

## BAT (CHIROPTERA) RECORDS FROM THE INFERIOR MEADOW OF THE CRIȘUL REPEDE RIVER NATURAL PROTECTED AREA, WESTERN ROMANIA

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**ABSTRACT.** *The research made with bat detectors in the spring of 2012 in the Inferior Meadow of the Crișul Repede River natural protected area had lead to the identification of 19 bat species. Most of them are tolerant, low altitude species, common in human settlements, their presence being expectable both from the ecologic and zoogeographic point of view. However, we registered also unexpected species, namely *Eptesicus nilssonii* and *Myotis alcathoe*. *Pipistrellus kuhlii* was the most common species of the region. Three of the encountered species (*Miniopterus schreibersii*, *Myotis dasycneme* and *M. myotis*) were not mentioned in the protected areas` standard data form, even if they have a high conservative value. Despite of the species richness in the area, many of these are rare, being registered only few times. The region is highly affected by human, being represented by agricultural fields along the Crișul Repede River, with many localities. Thus, in this region the natural shelters for bats are lacking, these sheltering probably in the localities. Moreover, some species could belong to populations from the forests surrounding Oradea city, or to populations from the city, which probably arrived in the region accidentally or for feeding.*

**KEY WORDS:** *bat detector, plain, diversity, distribution, human impact, rare species.*

### INTRODUCTION

Bats are negatively affected by humans in many ways (e.g. Mickleburgh et al. 2002, O'Shea et al. 2016, Fensome & Mathews 2016). For all that in the last period some European species seem to recover after the decline (Van der Meij et al. 2015). Agricultural plain areas are anthropogenically disturbed habitats, in which the presence of bats could be important, they

consuming herbivorous insects (see in: Heim et al. 2015). The number of the bat species and their activity in these zones rise with the amount of the surrounding woodland areas (Heim et al. 2015). Beside of the woodland patches, the existence of some water bodies near the agricultural fields is also important for bats (Kalda et al. 2015). In western Romania there are numerous plain areas used mostly for agriculture, in which, in some protected areas bats were registered in the last years (Szodoray-Paradi & Szodoray-Paradi 2008, Hoffmann & Berei 2012, Hoffmann & Hoffmann-Berei 2014). However, these protected areas even if situated on plains, also include in different percentages woodland areas. On the contrary, the Inferior Meadow of the Crişul Repede River is an agricultural plain which lacks forests. Nevertheless, this is a protected zone, in which, according to the protected areas` standard form only one bat species is present (ROSCI0104 standard Natura 2000 data form). Taking into account that in other protected areas from the Western Plain of Romania the bat fauna diversity proved to be higher than it was previously indicated in the site`s standard form (e.g. Hoffmann & Hoffmann-Berei 2014), and that this group has high conservative value (O.U.G 57/2007), we aimed to establish the real composition of the bat fauna in this region.

## **MATERIAL AND METHODS**

The field research took place in March, April and May of 2012. Eight field trips were organized, one in March (31), two in April (16 and 27) and five in May (4, 11, 18, 25 and 30). The research activity was realized by night, spending with observation between three and ten hours. In the daytime we crossed the zone searching for bat shelters, without any result. For the inventory of the bats from the protected area we used ultrasound detectors. We used the Batcorder 2 for fixed points. Also, we used a heterodyne detector (Pettersson 200 D). For the determination of the registered individuals the BatSound and Bat Species Identification Key (europekey) softwares were used. The field trips included only the bat sounds` detection and registration. We did not try to capture bats with the mist net because of the region`s particularities, which is an extremely affected plain area, with many localities and only few zones, where this activity could be realized.

The Inferior Meadow of the Crişul Repede River natural protected area (ROSCI0104) is situated westward to Oradea town, western Romania. It overlaps with the inferior course of the Crişul Repede River, between Oradea and the border between Romania and Hungary, having approximately 25 km lengths. The protected area is very narrow, usually having only some hundred of meters,

containing the river course, the wet areas from its vicinity, and pastures. The area is situated on the Crişuri Plain (Posea & Badea 1984), a low flat area, at less than 100 m a.s.l., altitude which decreases from east to west. The protected area is extremely affected by human, inside or at the vicinity of the area many rural localities being situated (Sântandrei, Sântion, Palota, Tărian, Girişu de Criş, Toboliu, Cheresig). Due to its localization at plain and the high number of localities, the region is very affected anthropogenically, being mostly transformed in agricultural fields and pastures. The Crişul Repede River is dammed, being surrounded by soil embankments. However, in the area there are ponds formed by the flooding of some former gravel pits. The area lacks forests or any woody vegetation, the only trees being isolated on the river's bank or in localities. For the research four sampling sites were chosen, which are representative for the region and situated relatively spread on the entire surface of the region. The study sites were situated on pastures, close to the localities Sântion, Tărian, Girişu de Criş and Cheresig.

## RESULTS

In the Inferior Meadow of the Crişul Repede River natural protected area we registered using the bat detectors 19168 contacts with individuals belonging to 19 bat species (*Eptesicus nilssonii*, *Eptesicus serotinus*, *Hypsugo savii*, *Miniopterus schreibersii*, *Myotis alcathoe*, *Myotis brandtii*, *Myotis daubentonii*, *Myotis dasycneme*, *Myotis myotis*, *Myotis mystacinus*, *Nyctalus leisleri*, *Nyctalus noctula*, *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *Pipistrellus pipistrellus*, *Pipistrellus pygmaeus*, *Plecotus auritus*, *Rhinolophus ferrumequinum* and *Vespertilio murinus*). Most of the registered contacts could be determined by the softwares to species level, only 2088 contacts were unidentifiable. The most common species of the region, with the most registered contacts, was *Pipistrellus kuhlii* (9892 contacts). The rarest species, with only two registered contacts was *Myotis brandtii*. This was followed by straightly by *Myotis dasycneme* with four contacts, and then by *Rhinolophus ferrumequinum*, with five contacts. Bats were identified in three of the four investigated localities, in Cheresig, Girişu de Criş and Tărian. At Sântion we did not register any bat contact, due to the very windy weather on March 31, date on which we organized our research activity in that locality.

The number of the bat species differs between the three localities they were registered in (Table 1). The percentage abundance of the different

species` contacts also differs (Table 1). The highest species number (17 species) was registered at Girişu de Criş, where the most research nights were spent. In Cheresig 13 bat species were registered, but in Tărian only 10 species, even if in both localities we spent the same number of nights with research. Only seven of the 19 bat species identified in the region were found in all the three investigated localities. Five of the 19 species were registered in only one locality. Few bat species seem to be well represented in the Inferior Meadow of the Crişul Repede River natural protected area. This fact was shown by the number of contacts, in reality only four species summing more than 95 % of the total contacts. On the contrary, five of the 19 species from the region were registered less than ten times.

Table 1. The bat species from the Inferior Meadow of the Crişul Repede River natural protected area and the percentage abundance of their registered contacts.

Species	Cheresig	Girişu de Criş	Tărian	Total
<i>Eptesicus nilssonii</i>	-	0.02	0.66	0.04
<i>Eptesicus serotinus</i>	0.03	0.34	3.31	0.37
<i>Hypsugo savii</i>	1.18	2.64	0.66	2.36
<i>Miniopterus schreibersii</i>	0.38	0.37	0.66	0.38
<i>Myotis alcathoe</i>	0.15	0.12	-	0.12
<i>Myotis brandtii</i>	-	-	0.44	0.01
<i>Myotis daubentonii</i>	-	0.14	-	0.11
<i>Myotis dasycneme</i>	-	0.02	-	0.02
<i>Myotis myotis</i>	0.11	0.02	-	0.04
<i>Myotis mystacinus</i>	0.30	0.09	-	0.12
<i>Nyctalus leisleri</i>	0.03	0.14	0.88	0.15
<i>Nyctalus noctula</i>	6.51	10.80	80.30	11.98
<i>Pipistrellus kuhlii</i>	2.05	70.10	4.42	57.91
<i>Pipistrellus nathusii</i>	19.74	13.88	2.65	14.49
<i>Pipistrellus pipistrellus</i>	68.43	0.49	-	10.91
<i>Pipistrellus pygmaeus</i>	0.57	0.32	-	0.35
<i>Plecotus auritus</i>	0.45	-	-	0.07
<i>Rhinolophus ferrumequinum</i>	-	0.03	-	0.02
<i>Vespertilio murinus</i>	-	0.37	5.97	0.46
Total determined contacts	2623	14005	452	17080
Total undetermined contacts	328	1732	28	2088

## DISCUSSIONS

The bat species registered in the Inferior Meadow of the Crișul Repede River natural protected area are common in Romania (Murariu et al. 2016), being reported recently in other plain areas from the western country (Hoffmann & Berei 2012, Hoffmann & Hoffmann-Berei 2014, Hoffmann et al. 2016). However, we identified three species of which presence seems unexpected considering the previous data in the Romanian scientific literature (Murariu et al. 2016). These species were *E. nilssonii*, *H. savii* and *M. alcathoe*. The last two species, according to the most recent Romanian monograph, are firstly recorded in the Western Plain, even if they are frequent in other regions of the country, but also in eastern Hungary (Murariu et al. 2016). Even if about *H. savii* is considered to populate mountain valleys and alpine pastures, being also recorded in the Carpathians, it was the most often reported in low zones of the eastern country (Murariu et al. 2016). Although in the most recent Romanian monograph it was not mentioned in western Romania (Murariu et al. 2016), this species was recently reported in many points from the region, including Satu Mare and Oradea cities (Uhrin et al. 2016). The last city is situated only at few kilometers from the studied region. *H. savii* is an expansive species, which has extended much its distribution range in the last decades, being favored by human activity and global warming (see in: Uhrin et al. 2016). Thus its presence is not surprising at all. Moreover, many of its newly occupied habitats are situated in cities or artificial habitats, the species being also reported in Oradea (Uhrin et al. 2016), which is a big city neighboring the studied area, so the species' identification in the zone is obvious. Also, in other areas of the Pannonian Plain, *H. savii* was frequently mentioned in strongly anthropogenically affected areas with intensive agriculture (Paunović et al. 2015). *M. alcathoe* was recently reported in Romania (e.g. Jéré & Dóczy, Uhrin et al. 2014), being mentioned until now only in the Carpathian Mountains (Murariu et al. 2016). However, its reports in Hungary (e.g. von Helversen et al. 2001) and from other parts of central and eastern Europe (e.g. Benda et al. 2003), justify its presence also in western Romania.

*E. nilssonii* is a northern species, in central and southern Europe it being present only at high altitudes (e.g. Rydell 1993). In Romania it was mentioned almost exclusively in the Carpathian Mountains (Murariu et al. 2016), being one of the rarest bat species of the country (Uhrin et al. 2014).

Exceptionally, *E. nilssonii* was reported in northern Dobruja and in the Western Plain, in Carei Plain (Murariu et al. 2016). Its recent and surprising discovery in the Carei Plain was integrated in the context of the zoogeographic particularities of the region (Hoffmann & Hoffmann-Berei 2014). Whereas in the Carei Plain these exceptions are frequently observed (e.g. Covaciu-Marcov et al. 2009, Ferenti et al. 2012, Gache 2014, Szatmari 2015), in the inferior meadow of the Crişul Repede river we do now know about the existence of high-altitude related species which are present at plain. The only exception is made by an anthropogenically introduced lizard species (Sas-Kovacs & Sas-Kovacs 2014). We can not exclude that some individuals of this species identified in the Inferior Meadow of the Crişul Repede River could belong to the populations from the hilly areas near Oradea city, which are situated at only 20-30 km east from the studied area, still the number of the contacts being reduced. On the contrary, in the agricultural landscapes in northern Europe *E. nilssonii* is a dominant species (Kalda et al. 2015).

From the point of view of their ecology and habitat requirements, the bat species identified in the region mostly fit to its characteristics. Thus, most of the bat species either are related to anthropogenically affected areas, or are sylvan species, according to the literature (Murariu et al. 2016). As well, most of these species prefer low altitudes. The main exception are *M. schreibersii*, a typically cave dwelling species (Murariu et al. 2016), and also *R. ferrumequinum*. Both of them are rare in the studied region, registering few contacts. According to their requirements, they need subterranean habitats, which to our knowledge are missing from the region. Though, because *M. schreibersii* can hunt at almost 30 km distance of its roosts (Vincent et al. 2011) and also needs watercourses (Russo & Jones 2003), these species probably use this region only for hunting. Subterranean shelters exist only at 20-30 km eastwards from the studied region, in Oradea Hills, which have both natural and artificial underground shelters, including wine cellars. Recently, these two cave dwelling species were identified at the limit of a plain area in western Romania, in a zone with many water bodies, hibernating in a large abandoned cellar (Hoffmann et al. 2016). A similar situation was registered in the Danube floodplain, where *M. schreibersii* hunt in the floodplain, but have roosts in karst areas from the river's right shore (Murariu 2005). Probably the same situation is valid in Oradea area. Likewise, the populations of *R. ferrumequinum* from low altitude areas in Hungary, which have maternal colonies in churches,

move for the winter in subterranean habitats from Slovakia (Bihari 2001). *M. schreibersii* and *R. ferrumequinum* were also reported south-westward of Oradea in the Betfia Pothole (e.g. Bücs et al. 2012).

The most common species of the inferior meadow of the Crişul Repede River is *P. kuhli*, a species considered to be strongly linked to human settlements (Murariu et al. 2016). The species has spread much to the north and east of Europe, expanding its distribution range almost four times, due to the climatic changes and anthropization (Ancillotto et al. 2016). *P. kuhli* seems to prefer urban illuminated areas situated near permanent water sources (Ancillotto et al. 2015, Maxinová et al. 2016). Thus, the species' abundance in a plain area with many human settlements and with an important water course is not surprising.

Although some bat species identified in the Inferior Meadow of the Crişul Repede River natural protected area are considered to be linked to forests (see in Murariu et al. 2016), this habitat type is missing completely from the region, even the woody vegetation is very rare, being present only in the villages or represented by isolated trees near the river. Fortunately for them, these species are also synanthropic, sheltering both in buildings or other artificial shelters and in trunks. Probably the bats' main problem in the region is represented by the lack of shelters and forests. Instead, the species which hunt near waters have many available wetlands which advantage them. Probably the bats use the region only for hunt and only few individuals live here, some bat species moving relatively long distances for hunting (e.g. Vincent et al. 2011). At least forests are situated at approximately 10 km to Tărian, in the southern part of Oradea city. In Cheresig zone there is a ruin of a medieval tower. Also, at 10-20 km is situated Oradea city, where they can shelter in many buildings or in forested zones at Oradea Hills. They also could shelter in the attics of the houses from the neighboring localities. In the protected area there are some bridges over the Crişul Repede River, which also can shelter bats, like in other regions (e.g. Amorim et al. 2013).

The bats from the Inferior Meadow of the Crişul Repede River natural protected area are mainly low altitude species, linked to woodland areas and tolerant to human activities. Most of them seem to be rare in the zone, being represented by a small number of individuals. This fact is a consequence of the anthropogenic disturbance of the studied region, represented by agricultural fields, localities, affected pastures, which lack natural zones or forests. In these cases, probably the species identified in

the region use it as a hunting territory, having probably shelters in the vicinity of the studied area, and not in the artificial shelters from the region. For the protected area the high number of the identified bat species is relevant, they being important conservation species (O.U.G. 57/2007). For all that, previously in this protected area only one bat species (*R. ferrumequinum*) was known (ROSCI0104 standard Natura 2000 data form). Beside this, we encountered other three species (*M. schreibersii*, *M. dasycneme* and *M. myotis*) of which presence requires the designation of special conservative areas (O.U.G. 57/2007). Even if after the present study the number of the recorded species was much increased, their statute is still uncertain, many of them probably not populating the region, but just using it for hunting. Probably in perspective the effective encounter of bats and their possible habitats from the area or its vicinity should be taken into consideration, instead or beside of their register by sound.

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