

NATURAL HISTORY NOTE

Northern record for *Tadarida teniotis* (NE Ukraine) far from known species range

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ABSTRACT

An unexpected record of *Tadarida teniotis* (Rafinesque, 1814) (adult male) was made in Kharkiv city, NE Ukraine. The bat was found in a private flat on the thirteenth floor of a multi-storey building (1970s construction). This new record is much further North than documented from in-hand and acoustic records of this species in the Russian Caucasus - 850 km, Bulgaria - 1200 km, and Crimea - 600 km. Two main interpretations of this record are presented: (i) it represents a species range expansion due to urbanization and climate warming, or (ii) an accidental transportation by a vehicle. In either of these circumstances, this species should be included in the bat species list of the Ukraine.

INTRODUCTION

Global climate warming, urbanization, and natural habitat degradation are three main factors affecting biodiversity in a predominantly negative way. However, some volant vertebrates of temperate latitudes (insectivorous birds and bats) that depend on seasonal resources could benefit from increased survival and reproductive success under global warming scenarios (e.g. Radchuk et al. 2019). Among volant vertebrates, bats are much less studied than birds, however, even for them there are still examples of species range expansions which are likely due to climate warming but also in response to urbanization (e.g. Ilyin 2000, Lundy et al. 2010, Godlevska 2015, Sachanowicz et al. 2019). Both of these factors are equally important for driving range expansions of some bat species in the Northern Hemisphere.

The European free-tailed bat, *Tadarida teniotis* (Rafinesque, 1814) has been recorded frequently on the northern margin of its range in the last 20 years (Benda & Horáček 1998, Ciechanowski et al. 2005, Gazaryan & Tembotova 2007, Uhrin et al. 2009, Zagmajster et al. 2015, Milanolo et al. 2017, Pejić et al. 2017, Dundarova et al. 2019, Presetnik & Šalamun 2019). *Tadarida teniotis* is the only species of the predominantly tropical bat family Molossidae to be found in Europe (Benda & Piraccini 2016, Dietz & Kiefer 2016, Amorim et al. 2020). The European range of this species in the western part covers the Iberian Peninsula, the northern Mediterranean up to Switzerland, Northern Italy, and southern Balkans (Benda & Piraccini 2016, Dietz & Kiefer 2016). Further in the east, the species is recorded in Crimea

(Uhrin et al. 2009) and in Russian Caucasus (Gazaryan & Tembotova 2007), and those locations were considered the northern margin of the species range in the east (Benda & Piraccini 2016). The ecomorphological features of this species (fast-flying and aerial hawking of insects at higher altitudes) make it hard to capture using mist-nets. However, the use of species-specific echolocation calls means this species is easily identifiable using ultrasound detectors. Indeed, most of the new records of *T. teniotis* have been made using acoustic identification (Benda & Horáček 1998, Ciechanowski et al. 2005, Uhrin et al. 2009, Zagmajster et al. 2015, Milanolo et al. 2017, Pejić et al. 2017, Presetnik & Šalamun 2019), and only a few include sightings of individuals (Gazaryan & Tembotova 2007, Dundarova et al. 2019).

Tadarida teniotis is a common urban bat species in Spain and Italy that roosts in different kinds of human constructions (Balmori 2007, 2018, Monsalve-Dolz 2014, Russo & Ancillotto 2015). Increasing urbanization over the last 70 years has allowed urban and rural tolerant bat species to expand their ranges (e.g. Sachanowicz et al. 2006, Russo & Ancillotto 2015, Hukov et al. 2020). Do these new records for *T. teniotis* over the last 20 years show species range expansion to the north, or it is just a result of using more advanced acoustic techniques in bat surveys? A similar case may be seen in America where the Molossidae *Tadarida brasiliensis*, a successful urban explorer (e.g. Li & Wilkins 2015) that occupies USA cities, is also showing further range expansion (e.g. McCracken et al. 2018).

Here we present the new record of *T. teniotis* in the north-eastern Ukrainian city - Kharkiv, hundreds of kilometres further north from the present species range, and discuss two main hypotheses of the origin of the specimen.

MATERIALS AND METHODS

The Bat Rehabilitation Centre of Feldman Ecopark (BRC-FE) provides a call-centre which collects information about factual and correspondence records of bats mainly in Kharkiv city, but also throughout the Ukraine (Vlaschenko & Prylutska 2018) and from other countries; BRC-FE staff also provide a rescue service, visiting people who find bats in Kharkiv city.

Bats arriving at the BRC-FE office have their sex, age category, reproductive status, forearm length (accuracy 0.1 mm), and body mass (accuracy 0.1 g) recorded and are subsequently banded according to the protocol described by Vlaschenko et al. 2020. For details of the methods used for age category classification see Kravchenko et al. 2017. Injured individuals are examined by a veterinarian and receive appropriate treatment. Bats which are not capable of flying when they arrive stay at BRC-FE for long-term rehabilitation, all the others are released in the next evening as long as climatic conditions are appropriate.

The BRC-FE works under the general permission of the Kharkiv Oblast Authority of Ecology and Natural Resources.

RESULTS

A record of an adult male *T. teniotis* was obtained 16th June 2020 in Kharkiv city (49,9935° N, 36,2304° E), NE Ukraine. The bat was found in a private flat on the thirteenth floor (nearly 40 metres high) of a forty-year-old multi-storey building (Fig. 1), 2 km from the northern administrative city border, and 6.5 km from the city center. The forearm length of the bat was 61,7 mm and body mass was 24,3 g. The bat had two symmetric wounds on the upper edge of both ears (Fig. 2). There were necrosis zones 2x3(4) mm the same size on both ears, possibly affected by extreme high temperatures. Wing punch samples were collected and preserved in ethanol for future genetic studies.

DISCUSSION

Here we describe the record of *T. teniotis*, Kharkiv city Ukraine, the first in-hand record of a specimen for over a hundred years (last record for Crimea described in 19th century, for details see Uhrin et al. 2009). Further, we discuss this record from the contrasting points of view of two main hypotheses: (i) a case of extraordinary range expansion to the north of this bat species' normal distribution, or (ii) a case of passive transportation of an individual by a vehicle.

The nearest records of *T. teniotis* to Kharkiv city were previously made in Crimea - 600 km (Uhrin et al. 2009), in the Russian Caucasus - 850 km (Gazaryan & Tembotova 2007) and in Bulgaria - 1200 km (Dundarova et al. 2019).

Bats of Ukrainian cities are well studied by bat rehabilitation centres and call-centres in different parts of the



Fig. 1 - The building where *T. teniotis* was found in Kharkiv city, Ukraine.



Fig. 2 - Wounds on the upper edge of *T. teniotis*' ears (picture was taken ten days after the bat was found).

country. Substantial records of bats have been documented for the last 10-15 years (e.g. Godlevska 2012, Prylutska & Vlaschenko 2013, Kravchenko et al. 2017, Panchenko & Godlevska 2018, Hukov et al. 2020) especially in the south, central and eastern parts of the country. The emergence of "new" bat species in additional areas or changes in a species phenology status are also well documented; see cases of *Plecotus austriacus* and *Pipistrellus nathusii* (e.g. Godlevska 2012, Prylutska & Vlaschenko 2013, Zagorodniuk 2019). It was the routine activities of the BRC-FE that were also responsible for recording this individual of *T. teniotis*. The most recent acoustic record of *T. teniotis* for all of the

Ukraine was made in 2009 in Crimea (Uhrin et al. 2009) which restarted the discussion about the presence of this species in Ukraine. However, there were no new records of the species for the next 10 years. It is unlikely that this species already occupied some part of continental Ukraine and was not detected or found by local conservationists. However, the level of acoustic studies in Ukraine is far behind other countries in the European Union, and urban landscapes may be providing increasingly suitable habitats for this species.

The more reasonable explanation for this *T. teniotis* record in Kharkiv is passive transportation of this individual by a vehicle. There are many examples of accidental long-distance movement of bats by human transport, between countries (e.g. Smirnov & Vehnik 2011) but also between continents and overseas (e.g. Constantine 2003, Hutterer et al. 2005, Ahlén et al. 2009, Petersen et al. 2014, Rydell et al. 2014, Lohi 2015, Hüppop & Hill 2016). The low body mass of an individual from Kharkiv (compared to normal range, Dietz & Kiefer 2016), and wounds on the bat's ears, might support the hypothesis of passive transportation. The wounds could have resulted from burns if the bat was sitting under a working engine. This version could explain the symmetric position of the wounds on the upper edges of its ears. However, the date of the record was at the end of COVID-19 quarantine lockdown with few international movements and international airport in Kharkiv closure. As an additional explanation of this *T. teniotis* record in Kharkiv city, we suggest disorientation of the individual in high altitudes and its passive transportation by air currents.

Finally, under any of the circumstances, this species should to be included in the bat species list of Ukraine, as an in-hand record verifies previous acoustic records of *T. teniotis* in Crimea in 2009. However, in our opinion *T. teniotis* cannot be included in the bat species list of the Kharkiv region based on this single record.

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