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THE FIRST RECORD OF A MATERNITY COLONY OF KUHL'S PIPISTRELLE *PIPISTRELLUS KUHLII* (CHIROPTERA) IN POLAND

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bats, maternity colony, range expansion, *Pipistrellus k. kuhlii*

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Abstract

For four decades, there have been changes in the ranges of many bat species in Europe, particularly shifts in their northern limits. This phenomenon is more spectacular for migratory species than sedentary ones, especially for representatives of the genera *Pipistrellus* and *Hypsugo*. Kuhl's pipistrelle *Pipistrellus kuhlii* (Kuhl, 1817) is the one of western Palaearctic bat species with conspicuous range expansion—in the last three decades, the species has rapidly expanded and colonised new territories both northwards and westwards. In Central Europe, two genetic lineages occur that are also quite different morphologically: *P. kuhlii kuhlii* (hereafter *P. kuhlii*) and *P. kuhlii lepidus* (hereafter *P. lepidus*). The contact zone between these two lineages passes through Hungary and Slovakia, although the real range of distinct lineages and/or morphotypes are still unclear. The first records of *P. kuhlii* from Poland (probably belonging to *P. lepidus*) come from Warszawa, central Poland (2004) and Zawiercie, southern Poland (2005): both specimens were males, found in December in buildings. Since then, there have been further reports of the presence of this species in Poland—occurring mostly in large cities along the valleys of large rivers such as the Wisła and Bug, from both periods of activity and hibernation. In subsequent years in Poland the occurrence of only *P. lepidus* has been confirmed, while *P. kuhlii* has been recorded from southern locations in the Carpathian Mountains in Slovakia. This paper describes the first record of this species from Poland, further indicating the existence of a maternity colony. In mid-July of 2020, a non-volant juvenile male was found in Kraków, Krowodrza district (50°04'11.7" N, 19°54'55.9" E). Initially poorly visible diagnostic features have become unambiguous with development and similar to those in *P. kuhlii*: narrow pale wing margin and orange penis colouration. After about two months in captivity, a mature individual capable of flying was released at the site where it was found. The presence of a maternity colony indicates that this species (i) has been part of the Polish fauna for several years, and (ii) its range in Poland possibly expands much further north.

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Перша реєстрація материнської колонії нетопира білосмугого *Pipistrellus kuhlii* (Chiroptera) у Польщі

Томаш Постава, Анна Мархевка

Резюме. За чотири десятиліття в Європі відбулися зміни в ареалах багатьох видів кажанів, особливо на їхніх північних межах. Це явище особливо вражає у випадку мігруючих видів, ніж осілих, особливо у представників родів *Pipistrellus* і *Hypsugo*. Нетопир білосмугий *Pipistrellus kuhlii* (Kuhl, 1817) є одним із видів кажанів західної Палеарктики з виразним розширенням ареалу — за останні три десятиліття цей вид швидко розширився та колонізував нові території як на північ, так і на захід. У Центральній Європі зустрічаються дві генетичні лінії, які також досить різні морфологічно: *P. kuhlii kuhlii* (далі *P. kuhlii*) і *P. kuhlii lepidus* (далі *P. lepidus*). Зона контакту цих двох ліній проходить через Угорщину та Словаччину, однак реальні ареали різних родинних ліній та/або морфотипів досі неясні. Перші згадки про *P. kuhlii* з Польщі (ймовірно, належні до *P. lepidus*), походять із Варшави, що в Центральній Польщі (2004), та Заверця, у Південній Польщі (2005): обидва екземпляри були самцями, знайденими в грудні у будівлях. Відтоді з'явилися нові повідомлення про присутність цього виду в Польщі — здебільшого у великих містах уздовж долин великих річок, таких як Вісла та Буг, з обох періодів їхнього життя — активного та зимосплячого. У наступні роки в Польщі підтверджено наявність лише *P. lepidus*, тоді як *P. kuhlii* був зафіксований з більш південних місць — у Карпатах у Словаччині. У цій статті описується перша знахідка цього виду з Польщі, яка додатково вказує на існування материнської (розродчої) колонії. У середині липня 2020 р. в Кракові, район Кроводжа (50°04'11.7"N 19°54'55.9"E) виявили нелітаючого ювенільного самця. Спочатку погано виразні діагностичні ознаки стали з ростом однозначно такими як ознаки *P. kuhlii*: вузький блідий край крил і помаранчеве забарвлення пеніса. Приблизно після двох місяців перебування у неволі цілком здатна до польоту особина була випущена на тому місці, де її знайшли. Наявність материнської колонії вказує на те, що цей вид: 1) є частиною польської фауни протягом кількох років, 2) що, можливо, його ареал у Польщі простягається значно далі на північ.

Ключові слова: кажани, материнська колонія, розширення ареалу, *Pipistrellus k. kuhlii*.

Introduction

Over the last 20 years, there has been a significant change in the ranges of many bat species in Europe, and the shifting of the northern limits of the ranges is particularly evident (Ancillotto *et al.* 2016). Range changes among sedentary species are rather small, while for migratory species they are much more spectacular probably due to their wide thermal tolerance [Ancillotto *et al.* 2018]. In some cases, migrations far beyond the previously known range are recorded [Zagorodniuk 2019]. For the Mediterranean bat fauna, the natural northern limit of occurrence was assumed to extend to the Outer Western and Eastern Carpathians.

The first species found outside its recognised range was the greater horseshoe bat *Rhinolophus ferrumequinum* (Schreber, 1774). Originally recorded in 1962 [Harmata & Wojtusiak 1963], followed by two findings in 1992 [Labocha & Postawa 1992; Mleczek 1992], and since then regularly wintering in the Łokietka cave (Ojców National Park [Grzywiński *et al.* 2020]), with potential breeding observed in 2003 in Beskidy Mts. [Szkudlarek *et al.* 2003] and in 2005 close to Ojców National Park [Kohyt & Postawa 2007]. The second species is the common bent-wing bat *Miniopterus schreibersii* (Kuhl, 1817), whose northerly site for this part of Europe was known from the Pieniny Mountains (Aksamitka cave, Slovakia) [Cel'uch 2014]. This species has been regularly recorded since 2015 in Rożnow Castle (Rożnowskie Foothills, Western Carpathians) during swarming and single individuals have also been recorded during hibernation [Piksa & Gubała 2021].

Both bat species belong to the so-called cave species group—they are found underground at least during part of their phenological cycle, so their observations are relatively easy and repeatable. Much more accidental findings concern species from genera that regularly migrate: *Pipistrellus*, *Hypsugo*, or *Nyctalus*. So far, of this group, only rare information on Savi's pipistrelle *Hypsugo savii* (Bonaparte, 1837) was noted from a location in southern Poland [Uhrin *et al.* 2016].

Considerably more widespread among them is Kuhl's pipistrelle *Pipistrellus kuhlii* (Kuhl, 1817), which is already known from eastern, southern and central Poland [Sachanowicz *et al.* 2017; Piskorski & Sachanowicz 2021].

Kuhl's pipistrelle *Pipistrellus kuhlii* sensu lato has a wide range that covers the entire Mediterranean basin both of Europe and Africa, extends through Asia Minor to Pakistan and northwards across the Caucasus to the Eurasian steppe [Juste & Paunovic 2016]. The species *P. kuhlii* is not homeogenic and several morphological and genetic forms with still unclear taxonomic status were described (see: [Andriollo *et al.* 2015; Sachanowicz *et al.* 2017]).

In Europe, three distinct lineages have been found: the western morphotypes (i) *P. kuhlii* sensu lato and (ii) *P. k. kuhlii*—reside throughout the Mediterranean basin; and the eastern morphotype (iii) *P. k. lepidus*—found mostly in Eastern Europe and Central Asia [Andriollo *et al.* 2015; Sachanowicz *et al.* 2017]. The eastern population of *P. kuhlii* (probably the lineage of *P. k. lepidus*), originally inhabited the dry zone of Central Asia [Strelkov et al. 1985; Strelkov & Il'in 1990] and the Southern Caucasus [Strelkov *et al.* 1985]. Until the end of the 1990s, the species' range expanded throughout/across the entirety of Ukraine [Kondratenko 1990; Zagorodniuk 2019], Belarus [Shpak & Larchenko 2016] and in European Russia [Prylutska & Vlaschenko 2013]. Therefore, this species has shown an extraordinary range expansion over the last 40 years, with the gradual appearance of overwintering populations [Hukov *et al.* 2020].

Both subspecies—*P. k. kuhlii* and *P. k. lepidus* (hereafter *P. kuhlii* and *P. lepidus*)—are sympatric and their current ranges overlap in eastern Slovakia and Hungary [Sachanowicz *et al.* 2017]. Until now, only *P. lepidus* has been found in Poland, and it indicates the presence of a sedentary population: single findings are either from hibernation (Puławy, Zawiercie) or breeding (eastern Poland) [Sachanowicz *et al*. 2006; Sachanowicz *et al.* 2017].

Material and Methods

During the chiropterological intervention, according to personal contact with the finder, a flightless bat was found that had left the maternity colony too early (probably due to overheating of the colony location: temperatures reached 30°C in those days). The juvenile male was found in Kraków, in the Krowodrza district (26.07.2020, Chocimska Street, 50°04'11.7" N, 19°54'55.9" E). The neighbourhood is built up with four- to six-storey blocks of flats, with a relatively high density of trees (small city parks, etc.). The bat was severely dehydrated and weakened, was fed and kept in conditions imitating natural conditions: a wooden bat box. It was initially fed with cat food (KiteKat Junior) and then its diet was gradually changed to *Tenebrio molitor* larvae. After two weeks, it started to fly autonomously. The bat (former name: Zeus) was released at the finding site in the second half of September. This allowed us to observe the final colouration features important for species diagnostics and to trace the formation of these features during growth and development, in particular the formation of a white stripe along the edge of the wing membrane.

Photographs were taken during the period of growth of the animal. According to Sachanowicz *et al.* [2017], three features were selected for species diagnostic: snout colouration, penis shape and colouration, and size of margin wing pale (Fig. 1, *a*–*c*). The distribution analysis was based on a map produced using data from various published sources mentioned above. The mapping data are shown in Figure 2.

Results and Discussion

Morphology. Diagnostic features were initially poorly visible and did not allow for species identification. Based on external morphology, those two morphotypes—*P. kuhlii* and *P. lepidus*—are clearly differentiated by body and penis colouration and the pale wing margin extent [Sachanowicz *et al.* 2017]. Around the middle of August, the white edge of the wings became clearly visible and enlarged to 1–2 mm wide (Fig. 1, *c*). The snout and ears were dark, with no bright orange and yellowish patterns (Fig. 1, *a*). The penis had pinkish-brown colouration (Fig. 1, *b*). These external features are fully consistent with those of *P. kuhlii* described by Sachanowicz *et al.* [2017].

Distribution. The presence of single individuals, especially found in spring and autumn, may indicate a migratory population. A sedentary population, on the other hand, is indicated by the presence of juveniles (confirmation of breeding) or overwintering individuals. According this assumption, our findings are the first record of *P. kuhlii* maternity colony in Poland.

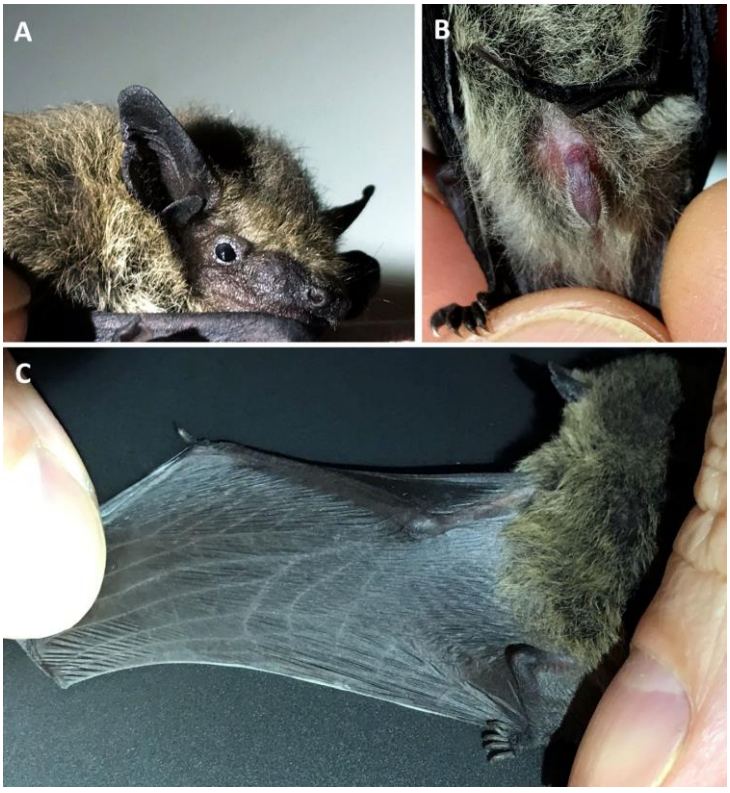

Fig. 1. Kuhl's pipistrelle *Pipistrellus kuhlii* (Zeus): snout (*a*), penis (*b*), and narrow margin of wing pale (*c*) (photo taken at 14.08.2020).

Рис. 1. Нетопир білосмугий *Pipistrellus kuhlii* (Зевс): морда (*a*), пеніс (*b*) та вузька крайова смуга крилової підласості (*c*) (фото 14.08.2020).

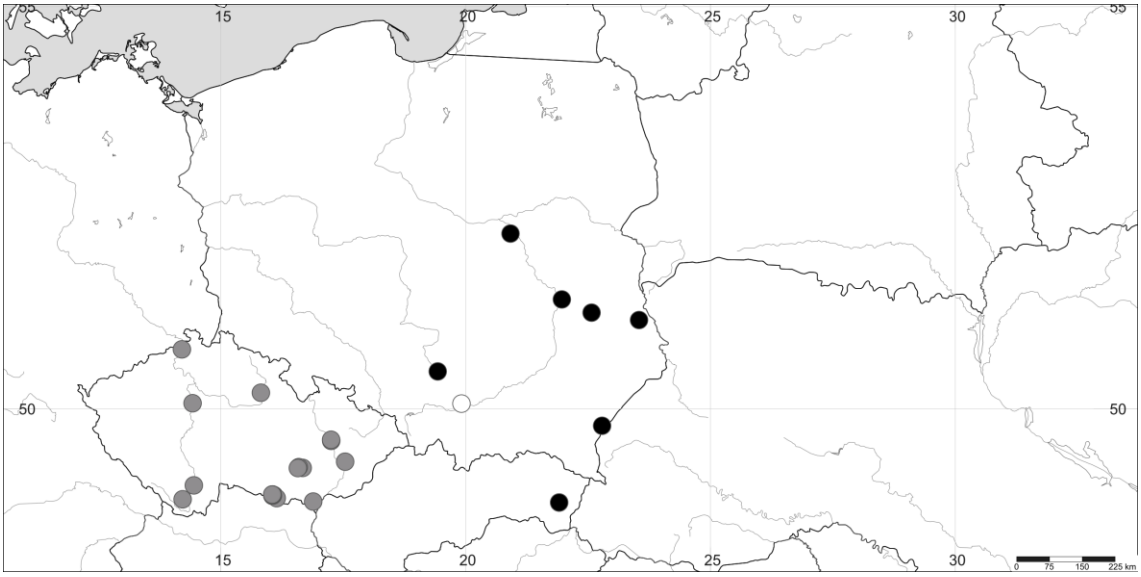

Fig. 2. Distribution of locations of *Pipistrellus lepidus* (black circles), *P. kuhlii* (white circles), and *P. kuhlii* sensu lato (grey circles) (after: [Cel'uch & Ševčík 2006; Sachanowicz et al. 2017; Lučan *et al.* 2020]).

Рис. 2. Розміщення місцезнаходжень *Pipistrellus lepidus* (чорні кола), *P. kuhlii* (білі кола) та *P. kuhlii* sensu lato (сірі кола) (за: [Cel'uch & Ševčík 2006; Sachanowicz et al. 2017; Lučan *et al.* 2020]).

To date, all individuals of *P. kuhlii* recorded from Poland concern specimens recognised as *P. lepidus*: in contrast to our finding, they were characterised by a broad, pale wing margin.

The nearest location for this species come from Zawiercie, 60 km to the north-west [Sachanowicz *et al.* 2006], followed by Puławy, 205 km to the north-east [Sachanowicz *et al.* 2017] and Warsaw, 255 km [Popczyk *et al.* 2008]. Currently, mating calls identified as those of *P. kuhlii*, were recorded from south-eastern Poland (Carpathians, Roztocze) [Piskorski & Sachanowicz 2021], although without morphological improvement.

Therefore, our findings are the first and, for the time being, the only certain record of the breeding of this species in Poland. Unexpectedly, this specimen belongs to *P. kuhlii*—the lineage occurring in western and southern Europe [Ancillotto *et al.* 2016; Sachanowicz *et al.* 2017]. Earlier finds come from the Carpathians and south of the Carpathians [Ceľuch & Ševčík 2006] and Sudetes [Lučan *et al.* 2020]. It should be noted, however, that identification is often restricted to *P. kuhlii* sensu lato, thus the real range of particular lineages and/or morphotypes is still unclear.

The range east of the Carpathians (Podolia plain, Ukraine) needs to be revised, especially as both species are also recorded in the Carpathians in Romania [Barti 2010]. The Mediterranean bat species differ both in their range and in their rate of migration: *R. ferrumequinum* and *M. schreibersii*, as species closely associated with the undergrounds, restrict their distribution to the southern edge of Poland [Ruprecht *et al.* 2008; Piksa & Gubała 2021], while the *Pipistrellus* species—as bat species independent from caves—seem to occupy new areas along the valleys of large rivers, as it was suggested by Zagorodniuk [2019].

References

Andriollo, T., Y. Naciri, M. Ruedi. 2015. Two mitochondrial barcodes for one biological species: the case of European Kuhl's pipistrelles (Chiroptera). *PLoS ONE*, **10** (8): e0134881. CrossRef

Ancillotto, L., L. Santini, N. Ranc, L. Maiorano, D. Russo. 2016. Extraordinary range expansion in a common bat: the potential roles of climate change and urbanisation. *Science of Nature*, **103** (15): 1–8. CrossRef

Ancillotto, T., I. Budinski, V. Nardone, I. Di Salvoa, M. Della Corte, L. Bosso, P. Conti, D. Russo. 2018. What is driving range expansion in a common bat? Hints from thermoregulation and habitat selection. *Behavioural Processes*, **15**: 540–546. CrossRef

Barti, L. 2010. First record of Pipistrellus kuhlii (Chiroptera: Vespertlionidae) from Transylvania and a morphological approach to the lepidus taxon. *Acta Siculica*, 2010: 155–168.

Cel'uch, M. 2014. Return of Miniopterus schreibersii to the northern edge of its historical distribution in Slovakia. *Vespertilio*, **17**: 59–63.

Cel'uch, M., M. Ševčík. 2006. First record of Pipistrellus kuhlii (Chiroptera) from Slovakia. *Biologia (Bratislava)*, **61**: 637–638. CrossRef

Grzywiński, W., J. Nowak, K. Kozakiewicz. 2020. Bats of Ojców National Park – summary of the state of knowledge. Prądnik. *Prace Muz. Szafera*, **30**: 135–162. [In Polish]

Harmata, W., J. Wojtusiak. 1963. Podkowiec duży, *Rhinolophus ferrum-equinum* Schreber (Chiroptera), nowym ssakiem dla fauny Polski. *Przegląd Zoologiczny*, **7** (2): 154–157.

Hukov, V., O. Timofieieva, A. Prylutska, O. Rodenko, M. Moiseienko, [*et al.*]. 2020: Wintering of an urban bat (Pipistrellus kuhlii lepidus) in recently occupied areas. *European Journal of Ecology*, **6**: 102–120. CrossRef

Juste, J., M. Paunović. 2016. Pipistrellus kuhlii. *The IUCN Red List of Threatened Species.* Retrieved from: https://www.iucnredlist.org/species/17314/22132946

Kohyt, J., T. Postawa. 2007. The first record of Rhinolophus ferrumequinum (Chiroptera: Rhinolophidae) from Poland outside the hibernation period. *Acta zoologica cracoviensa*, **50A** (1–2): 49–51. CrossRef

Kondratenko, O. V. 1999. The first record of Kuhl's pipistrelle (*Pipistrellus kuhlii*) in Luhansk oblast (Eastern Ukraine). *Vestnik zoologii*, **33** (3): 96. [In Ukrainian]

Labocha, M., T. Postawa. 1992. Prawdopodobne stanowisko podkowca dużego Rhinolophus ferrumequinum (Schreber, 1774) w Jaskini Wiernej na Wyżynie Częstochowskiej. *Wszechświat*, **93** (10): 267.

Lučan, R.K., A. Reiter., J. Chytil, I. Horáček, T. Bartonička. 2020. Pipistrellus kuhlii in the Czech Republic: 2007–2020 (Chiroptera: Vespertilionidae). *Lynx, n. s. (Praha)*, **51**: 81–94. CrossRef

Mleczek, T. 1992. Nowe stanowisko podkowca dużego Rhinolophus ferrumequinum Schreber w Beskidach. *Wszechświat*, **93** (12): 318.

Piksa, K., W. J. Gubała. 2021. First record of Miniopterus schreibersii (Chiroptera: Miniopteridae) in Poland—a possible range expansion? *Mammal Research*, **66**: 211–215. CrossRef

Piskorski, M., K. Sachanowicz. 2021. Different songflight calls of Pipistrellus kuhlii and Pipistrellus lepidus (Vespertilionidae, Chiroptera) in Europe. *Journal of Vertebrate Biology*, **71** (21058). CrossRef

Popczyk, B., G. Lesiński, A. Baumann, B. Wojtowicz. 2008. Kuhl's pipistrelle, Pipistrellus kuhlii (Kuhl, 1817) or Pipistrellus lepidus Blyth, 1845, in central Poland—accidental record or a result of expansion? *Nyctalus (N. F.)*, **13**: 279–281.

Prylutska, A. S., A. S. Vlaschenko. 2013. Materials on bat distribution on the base of results of contact-center in Kharkiv (2008–2012). *Biological Systems*, **5** (4): 532–537. [In Russian]

Ruprecht, A.L., Cichocki, J., Szkudlarek, R. 2008. Distribution and morphometry of the greather horseshoe bat Rhinolophus ferrumquinum (Schreber, 1774) in Poland. *Nietoperze*, **9**: 73–77.

Sachanowicz, K., A. Wower, A. Bashta. 2006. Further range extension of Pipistrellus kuhlii (Kuhl, 1817) in Central and Eastern Europe. *Acta Chiropterologica*, (8): 543–548.

CrossRef

Sachanowicz, K., M. Piskorski, A. Tereba. 2017. Systematics and taxonomy of Pipistrellus kuhlii (Kuhl, 1817) in Central Europe and the Balkans. *Zootaxa*, **4306** (1): 053–066. CrossRef

Shpak, A., A. Larchenko. 2016. Range expansion of Kuhl`s pipistrelle (Pipistrellus kuhlii) into Belarus. *Proceedings of the Theriological School*, **14**: 99–102. CrossRef

Strelkov, P. P., V. I. Unkurova, G. A. Medvedeva. 1985. Novye dannye o netopyre Kulâ (Pipistrellus kuhlii) i dinamika ego areala v SSSR [New data on the Kuhl's pipistrelle (Pipistrellus kuhlii) and dynamics of its range in the Soviet Union]. *Zoologičeskij Žurnal*, **64**: 87–97. [In Russian]

Strelkov, P.P., V.Y. Il'in. 1990. The bats (Chiroptera, Vespertionidae) of the south Middle Volga and Lower Volga provinces. *Annals of the Zoological Institute of Academy of Science of USSR*, **225**: 42–167. [In Russian]

Szkudlarek, R., A. Węgiel, Ł. Iwaniuk. 2003. Klasztor w Szczyrzycu — najcenniejszy strych w Polsce [Szczyrzyc Monastery—the most precious attic in Poland]. *Nietoperze*, **4** (2): 175–176.

Uhrin, M, U. Hüttmeir, M. Kipson, P. Estók, K. Sachanowicz, S. [et al.]. 2016. Status of Savi's pipistrelle Hypsugo savii (Chiroptera) and range expansion in Central and south-eastern Europe: a review. *Mammal Review*, **46**: 1–16. CrossRef

Zagorodniuk, I., V. Negoda. 2001. Pipistrelle bats of the genus Pipistrellus and genus Hypsugo. *In:* Zagorodniuk, I. (ed.). *Migration Status of Bats in Ukraine.* Ukr. Theriol. Soc., Kyiv, 65–72. (Series: Novitates Theriologicae; Pars 6). [In Ukrainian] pdf: https://bit.ly/32vsZpI

Zagorodniuk, I. 2019. Range dynamics in sibling species: facts and reconstructions for the mammal fauna of Eastern Europe. *Theriologia Ukrainica*, **18**: 20–39. CrossRef