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BREEDING EVIDENCES FOR THE PARTI-COLOURED BAT *VESPERTILIO MURINUS* LINNAEUS, 1758 IN NORTH-EASTERN ITALY (CHIROPTERA: VESPERTILIONIDAE).

EVIDENZE RIPRODUTTIVE DEL SEROTINO BICOLORE *VESPERTILIO MURINUS* LINNAEUS, 1758 NELL'ITALIA NORD-ORIENTALE (CHIROPTERA: VESPERTILIONIDAE).

Abstract - The Authors refer about the first evidences of reproduction of the parti-coloured bat *Vespertilio murinus* Linnaeus, 1758 in North-eastern Italy. They are constituted by both various females collected during the spring and the breeding period and by some young and newborns collected in some localities of North-eastern Italy (Friuli Venezia Giulia and Veneto). Males' summer roosts have been also noted in some localities from North-eastern Italy.

Key words: *Vespertilio murinus*, Breeding, Maternal roost, North-eastern Italy, Veneto, Friuli Venezia Giulia.

Riassunto breve - Gli Autori riferiscono le prime evidenze di riproduzione del serotino bicolore *Vespertilio murinus* Linnaeus, 1758 in Italia nord-orientale. Esse sono costituite sia da diverse femmine raccolte in primavera e nel periodo riproduttivo, sia da alcuni giovani e neonati, raccolti in alcune località dell'Italia nord-orientale (Friuli Venezia Giulia e Veneto). Assembramenti estivi di maschi sono stati segnalati in alcune località alpine e prealpine dell'Italia nord-orientale e della vicina Slovenia.

Parole chiave: *Vespertilio murinus*, Riproduzione, Assembramento di femmine riproduttive, Italia nord-orientale, Veneto, Friuli Venezia Giulia.

Introduzione

All the European bats are under the protection of the 92/43 EU "Habitat" Directive, that requires to conduct a regular six-years monitoring in the whole EU Countries, in Northern Italy performed both on regional (LAPINI & DORIGO 2011; LAPINI et al. 2014) and national scale (AA. VV. 2014).

For this reason, between 2013 and 2015 the Friulian Natural History Museum and the Public Administration of the Autonomous Region Friuli Venezia Giulia (Udine, Italy) conducted a large-scale Regional bat monitoring programme, which included the use of mist-netting, harp-trapping and bat-detector study methods. The bat-detector field surveys had been conducted in cooperation with the Department of Biology of Biotechnical Faculty of the University of Ljubljana (Slovenia).

The overall results were very important, with 30 species signalled so far throughout the whole region (LAPINI & DORIGO 2011, 2015; LAPINI et al. 2014; ZAGMAJSTER et al. 2015).

One of the most interesting species recorded in the area was the parti-coloured bat *Vespertilio murinus*, that in the 2013-2015 monitoring turned out to be quite

common in Friuli Venezia Giulia, showing clear trends to expansion (LAPINI et al. 2015).

The species is widely distributed in Northern Palaearctic, with an European-Asiatic choro-type (LANZA 2012; LAPINI et al. 2015), reaching the 60° Parallel in Northern Europe.

It is protected by local (Regional Law 9/2007 by Friuli Venezia Giulia), national (Italian Law 157/1992 and DPR 357/1997) and international Laws (it has been listed in the IV Annex of the 92/43 EU "Habitat" Directive). It is also protected by various other international conventions and agreements (Bern Convention, Annex II; Bonn Convention, Annex II; Eurobats Agreements).

Vespertilio murinus is a frigophilous species quite common in Central and Eastern Europe, but it spreads also towards South Eastern Europe (LANZA 2012; DIETZ & KIEFER 2014). Nevertheless, there are only vagrant findings from Great Britain, Iberia, France, while recent works indicate that it is quite common in Slovenia (PRESETNIK et al. 2013). In the Balkans, anyway, the species has a patchy and scattered distribution (PAVLINIĆ & TVRTKOVIĆ 2003; DIETZ et al. 2009), with hypothesized breeding only based on the finding of a



Fig. 1 - The young of parti-coloured bat (*Vespertilio murinus*) and Savi's pipistrelle (*Hypsugo savii*) are quite similar. Below, overall aspect and terrific display of a young of *Vespertilio murinus* (on the left: 5-6 months old male, Aiello del Friuli, Udine, October, 4th, 2015, E. Antoniutti leg., photo L. Lapini), and a young of *Hypsugo savii* (on the right: 1-3 months old female, Hospital of Monfalcone, Gorizia, July, 16th, 2016, photo L. Mazzoli/CFR). Terrific displays are quite different in the young of the two species, particularly in the exposition of the upper gums.

- I giovani di Serotino bicolore (*Vespertilio murinus*) e di Pipistrello di Savi (*Hypsugo savii*) sono molto simili. Aspetto generale e atteggiamento terrifico di un giovane *Vespertilio murinus* (a sinistra, maschio di 5-6 mesi, Aiello del Friuli, Udine, 4 ottobre 2015, E. Antoniutti leg., foto L. Lapini), e di un giovane di *Hypsugo savii* (a destra, femmina di 1-3 mesi, Ospedale di Monfalcone, Gorizia, 16 luglio 2016, foto L. Mazzoli/CFR). Gli atteggiamenti terrifici sono piuttosto differenti nei giovani delle due specie, in particolare nell'esposizione delle gengive superiori.

pregnant female in Slovenia, recently evaluated as a vagrant (KRYŠTUFEK & ČERVENÝ 1997; PRESETNIK et al. 2009, 2013).

The species was not recorded in most of Peninsular Italy, but scattered data indicate the spreading of vagrant males to the North (LAPINI et al. 1996, 2015; LANZA 2012), recorded at least up to Tuscany (DONDINI & VERGARI 2015).

Up to now in Italy its reproduction had been only hypothesized on the bases of a nulliparous female collected in the Canyon of Natisone/Nadiza River (Cividale del Friuli, Julian Pre-Alps, Udine, L. Lapini in LANZA, 2012; LAPINI et al. 2014), on other females more recently collected in North-eastern Italy and on a 5-6 months-old young (LAPINI et al. 2015). During 2015 and 2017 clear breeding evidences were collected, that are presented in this paper.

Methods

Starting from the data set provided by Lapini et al. (2015), we have increased the knowledge on *Vespertilio murinus* collecting all available records and materials, with a special attention to the aggregations of bats already quoted in previous papers.

Accidental findings

New records were mostly due to generic public, hunters, forestry agents, game keepers, farmers,

universities and from various provincial centres for the recovery of wild fauna. All the handled specimens were measured, sexed and their reproductive status determined. If possible they were released back into the wild. In a lot of cases, anyway, we received only photographic material, and we determined the species and the sex (if possible) from them and by consulting the collectors, following the indications of LAPINI et al. (2015).

Identification of the species

All the handled specimens were determined following LANZA (2012) and DIETZ & KIEFER (2014), but sometimes it was no possible to study certain specimens, obtaining only good digital photo of them. In the determination of the photos of the adults we have paid a particular attention to the unmistakable silvery grizzled dorsal hairs, diagnostic for the species in the comparison with other Italian bats.

The identification of the young and babies was more difficult. With incompletely developed specimens, indeed, misidentifications are quite easy, since the overall external phenotype of *Hypsugo savii* is quite similar to that of the yearlings of *Vespertilio murinus* (fig.1), that only in October begin to develop the typical diagnostic silver hairs on the back (fig. 2). In these cases, anyway, the terrific behaviour of *Vespertilio murinus* greatly helps in the identification of this species, resulting in a particular exposure of the upper gums (fig. 1).



Fig. 2 - Comparison between a young (on the left: 5-6 months old male, Aiello del Friuli, Udine, October, 4th, 2015, E. Antoniutti leg.) and an adult *Vespertilio murinus* (on the right: adult male, Cason di Lanza, Paularo, Udine, October, 3th, 2015, S. Cescutti leg.). Photo L. Lapini.

- *Confronto fra un giovane (a sinistra: maschio di 5-6 mesi, Aiello del Friuli, Udine, 4 Ottobre 2015, E. Antoniutti leg.) e un adulto di Vespertilio murinus (a destra: maschio adulto, Cason di Lanza, Paularo, Udine, 3 Ottobre 2015, S. Cescutti leg.). Foto L. Lapini.*

Anyway, to avoid misidentifications in the study of incompletely developed young and babies of the two species, the better external character to check was the lower origin of the ear, clearly located on the lower mandible in *Vespertilio murinus*, at the corner of the mouth in *Hypsugo savii* (DIETZ & VON HELVERSEN 2014).

Roosts verifications

The verification of some roosts had been performed by visual inspections, in some cases by using endoscopic cameras, in other thanks to particularly dedicated photographic sessions, in other by studying the preys of house cats, in other studying naturally dead babies, fallen from a nursery.

Bioacoustics

The Pettersson D1000x bat detector was used to recording the vocalizations of the bats in one maternal roost, with a special attention to the emerging bats at the sunset. The pc elaboration of these recording gathers the identification of various species by using the software Batsound4 (Pettersson inc.), following the parameters of Russ (1999) and Russo & Jones (2002).

Results

Presence of single females

Up to now they were recorded in various towns of North-eastern Italy, Both in October (one specimen: Rivignano-Teor, Udine), December (one specimen: Monfalcone, Gorizia), March (two specimens: Cividale del Friuli, Udine; town of Trieste), Maj (one specimen: town of Trieste), without clear signs of true aggregation or reproductive evidences.

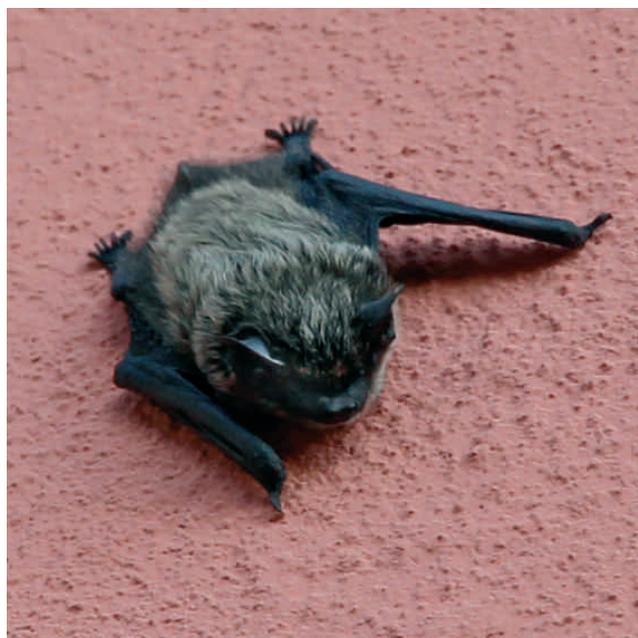


Fig. 3 - *Vespertilio murinus*, adult female at the end of the breeding period, just before she left the maternal roost of Verona (July, 19th, 2016, photo M. Bottazzo).

- *Vespertilio murinus, femmina adulta al termine del periodo riproduttivo, poco prima di abbandonare il roost riproduttivo di Verona (19 Luglio 2016, foto M. Bottazzo).*

Presence of single males

In 2016 and 2017 single males were collected in various other localities of North-eastern Italy (Tarvisio, Udine; Rutte Piccolo, Tarvisio, Udine; Venzone, Udine; Sedico, Belluno; Trieste), but without clear signs of true aggregation.

Male roosts

Up to now this type of summer aggregation was only recorded in Veneto.



Fig. 4 - *Vespertilio murinus*, dead baby semi-finished by ants, collected under the same maternal roost. June, 29th, 2017, photo M. Bottazzo. Its ear clearly originates from the external surface of the mandible, under the lower lip.

- *Vespertilio murinus*, cadavere di un neonato semidivorato da formiche raccolto sotto la medesima nursery (29 giugno 2017, foto M. Bottazzo). L'orecchio si origina chiaramente dal lato esterno della mandibola, al di sotto del labbro inferiore.

- Between 2000 and 2017 it was possible to examine eight specimens caught by a domestic cat under the same tall chimney located on the high roof of a tall building in the Village of Sedico (Sedico Municipality, Belluno). Almost all these bats were males, caught between May (two specimens), June (four specimens), August (one specimen), but one of these was a nulliparous female, collected on August, 6th, 2014. These data indicate a seven years frequentation of the same roost.
- Between 2014 and 2017 it was possible to examine some isolated specimens from a private house of the Village of Conzago (Mel, Belluno). They appears in June and July behind the sets of a very high window exposed on a wide meadow spaces. These data seems to indicate a little summer roost of males, that usually disperses in late July.

Nursery

On July, 19th, 2016, a *Vespertilio murinus* female was photographed before she left a roost (fig. 3), formed at least from three-five years under a square-section rain tube in a building of Verona (fig. 5).

At the beginning of his history this nursery was formed by 3-5 specimens, but in 2016 it was already constituted at least by ten-twelve specimens, and in

2017 by more than twenty specimens. In 2017 it was formed around mid-June.

On June, 29th, 2017, after a storm, a 10-15 days old baby of *Vespertilio murinus* had been collected under the nursery (fig. 4), while another specimen of similar age was discovered and collected only later, on July, 4th, 2017.

On July, 5th, 2017, however, in the nursery there were about 12 females and 20 babies.

This estimation of their overall number seemed to be constant also during a short bio-acoustic survey conducted on July, 8th, 2017.

An intensive photographic session was conducted on July, 12th, 2017, confirming the estimation of at least 12 adult females and at least 10-15 babies.

Youngs and newborns

Up to now young or babies of the species have been collected only in two localities of North-eastern Italy: Aiello del Friuli, Udine (LAPINI et al. 2015; fig. 1 and 2) and Verona (fig. 4).

Bioacustics

A single bio-acoustic session had been performed on July, 8th, 2017, by using a D1000x Pettersson bat-detector. The calls of the bats were recorded in Time Expansion both in general nursery activities and in their sunset flying emergence, started at 21.16.

It was possible to obtain recordings of a wide general very low chittering from the nursery, and of various echolocation calls from emerging bats.

Some of these had been attributed to *Pipistrellus kuhlii/nathusii*, clearly emitted by at least one emerging bat started in fly from the higher part of the nursery and probably by other specimens flying around the nursery.

Other calls had uncertain characteristics, but they had so wide extension that seems to be vocalizations of *Vespertilio murinus*. In effect they were recorded during the emergence of this species, clearly distinguishable in fly for its silvery-withish dorsal colouring. This bat is surely distinguishable by bio-acoustics only thanks to the display songs of males, usually emitted in October-November (AHLÉN & BAAGØE 1999; ZAGMAJSTER 2003; LAPINI & DORIGO 2015), and it is note to emit in a wide frequency spectrum between 11 and more than 35 kHz or more, normally within the spectra of emission of the genus *Nyctalus* and/or *Eptesicus*.

In the same bio-acoustic survey it was possible to record also the typical emission of *Hypsugo savii*, but it was no possible to have certainty on the provenience of its echolocation calls. It could be recorded because this bat were flying around the building that hosts the nursery under study.



Fig. 5 - Collocation of the nursery of *Vespertilio murinus* from Verona. On the left: a wide overview of the maternal roost, located under a square-section rain tube protected by a masonry wall, with West-South West exposition (June, 28th, 2017, photo M. Bottazzo); on the right: young specimens peep from the rain tube (July, 12th, 2017, photo G. Perlato).

- Collocazione della nursery di *Vespertilio murinus* di Verona. A sinistra: la visione complessiva del roost, posizionato sotto un tubo di sgrondo delle acque piovane a sezione quadrata, protetto da una parete in muratura con esposizione a Ovest-Sud Ovest (28 giugno 2017, foto M. Bottazzo); a destra: esemplari giovanili fanno capolino dalla fessura tra il muro e il tubo di sgrondo (12 luglio 2017, foto G. Perlato).

Remarks

The discovery of a first nursery and other evidences indicate that the parti-coloured bat *Vespertilio murinus* breeds in north-eastern Italy. Up to now only a single nursery was found, but the relative frequency of vagrant females and male roosts could indicate that the presence of maternal roosts could be under estimated in north-eastern Italy.

The environment around the only nursery know so far is a thermophilic hilly place, exposed to West-North West, in a building located on a North-eastern hilly quarter of the town of Verona (Castel Montorio), about 20 meters flyover the valley bottom. The flying access to the nursery is completely open, with scarce trees and buildings.

Further studies could clear if in other buildings of the same zone there are other maternal roosts of *Vespertilio murinus*, because the particular accessibility of the described nursery could be the principal reason of its discover.

All the other Italian roosting sites of this frigophilous species, indeed, are located in urban and suburban environments, all characterized by a wide opening front in the flying approaching corridor, usually with very high collocations of the roosts, like as happens in other parts of the range of the species (RYDELL & BAAGØE 1994).

All our data seems to be in agreement with the hypothesis of a recent range expansion of the species (DONDINI & VERGARI 2015; LAPINI et al. 2015).

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Addendum

The last observation of bats in the nursery site of *Vespertilio murinus* from Verona date back to August, 1th, 2017. After this date the maternal roost was abandoned.

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