall with cellars of an abandoned quarry in a devastated landscape intensively exploited by man. In contrast to the records of *P. pygmaeus* in a floodplain forest (cf. Bartonička & Řehák 2004), it used a dry habitat far away from water. This finding was probably the first record of the species in Italy at the time of the author's visit.

The record of *V. murinus* (loc. 2) is very interesting because only few localities of this species in northern Italy have been known so far (Vernier 1997, Mitchell-Jones et al. 1999). The species was recorded both acoustically by a bat detector and also visually in straight flight, back and forth (Doppler's effect), high above a grove. The detection of *V. murinus* is easy and reliable due to its typical regular slow hard clicks at about 24 kHz (Řehák 1999). This species has been considered rare in Italy, recorded only in NE regions, especially in the Alps (Vernier 1997), but it has been also caught in Milano (Agnelli et al. 2006). The present observation represents the southernmost record of this rare species in Italy.

The highest number of bat species was registered by the bat detector in a karstic area with forests, rocks and cliffs of the loc. 7 (Table 2). The high flight activity of *E. serotinus* was caused by both commuting and group foraging above a road leading along rocks through a forest. *B. barbastellus* as well as other bat species recorded also used this flight corridor above the road. The lowest bat activity was recorded in a mountain area of the d'Abruzzo NP because of low temperature during the survey (about 8 °C), when only two records of *N. leisleri* were made.

Conclusions

Distributional status of many bat species in Italy seems to be unclear, as the data drawn in the maps of the Atlas of European Mammals (Mitchell-Jones et al. 1999) differ from those in the maps given by Vernier (1997). Compared to the Italian Mammal Atlas Project (P.A.M.I.) (Amori & Prigioni, in Mitchell-Jones et al. 1999), the records of *E. serotinus*, *P. nathusii*, *B. barbastellus*,

and *P. auritus* should be the first records of these species in the area of the Gargano National Park. On the contrary, compared to Vernier (1997), *N. leisleri*, *B. barbastellus*, and *P. auritus* seem to be new species for this region. It is obvious that only 2 bat species, *B. barbastellus* and *P. auritus*, are new for the Gargano bat fauna when the data from the two sources are combined. It is necessary to pay further attention to the occurrence of *V. murinus*. Using bat detectors, this fast flying and migrating bat species with typical vocalisations is likely to be discovered at further localities in Italy, including human settlements (towns), where it may be heard, especially in autumn. This possibility is also suggested by the record of *V. murinus* in Milano (Agnelli et al. 2006).

Acknowledgements

The author thanks Prof. J. Gaisler for the kind review of the manuscript. The study was partially supported by the Long-term Research Project of the Ministry of Education, Youth and Sports of the Czech Republic No. MSM 0021622416.

Souhrn

Něco faunistických údajů o netopýrech Itálie. Netopýři byli sledováni během týdenní expediční cesty po Itálii v květnu 1998 s cílem navštívit Národní park Gargano. Ke studiu netopýřů byl použit jak odchyt do nárazových sítí (netting), tak detekce ultrazvukových signálů s pomocí heterodynovacího bat-detektoru. Při detekci byla použita jak metoda liniových transektů (cca 20 minut/transekt), tak bodová metoda. Netopýři byli identifikováni na základě charakteru echolokačních signálů, zejména podle hodnoty vrcholové frekvence, příp. i podle letových siluet a způsobu letu. U sporných druhů byly pořízeny záznamy později srovnávány s referenčními mg kazetami nebo CD. *Pipistrellus pipistrellus* a *P. pygmaeus* byly rozlišeny zpětně na základě záznamu vrcholových frekvencí v terénním zápisníku. Zatímco odchyt do sítí byl celonoční, detekce probíhala jen v 1. polovině noci. Detekce na 7 lokalitách trvala celkem 325 minut, zatímco odchyt do sítí proběhl jen na 3 lokalitách a jeho celková doba činila 1615 minut.

Netopýři byli zaznamenáni celkem na 7 lokalitách. Na břehu lesního jezírka v State Nature Reserve of Foresta Umbra (loc. No. 6) bylo odchyceno do sítí celkem 37 jedinců 6 druhů – *Rhinolophus ferrumequinum* (1), *Nyctalus leisleri* (1), *Pipistrellus pipistrellus* (22), *P. nathusii* (1), *Barbastella barbastellus* (1) a *Plecotus auritus* (11). Vysoká aktivita *P. pipistrellus* (netting + detekce) byla zaznamenána nad jezerem a při jeho březích v první polovině noci a poté až před svítáním. Mezi 2. a 5. hodinou byla naopak nejnižší. Naopak aktivita *P. auritus* byla zjištěna v hustém břehovém porostu jezera. Byla náhodně rozložena po větší část noci s výjimkou doby po západu slunce a před jeho východem. Jeden *R. ferrumequinum* byl také odchycen při výletu z opuštěných sklepů pod skalní stěnou starého lomu (loc. No. 5). Odchyt na břehu jezera a v koridoru mezi rákosinami a keřovým porostem na lokalitě Lago de la Accessa (loc. No. 2) byl neúspěšný.

Bat-detektorem bylo zjištěno nejméně 11 druhů netopýřů – *Myotis daubentonii*, *Vespertilio murinus*, *Eptesicus serotinus*, *Nyctalus leisleri*, *Hypsugo savii*, *Pipistrellus pipistrellus*, *P. pygmaeus*, *P. nathusii*, *P. kuhlii*, *Barbastella barbastellus* a *Plecotus* sp. Nejběžnějším druhem zejména v nižších nadmořských výškách byl *P. kuhlii*, zatímco *H. savii* byl častěji zaznamenáván ve vyšších polohách. Oba zmíněné druhy spolu s *E. serotinus* byly také sledovány v okolí lamp pouličního osvětlení. Pět druhů zaznamenaných v NP Gargano nebylo v té době uvedeno v Italian Mammal Atlas Project. Údaj o výskytu *V. murinus* (loc. No. 2), druhu evidovaného obzvláště z podhůří Alp na severu Itálie, posouvá hranici jeho areálu výrazně na jih. Šíření druhu na jih podporuje i pozdější nález v Miláně (Agnelli et al. 2006).

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received on 13 September 2010