

***Pipistrellus kuhlii* in the Czech Republic: 2007–2020 (Chiroptera: Vespertilionidae)**

Netopýr vroubený (*Pipistrellus kuhlii*) v České republice: 2007–2020
(Chiroptera: Vespertilionidae)

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received on 2 December 2020

Abstract. Based on 25 records (both published and new) we summarize the recent distribution of *Pipistrellus kuhlii* in the Czech Republic and discuss possible colonization routes. The species colonized a major part of the Czech Republic during 14 years since its first record in 2007. Based on locations and chronology of the records it seems that the eastern part of the Czech Republic (Moravia) was colonized from the south along the Dyje and Morava rivers, while in Bohemia, two possible routes may have existed: one from the south along the Vltava river from the Danube valley, and another from the east or south-east along the valley of the Svitava and Orlice rivers. Given the fact that already in 2018 the presence of *P. kuhlii* was confirmed in Saxony, which predated the species confirmation in the north-western and central parts of Bohemia, we do not exclude possible existence of a third colonization route along the Labe river from the north-west (Germany). All the records come from human settlements, typically cities or towns, and dates of the records suggests the year-round occurrence. At least four records (including two roosts of maternity colonies), all from Moravia, proved reproduction of this bat in the country. All examined individuals displayed pelage and skin colouration patterns typical for *P. kuhlii kuhlii*.

Key words. Chiroptera, range expansion, distribution.

INTRODUCTION

The Kuhl's pipistrelle, *Pipistrellus kuhlii* (Kuhl, 1817), is a vespertilionid bat species whose European distribution range has undergone a dramatic expansion by ca. 400% during the last four decades (ANCILLOTTO et al. 2016). While its original distribution area ranged from the Canary Islands through the Mediterranean, Middle East to western Asia, it started to expand northward in its European part during the second half of the 20th century (BOGDANOWICZ 2004). In central Europe the spreading northwards from the Mediterranean area was particularly well documented in the regions north of the mountain ranges of the Alps, Dinarides and southern parts of the Balkans, which most probably delimited the northern margins of its original distribution. The

first occurrences north of these limits were as follows: Austria – first record north of the Alps in 1992, first record in Vienna in 1994 (BAUER 1996), Bulgaria – 1987 (BENDA et al. 2003), Serbia – 1994 (PAUNOVIĆ & MARINKOVIĆ 1998), Hungary – 1993 (FEHÉR 1995), Romania – 2000 (but earlier occurrence cannot be excluded – cf. SACHANOWICZ et al. 2006), Slovakia – 2006 (CELUCH & ŠEVČÍK 2006), Czech Republic – 2007 (REITER et al. 2007), Poland – 2004 (POPCZYK et al. 2008). A similar situation was recorded in the easternmost parts of Europe, where *Pipistrellus kuhlii* expanded from Transcaucasia and/or the Black Sea region since the 1970s (STRELKOV et al. 1985) and by 2010 it colonized the middle Volga region at 53–54° N (SMIRNOV & VEHNİK 2011), most of Ukraine (SACHANOWICZ et al. 2006, BILUSHENKO 2013) and in 2012 it reached Belarus (SHPAK & LARCHENKO 2016). In most of these countries, the species soon established reproducing populations and became locally abundant. A recent survey of the distribution in Ukraine demonstrated frequent records of winter colonies in buildings (reaching up to several hundred individuals), the total abundance of the species in Ukraine is thus estimated at 0.5–3 million individuals (HUKOV et al. 2020).

Colonization of the northern regions by populations from two separate segments of the distribution range, i.e. central Europe from the Mediterranean and eastern Europe from the Ponto-Caspian region, respectively, suggested already by STRELKOV et al. (1985), was later supported in a study with the use of genetic markers by SACHANOWICZ et al. (2017). The latter authors further revealed that the two genetic lineages, corresponding roughly to the Mediterranean and Ponto-Caspian origins, respectively, have different phenotypes and thus should be treated as separate (probably subspecific) forms, tentatively referred to as *Pipistrellus kuhlii kuhlii* and *P. k. lepidus* Blyth, 1845. These two forms, originally allopatric outside of the Mediterranean, have probably come into secondary contact just recently in eastern Slovakia (SACHANOWICZ et al. 2017).

In the Czech Republic, the first record of *P. kuhlii* was made in 2007 in southern Moravia (REITER et al. 2007) and in a short time established local populations there, based on the evidence of hibernation and reproduction (WAWROCKA et al. 2012). The spreading towards the north and west was proved by two records in central Moravia in 2014 (Olomouc – MICHÁLEK et al. 2017), the first record from eastern Bohemia in 2016 (Hradec Králové – MICHÁLEK et al. 2017) and, quite surprisingly, also by the first record from southern Bohemia (foothills of the Šumava Mts. – ČERVENÝ 2017). Except for these records, no other information has been published. The aim of this study is to provide new records and draw a current picture of the distribution of *P. kuhlii* in the Czech Republic.

METHODS

Most of the new records include cases where the presence of bats was reported to a local bat expert who visited the place of finding and inspected the bats or bats were brought to an expert by people. In cases where bats were mist-netted, the mistnets (Ecotone, Poland) of different lengths (mesh size 16–20 mm) were used, typically set over different types of water bodies in order to sample the local bat community.

When examining bats for identification, we used a combination of quantitative and qualitative criteria given by DIETZ et al. (2009). Further, we inspected the state of characters distinguishing two subspecific forms *Pipistrellus kuhlii kuhlii* and *P. k. lepidus* sensu SACHANOWICZ et al. (2017).

Given the fact that echolocation calls of *Pipistrellus kuhlii* are very similar to those of *P. nathusii* (von Keyserling et Blasius, 1839), see e.g. OBRIST et al. (2004), we used echolocation data for confirmation of the presence of *P. kuhlii* only at one locality, from where echolocation was repeatedly accompanied with social calls that are different from other sympatric pipistrelle bat species and allow the undoubted identification of *P. kuhlii* (RUSSO & JONES 1999). The above mentioned acoustic survey was conducted at

Děčín, northern Bohemia (record 22), where we attached a batcorder (SM4Bat, Wildlife Acoustics, Inc., Maynard, USA, equipped with one microphone SMX-US) to the construction of the railway bridge above the confluence of the Ploučnice and Labe rivers. The obtained records were analyzed with the SonoChiro software (Biotope, Méze, France), which uses the principle of artificial neural networks (ANN) and can evaluate a large amount of data. Only records with a high confidence index were included, in which not only echolocation but also social signals (checked also visually) were present.

RECORDS

In total, 25 record sites of a minimum of 102 recorded individuals have been gathered so far from the territory of the Czech Republic by the end of November 2020 (Fig. 1). A chronological review of all records, including the published ones is given below.

- 1 **Znojmo**, ca. 48°50'32"N, 16°03'21"E, 208 m a. s. l., 25 August 2007, an adult female mist-netted at a bank of the Dyje river (REITER et al. 2007);

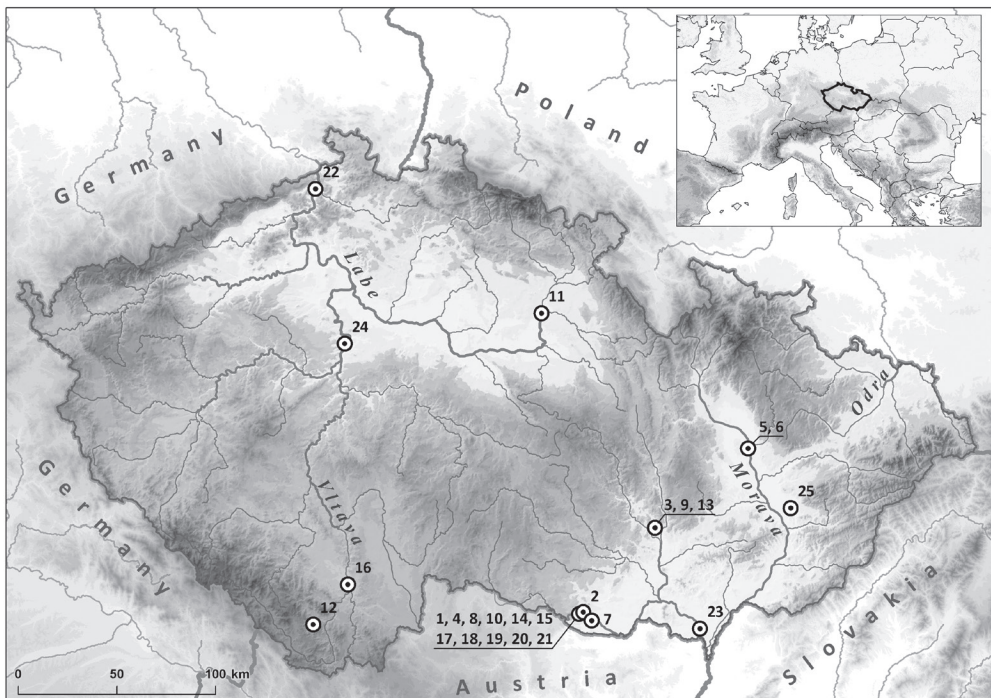


Fig. 1. Map of the records of the Kuhl's pipistrelle (*Pipistrellus kuhlii*) in the Czech Republic in 2007–2020. For lucidity, only one point in each settlement is given. Number at a point refers to the record order given in the text.

Obr. 1. Mapa nálezů netopýra vroubeného (*Pipistrellus kuhlii*) v České republice v letech 2007–2020. Pro přehlednost je v mapě pro více nálezů z jednoho sídla uveden jen jeden bod. Číslo u bodu odpovídá chronologickému pořadí nálezů udanému v textu.



Fig. 2. Dorsal view of the wing membrane and pelage colouration of a juvenile female of *Pipistrellus kuhlii* found in Olomouc, central Moravia, on 26 August 2014. Photo by D. ŠAFÁŘOVÁ.

Obr. 2. Hřbetní pohled na létací blánu a barvu srsti u juvenilní samice *Pipistrellus kuhlii* nalezené 26. 8. 2014 v Olomouci. Foto D. ŠAFÁŘOVÁ.

- 2 **Dobšice**, ca. 48°51'04"N, 16°05'10"E, 230 m a. s. l., 2 December 2010, an adult female found in a family house (WAWROCKA et al. 2012);
- 3 **Brno**, ca. 49°13'02"N, 16°40'21"E, 310 m a. s. l., 18 May 2012, a pregnant female mist-netted at a small water body (WAWROCKA et al. (2012);
- 4 **Znojmo**, 48°51'25"N, 16°03'17"E, 290 m a. s. l., 20 July 2014, a juvenile not fully volant male found inside a building (leg. & det. A. REITER);
- 5 **Olomouc**, Werichova 1, 49°34'38"N, 17°15'17"E, 220 m a. s. l., 26 August 2014, a juvenile fully volant female flew into a flat (Fig. 2; MICHÁLEK et al. 2017);
- 6 **Olomouc**, Dolní náměstí, 49°35'31"N, 17°15'10"E, 220 m a. s. l., 6 September 2014, an adult male found on the street (Fig. 3; MICHÁLEK et al. 2017);
- 7 **Derflice**, 48°48'42"N, 16°08'31"E, 230 m a. s. l., 4 October 2014, a group of five individuals (an adult male examined – Figs. 4, 5) found in a crevice in a statue at a local cemetery (leg. L. KRATOCHVÍL, det. A. REITER);
- 8 **Znojmo**, Rudoleckého 9, 48°51'15"N, 16°03'19"E, 290 m a. s. l., 10 December 2014, a hibernating group of eight individuals (four adult females examined – Fig. 6) found in crevices under windowsills on the first floor of a two-storey house (leg. & det. A. REITER);
- 9 **Brno**, Blatného ulice, ca. 49°12'55"N, 16°34'26"E, 220 m a. s. l., 15 November 2015, a male found and transported to an animal rescue center at Jinačovice (Figs. 7, 8; det. P. ŠRÁMEK; MICHÁLEK et al. 2017);
- 10 **Znojmo**, Kotkova 19, 48°50'51"N, 16°03'51"E, 290 m a. s. l., 15 January 2016, a nulliparous female found in a stock-building (leg. & det. A. REITER);
- 11 **Hradec Králové**, Gočárova třída, ca. 50°12'41"N, 15°49'08"E, 235 m a. s. l., 18 January 2016, two individuals found (an adult female examined) hibernating in a crevice at a window during reconstruction works (MICHÁLEK et al. 2017);
- 12 **Kladenské Rovné**, ca. 48°47'45"N, 14°13'16"E, 600 m a. s. l., 25 June 2017, a male found in a fissure between the roofing and wooden construction of a family house (ČERVENÝ 2017);
- 13 **Brno**, Riegrova 1, 49°13'39"N, 16°35'32"E, 220 m a. s. l., 15 August 2017, a juvenile female flew into a flat (leg & det. T. BARTONICKA);

- 14 **Znojmo**, Janáčkova street, ca. 48°51'23"N, 16°03'41"E, 290 m a. s. l., 8 March 2018, an adult female found on the street (Fig. 9; leg. A. JORDÁNOVÁ, det. A. REITER);
- 15 **Znojmo**, Žižkovo náměstí, 48°51'35"N, 16°03'13"E, 290 m a. s. l., 8 March 2018, an adult male found exhausted on the street (leg. BRADOVÁ, det. A. REITER);
- 16 **České Budějovice**, ca. 48°59'N, 14°27'E, ca. 400 m a. s. l., 1 July 2018, an adult male brought by local people to the animal rescue centre in the Ohrada Zoo at Hluboká nad Vltavou (leg. M. JARIABKOVÁ, det. R. LUČAN);
- 17 **Znojmo**, Náměstí Republiky, 48°51'10"N, 16°03'07"E, 290 m a. s. l., 29 August 2018, an adult male, an adult post-lactating female, and a juvenile female found in a room on the third floor of a house (leg. & det. A. REITER);
- 18 **Znojmo**, Náměstí Republiky, 48°51'10"N, 16°03'07"E, 290 m a. s. l., 3 September 2018, a juvenile female found in a room on the third floor of a house (leg. & det. A. REITER);
- 19 **Znojmo**, 17. listopadu 37, 48°51'14"N, 16°03'29"E, 290 m a. s. l., 2 January 2019, an adult male found exhausted and injured at the entrance to a house (leg. HANKOVÁ, det. A. REITER);
- 20 **Znojmo**, Palliardiho 53, 48°51'40"N, 16°03'20"E, 290 m a. s. l., 23 August 2019, a colony of 30 inds. (an adult female, two juvenile males and five juvenile females examined) in a dilatation fissure of a house (Fig. 10; leg. & det. A. REITER); according to an information from the inhabitants the bats were present there for the whole summer;
- 21 **Znojmo**, Sokolská 8, 48°51'36"N, 16°03'02"E, 290 m a. s. l., 7 November 2019, a subadult male found stacked between windows (leg. MALENOVÁ, det. A. REITER);
- 22 **Děčín**, 50°46'34"N, 14°12'22"E, 125 m a. s. l., 18 May – 9 September 2019, social calls in numerous recordings obtained from a batcorder installed at the Labe river (Fig. 16; det. T. BARTONIČKA);

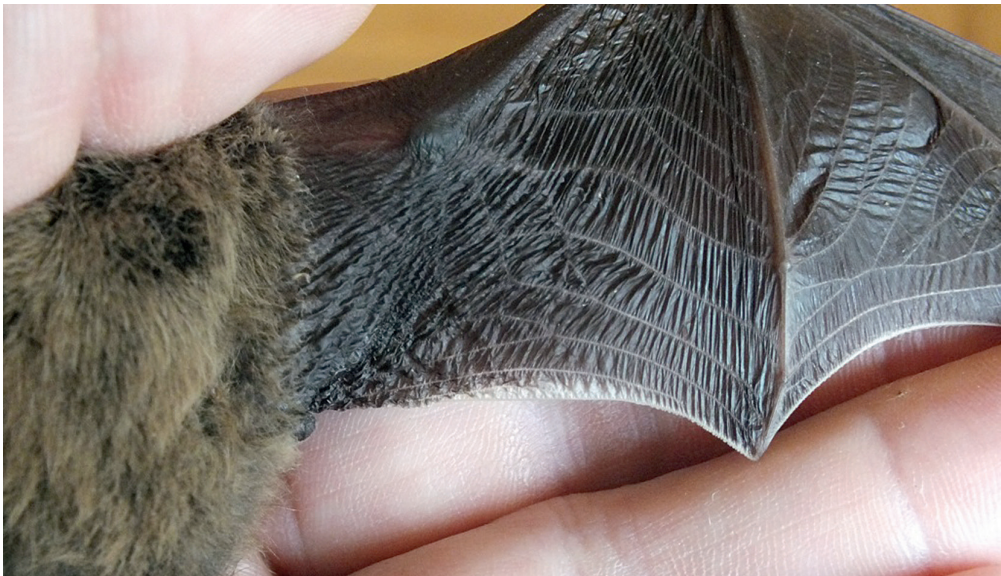


Fig. 3. Dorsal view of the wing membrane and pelage colouration of an adult male of *Pipistrellus kuhlii* found in Olomouc, central Moravia, on 6 September 2014. Photo by E. TOŠENOVSKÝ.
 Obr. 3. Dorsální pohled na létací blánu a barvu srsti u adultního samce *Pipistrellus kuhlii* nalezeného 6. 9. 2014 v Olomouci. Foto E. TOŠENOVSKÝ.



Figs. 4, 5. General appearance and colouration of penis in an adult male of *Pipistrellus kuhlii* found at Derflice, southern Moravia, on 4 October 2014 . Photo by A. REITER.

Obr. 4, 5. Celkový vzhled a zbarvení pyje samce *Pipistrellus kuhlii* nalezeného 4. 10. 2014 v Derflicích. Foto A. REITER.

23 **Břeclav**, 48°45'55"N, 16°53'15"E, 155 m a. s. l., 31 May 2020, an adult female (Fig. 11) with no signs of pregnancy mist-netted along with 20 inds. of *Myotis daubentonii* (Kuhl, 1817) above the Dyje river in the town centre (leg. & det. R. LUČAN & A. LUČANOVÁ);

24 **Praha**, crossing of the Viničná and Kateřinská streets, 50°04'26"N, 14°25'27"E, 225 m a. s. l., 12 June 2020, an adult female with no signs of reproduction found dead on the street (leg. & det. I. HORÁČEK);



Fig. 6. General appearance of an adult female of *Pipistrellus kuhlii* found in Znojmo, southern Moravia, on 10 December 2014. Photo by A. REITER.

Obr. 6. Vzhled adultní samice *Pipistrellus kuhlii* nalezené 10. 12. 2014 ve Znojmě. Foto A. REITER.

Table 1. Forearm lengths (in millimetres) and body weights (in grams) of the examined individuals of *Pipistrellus kuhlii* from the Czech Republic (2007–2020); mean±standard deviation (value range)

Tab. 1. Délka předloktí (v milimetrech) a hmotnost (v gramech) zkoumaných jedinců *Pipistrellus kuhlii* z České republiky (2007–2020); průměr±směrodatná odchylka (rozmezí hodnot)

sex, age pohlaví, věk	forearm length / délka předloktí		weight / hmotnost	
♂♂ juv (n=3)	34.33±0.76	(33.8–35.2)	5.9±0.20	(5.7–6.1)
♀♀ juv (n=10)	34.93±0.92	(33.5–37.0)	6.25±0.48	(5.5–7.0)
♂♂ ad (n=9)	34.66±0.62	(33.6–35.6)	6.06±0.72	(5.1–6.9)
♀♀ ad (n=17)	34.76±0.64	(33.5–36.2)	6.75±0.73	(5.0–8.2)
all / všichni (n=39)	34.75±0.71	(33.5–37.0)	6.40±0.71	(5.0–8.2)

25 **Ludslavice** 25, 49°18'01"N, 17°32'23"E, 211 m a. s. l., 14 August 2020, a maternity colony of 45 inds. found in a fissure behind wooden cladding of a two-storey family house (Fig. 12); four adult post-lactating females, a lactating female (Fig. 13), four adult males (Fig. 14), eight juvenile volant females and three juvenile volant males examined (Fig. 15; leg. & det. J. CHYTL & R. LUČAN).

All examined individuals showed the characters of *Pipistrellus kuhlii kuhlii* sensu SACHANOWICZ et al. (2017), they had a grayish brown pelage, the face was brown to pinkish but without prominent orange colouration, white margins on the plagiopatagia were rather narrow, ca. 1–2 mm wide, the penes were pinkish (not orange). Forearm lengths and body weights for 39 examined bats are given in Table 1.

DISCUSSION

Despite a relatively small number of the records, it is quite obvious that *Pipistrellus kuhlii* colonized a major part of the Czech Republic during 14 years since its first record in 2007. All but one record were made in the lowland areas (mean elevation: 268 m a. s. l., range 125–600 m)



Figs. 7, 8. General appearance and wing membrane colouration of a male of *Pipistrellus kuhlii* found in Brno, southern Moravia, on 15 November 2015. Photo by P. ŠRÁMEK.

Obr. 7, 8. Celkový vzhled jedince a zbarvení létací blány samce *Pipistrellus kuhlii* nalezeného 15. 11. 2015 v Brně. Foto P. ŠRÁMEK.



Fig. 9. General appearance of an adult female of *Pipistrellus kuhlii* found in Znojmo, southern Moravia, on 3 March 2014. Photo by A. REITER.

Obr. 9. Celkový vzhled adultní samice *Pipistrellus kuhlii* nalezené 8. 3. 2018 ve Znojmě. Foto A. REITER.

and in a close vicinity of large rivers. Thus, we hypothesize that the rivers played a certain role as corridors for spreading of this species. In accordance with our hypothesis, spreading along big rivers was suggested in other countries too (e.g. Austria – SPITZENBERGER & BAUER 2001, Russia – SMIRNOV & VEHNÍK 2011). Regarding the locations and chronology of the records it seems that the eastern part of the Czech Republic (Moravia) was colonized from the south along the Dyje and Morava rivers (from Austria), while in Bohemia, two possible routes may be considered: one from the south along the Vltava river from the Danube valley (Austria) as can be suggested from the records 12 and 6, and the other from the east or south-east along the valley of the Svitava and Orlice rivers. Both colonization routes have already been suggested for spreading or vagrancy of other southern and thermophilous faunal elements, including bats such as *Rhinolophus ferrumequinum* (Schreber, 1774) or *Myotis emarginatus* (Geoffroy, 1806), see BENDA & HANÁK (2003) and ČERVENÝ et al. (2006). Given the fact that already in 2018 the presence of *P. kuhlii* was confirmed in Saxony (SCHUBERT et al. 2019), which predated the species confirmation in north-western Bohemia (record 22) and central Bohemia (record 24), we do not exclude possible existence of a third colonization route along the Labe river from the north-west (Germany).

It is quite interesting that a very similar range expansion in roughly the same time period and geographical area was observed in another Mediterranean vespertilionid bat, the Savi's pipistrelle, *Hypsugo savii* (Bonaparte, 1837), see UHRIN et al. (2016). In the Czech Republic, the latter species was recorded for the first time in 2001 (GAISLER 2001) and soon established reproducing populations in southern Moravia (BARTONIČKA & KAŇUCH 2006) from where it

most probably moved over the Českomoravská vrchovina Highlands to Bohemia (REITER et al. 2010, JAHELKOVÁ et al. 2014). It took both species almost the same time (12 years in *H. savii* and 13 years in *P. kuhlii*) to be recorded for the first time in the capital of the Czech Republic (Prague, central Bohemia) after their first records in southern Moravia. This may be the result of a remarkable random coincidence or, alternatively, an evidence of a similar rate of spreading resulting from quite similar ecology of both species in some ways, e.g. synurbic life style and reproductive potential (both species regularly raise two youngs, which is otherwise rare in most vespertilionid bats in the region except for representatives of the genera *Pipistrellus*, *Nyctalus*, *Hypsugo*, and *Vespertilio* – cf. BOGDANOWICZ 2004, HORÁČEK & BENDA 2004).

The range expansion of *Pipistrellus kuhlii* in Europe has been completely linked with strict use of anthropogenic structures for roosting. The species' adaptability to human settlements, including frequent foraging at street lamps, has been suggested as an important factor standing behind its current range expansion, although the major driver of it is most probably the climate change (ANCILLOTTO et al. 2016). The situation in the Czech Republic is not an exception as all the records come from human settlements and 21 of 25 records were made in towns and cities with $\geq 25,000$ inhabitants.

Direct evidence of reproduction was proved by findings of maternity colonies in Znojmo (record 20) and Ludslavice (record 25), a pregnant female in Brno (record 3) and a non-volant juvenile in Znojmo (record 4). Although no evidence of reproduction has been registered in Bohemia (i.e. the western part of the Czech Republic), records of both sexes and occurrence in both hibernation and reproductive seasons indicate possible reproduction there.



Fig. 10. Location of the roost (indicated by an arrow) of a maternity colony of ca. 30 individuals of *Pipistrellus kuhlii* found in Znojmo, southern Moravia, on 23 August 2019. Photo by A. REITER.

Obr. 10. Umístění úkrytu (upřesněno šipkou) mateřské kolonie cca 30 jedinců *Pipistrellus kuhlii* nalezené 23. 8. 2019 ve Znojmě. Foto A. REITER.



Fig. 11. General appearance (ventral view) of an adult female of *Pipistrellus kuhlii* captured in Břeclav, southern Moravia, on 31 May 2020. Photo by R. LUČAN.

Obr. 11. Celkový vzhled (ventrální pohled) dospělé samice *Pipistrellus kuhlii* odchytené 31. 5. 2020 v Břeclavi. Foto R. LUČAN.

Similarly to *Pipistrellus pipistrellus* (Schreber, 1774), the Kuhl's pipistrelle has been found to occasionally invade buildings in late summer, typically admixed to groups of *P. pipistrellus* and/or *P. pygmaeus* (Leach, 1825), see NUSOVÁ et al. (2019). Findings of several individuals in the same room of a building in late summer in Znojmo (records 17 and 18) suggest this type of behavior may occur also in the Czech Republic and should motivate researchers for careful examination of bats at the sites where such invasions have been frequent, whenever possible.

All examined individuals displayed the pelage and skin colouration pattern typical of *Pipistrellus kuhlii kuhlii* sensu SACHANOWICZ et al. (2017), i.e. they were rather dark-faced with no prominent orange colouration of skin on face and around genitals and with only a narrow white margin on plagiopatagium. The mean forearm length and body mass in the examined individuals was lower than reported for *P. k. lepidus* from the European part of its range (SACHANOWICZ et al. 2017), but slightly higher than those reported for south-western Europe by BOGDANOWICZ (2004). We argue that this slight difference might arise from a relatively small number of examined individuals rather than from any other reason.

In conclusion, although the number of reliable records is not too high, their geographic distribution along with the species adaptation to synurbic life-style suggest that *P. kuhlii* regularly occurs in a significant part of the Czech Republic. Some evidence inferred from echolocation data gathered in various parts of the country, not shown in this study due to their limitation for the 100% certainty of species identification (see e.g. discussion in SCHUBERT et al. 2019), suggests that *P. kuhlii* may already be widespread in several regions, particularly in southern and

central Moravia and in the lowlands surrounding the Labe river in the eastern and western part of the country, respectively (R. LUČAN & T. BARTONIČKA pers. obs.). Last but not least, given its presence in the surrounding countries (Poland, Germany), in the areas lying further north, the territory of the Czech Republic became a region lying well within the European distribution range of *P. kuhlii*.

SOUHRN

Spisek shrnuje současný stav rozšíření netopýra vroubeného (*Pipistrellus kuhlii*) v České republice známý ke konci roku 2020. Na základě 25 záznamů minimálně 102 jedinců je zřejmé, že během 14 let od prvního záznamu ve Znojmě na jižní Moravě tento druh postupně kolonizoval většinu území České republiky,



Figs. 12–15. Location of the roost of a maternity colony of 45 individuals of *Pipistrellus kuhlii* (12, indicated by an arrow), general appearance of one lactating female (13), adult male (14) and juvenile male (15) inspected at Ludslavice on 14 August 2020. Photo by L. RUBÁČOVÁ (12) & R. LUČAN (13–15).
Obr. 12–15. Umístění úkrytu mateřské kolonie 45 jedinců *Pipistrellus kuhlii* (obr. 12, označeno šipkou), celkový vzhled jedné kojící samice (13), dospělého samce (14) a juvenilního samce (15) kontrolovaných 14. 8. 2020 v Ludslavicích. Foto L. RUBÁČOVÁ (12) & R. LUČAN (13–15).

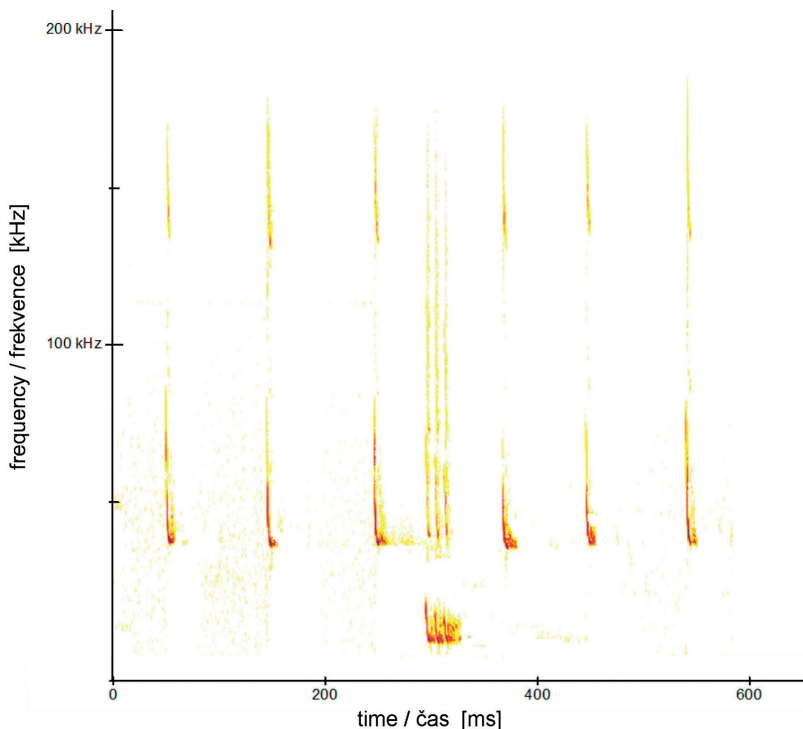


Fig. 16. An example of one of many recordings of echolocation and social calls of *Pipistrellus kuhlii* from a batcorder installed above the Labe river in Děčín, northern Bohemia, in 2019 (record 22). Kuhl's pipistrelles produced echolocation calls peaked at 38–40 kHz and social calls peaked at 17 kHz with three components.

Fig. 16. Ukázka jedné z mnoha nahrávek echolokačních a sociálních signálů *Pipistrellus kuhlii* z automatického detektoru umístěného nad korytem řeky Labe v Děčíně v roce 2019 (nálezy 22). Netopýři vroubení vysílali echolokační signály s vrcholovou frekvencí 38–40 kHz a sociální signály se třemi komponentami s maximální intenzitou 17 kHz.

přičemž všechny nálezy pocházejí z lidských sídel, většinou středně velkých a větších měst. S výjimkou jednoho nálezu jde o lokality v nížinných oblastech v těsné blízkosti velkých řek, které mohly sloužit jako koridory pro expansi druhu do nových oblastí. Ta probíhala pravděpodobně ze dvou různých směrů – na jihovýchodě ČR podél řek Moravy, Dyje a Svitavy moravskými úvaly a dále směrem do východních Čech nejspíše údolím řeky Orlice, v Čechách pak od jihu nejspíše z údolí Dunaje v Rakousku podél Vltavy. V souvislosti s potvrzením přítomnosti netopýra vroubeného v Sasku (Dražďany) přímo u řeky Labe, které časově předcházelo potvrzení pravidelného výskytu v severozápadních Čechách u Labe v Děčíně, nevylučujeme ani možnost kolonizace území Čech od severozápadu podél řeky Labe z Německa. Sezónní rozložení nálezů ukazuje na celoroční výskyt na území ČR, včetně dokladů o rozmnožování (a dokonce dvou nálezů úkrytů mateřských kolonií) a zimování. Všechny zkoumané exempláře odpovídaly zbarvením srsti a rozsahem světlých lemů křídelních blan poddruhu *P. kuhlii kuhlii* sensu SACHANOWICZ et al. (2017), tedy formě běžné v jižní a západní Evropě.

Acknowledgements

We are grateful to Anna LUČANOVÁ and Jakub JUDA for the help in the field, Jiří ŠAFÁŘ, Petr ŠRÁMEK and Evžen TOŠENOVSKÝ for providing additional information and photo documentation to their published data and to Ondřej HÁJEK for creating the map figure. The project was supported by the research grant 260571/2020 from Charles University and by the Charles University Research Centre program No. 204069.

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