

SHORT COMMUNICATIONS

КРАТКИЕ СООБЩЕНИЯ

ROAD-KILLED GROUND BEETLES PROVE THE PRESENCE OF *CARABUS HUNGARICUS* (COLEOPTERA: CARABIDAE) IN NORTH-WESTERN ROMANIA

Alfred Ş. Cicort-Lucaciu

University of Oradea, Romania
e-mail: cicort.alfred@yahoo.com

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Carei Plain is a Protected Area in Northwestern Romania with a rich biodiversity, which among other human impacts, is threatened by road traffic. The road mortality intensity and its consequences were indicated in the region by some studies. During such a road mortality survey, realised in 2016, we identified five road-killed individuals of *Carabus hungaricus*, a rare species in Romania. Carei Plain is situated a few kilometres away from the area where the species presence was known in Hungary. The road is surrounded with sand dunes and wet areas with rich herbaceous vegetation, but also with *Robinia pseudoacacia* plantations. *Carabus hungaricus* is a rare species, with zoogeographic and conservation importance, affected by the road mortality in the region. The real distribution of *C. hungaricus* in the region should be established by investigating its potential habitats in the Protected Area.

Key words: Carei Plain, distribution, grassland, habitat, Protected Area, road mortality

Introduction

Temperate grasslands are one of the most affected and threatened ecosystems (Henwood, 2010). The strong disturbance of their surviving biodiversity caused by future human activities was already predicted (Sala et al., 2000). A recent study indicated that a dramatic decline of the open grassland habitats will take place in the future in the case of Deliblato Sands (Ivajnsič & Devetak, 2020). A species directly threatened by agricultural activities on steppes is *Carabus hungaricus* Fabricius, 1792 (Turin et al., 2003). It is a beetle species with Eurasian distribution recorded from Austria to Kazakhstan (Kadyrbekov et al., 2016; Březina et al., 2017). Its current distribution area is fragmented by the Romanian Plain (Turin et al., 2003). In Romania, *C. hungaricus* is a rare species (Barloy & Prunar, 2012a), with only two reliable records. One of them is located in western Romania, between Jamu Mare and Lăţunaş localities (Lie, 1995, 1996), while the other is situated in southern Romania, near Murta locality (Popescu & Iorgu, 2016). Other records are either out of date and unconfirmed (Breuning, 1932), or only mentioned in the standard data form of some Natura 2000 sites and not supported by any, previously or subsequently published, study (Barloy & Prunar, 2012a,b). In the vicinity of Romania, *C. hungaricus* was recorded in Ömböly in Hungary (Szél et al., 2006), Deliblato in Serbia (Breuning, 1932),

Dragoman in Bulgaria (Hieke & Wrase, 1988; Geuorguiev & Geuorguiev, 1995), Codru Reserve in Moldova (Baban, 2015) and Khotyn National Park in Ukraine (Putchkov, 2009). In Bulgaria, there are other new records of *C. hungaricus* (Bekchiev et al., 2018). Probably, because it uses open habitats, *C. hungaricus* seems faster compared with other carabid species (Bérces & Růžicková, 2019). Generally, the movement of *C. hungaricus* individuals seems random, but their speed differs among the utilised habitat types (Bérces & Růžicková, 2019). When the habitats of ground beetles are crossed by roads, they can fall victims to vehicles (e.g., Noordijk et al., 2006; Yamada et al., 2010; Cicort-Lucaciu et al., 2016). Knowing the facts that the Carei Plain fauna is affected by road mortality (Cicort-Lucaciu et al., 2012; Covaciu-Marcov et al., 2017), and *C. hungaricus* is present in the immediate vicinity in Hungary (Szél et al., 2006), we hypothesised that the species could also be present in the region and its presence could be indicated by road mortality. Recently in Carei Plain road mortality revealed the existence of some species whose presence was not known previously in the region (Teodor et al., 2019). This fact is true for other animal groups in another region in Romania (Covaciu-Marcov et al., 2012, 2020). In this context, our objective was to search also for road-killed *C. hungaricus* individuals during the road mortality study in Carei Plain.

Material and Methods

The study was made in 2016 in Carei Plain Protected Area, Northwestern Romania (Fig. 1). We studied the road mortality of fauna on a recently modernised road, situated between Sanislău and Horia localities. The mortality on this road was already studied before its modernisation (Cicort-Lucaciu et al., 2012). Thus, our main objective was to observe how road mortality increased after road modernisation. The studied road was monitored on its entire length once every two weeks, between March and October (unpublished data). We made pedestrian surveys on the road, like in other similar studies (Cicort-Lucaciu et al., 2012, 2016; Covaciu-Marcov et al., 2017). During those pedestrian surveys, we collected some road-killed ground-beetles, like in the case of other road-killed insects (Teodor et al., 2019). The identification of road-killed ground beetles from Carei Plain was realised in the laboratory following the keys (e.g. Breuning, 1932).

Results

In 2016, we identified a new population of *C. hungaricus* in Northwestern Romania (Fig. 1), between Sanislău and Horea localities. Totally, we encountered five road-killed *C. hungaricus* individuals. The first individual was identified on 26 May 2016. On 8 June 2016, we encountered another three individuals, and on 23 June 2016, another one. The road-killed ground beetles were identified in sectors where the road is surrounded both by sandy areas, wet areas, and *Robinia pseudoacacia* L. plantations. Three *C. hungaricus* corpses were relatively unbroken (Fig. 2), one was partially dismantled, and the last one was in an advanced state of degradation. The identification realised using the keys of Breuning (1932) proved that the encountered individuals belong to *C. hungaricus hungaricus* Fabricius, 1792 (Fig. 2).

Discussion

Despite the existence of some data upon ground beetles in Carei Plain, *C. hungaricus* had not previously been mentioned in the region (Ardelean & Karácsonyi, 2005). Nevertheless, *C. hungaricus* presence in Northwestern Romania was expectable due to the short distance to the country border with Hungary and to its currently known distribution range (Szél et al., 2006). The other two recently recorded populations in Romania are situated either in south-western Romania, in Banat region (Lie, 1995, 1996), or even further south, beyond the Carpathian Mountains, in Oltenia region (Popescu & Iorgu, 2016).



Fig. 1. The distribution of *Carabus hungaricus* in Romania. Designations: square – new record, circle – other recent and reliable records, cross – old records from Breuning, x – the closest records from the surrounding countries, 1 – Nyirség and Nirului Plain, 2 – Deliblato Sands.



Fig. 2. The road-killed *Carabus hungaricus hungaricus* from Northwestern Romania.

Near the road where we encountered the road-killed *C. hungaricus* individuals, there were sand dunes with herbaceous vegetation, *Robinia pseudoacacia* plantations on sand dunes and wet areas with rich herbaceous vegetation. The species was found near two *R. pseudoacacia* plantations crossed by the road. Near plantations psammophile grassland fragments are still preserved, vegetation which once dominated the nearby sandy oak woods and interdune marshes (Boros, 1932). We consider that these fragments represent, in fact, the species' main habitat, which prefers more humid areas of the steppe, with higher herbaceous vegetations, completely avoiding dense forest (Cizek et al., 2012; Pokluda et al., 2012). With all its preference toward natural habitats, *C. hungaricus* was also mentioned in urban areas (Putchkov et al., 2019). The identification of road-killed *C. hungaricus* individuals in late May and especially in June corresponds with one of this species' activity peaks (Bérces & Elek, 2013).

As a steppe species (Panin, 1955), *C. hungaricus* lives in Hungary on calcareous sandy grasslands near the River Danube and River Tisa, on dolomitic grasslands from Buda and Bakony Mountains, and on acidic grasslands from the Nyírség area (Szél et al., 2006). The sandy areas from Northwestern Romania, known as Nirului Plain, are continuous with the Nyírség area (Hungary). Therefore, many species mentioned on the sand dunes from Nyírség were also recorded in Nirului Plain (e.g. Covaciu-Marcov et al., 2009; Sas-Kovács et al., 2015). It is considered that some of the thermophilous steppe species have arrived in the Great Hungarian Plain through the Lower Danube Corridor (Magyari et al., 2010). Probably, the psammophilous species have advanced along the River Danube and River Tisa up to the sand dunes situated at the Hungarian-Romanian border (Covaciu-Marcov et al., 2009). Nevertheless, in the region, wet areas shelter the ancient fauna and flora (e.g. Covaciu-Marcov et al., 2009; Ferentzi et al., 2012; Szatmari, 2015). Thus, even being a steppe element, *C. hungaricus* preferences for more humid areas of the steppe (Cizek et al., 2012; Pokluda et al., 2012) probably place this species in this category.

Recent studies have indicated that road-killed animals could provide ecological or zoogeographic information (e.g. Teodor et al., 2019; Ile et al., 2020). Road-killed *C. hungaricus* records in Northwestern Romania confirm this fact. Although the number of road-killed ground beetles was low, the main activity peak of *C. hungaricus* is in autumn (Bérces & Elek, 2013), and we only determined individuals that were killed in summer. At the same time, even if roads act as barriers for forest ground beetles (Yamada et al., 2010), *C. hungaricus* is a steppe species (Panin, 1955). It seems to be more vulnerable to road mortality compared to other ground beetles. Nevertheless, the barrier effect of roads was mentioned also in the case of ground beetle species with other ecological demands (Noordijk et al., 2006).

The Nirului Plain is a part of the Protected Area of the community interest «Carei Plain». Thus the presence of this species increases its conservation importance. The discovery of this species in Carei Plain shows the necessity of studies on its distribution. It should be searched in different habitat types in the region using adequate methods. At the same time, investigating other roads from the region, or the same road but on a longer period would make possible investigations

on the species activity cycle, which has two peaks (Bérces & Elek, 2013). Thus, studying road-killed animals proves its value one more time, succeeding to offer information without any impact on living specimens, a fact recently indicated in Romania in the case of other animals (Ile et al., 2020). Regarding the impact of roads on biodiversity in the Carei Plain, we consider that the most important conservation decision should be to stop further road modernisation in the region.

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ПОГИБШИЕ НА ДОРОГАХ ЖУЖЕЛИЦЫ ПОДТВЕРЖДАЮТ НАЛИЧИЕ *CARABUS HUNGARICUS* (COLEOPTERA: CARABIDAE) НА СЕВЕРО-ЗАПАДЕ РУМЫНИИ

А. Ш. Чикорт-Лукачиу

Университет Орадя, Румыния
e-mail: cicort.alfred@yahoo.com

Равнина Карей является особо охраняемой природной территорией (ООПТ) на северо-западе Румынии. Она отличается высоким биоразнообразием, которому, помимо прочих антропогенных факторов, угрожает наличие движения на дорогах. Уровень смертности на дорогах и ее последствия были отмечены на территории исследования некоторыми другими данными. В ходе исследования смертности на дорогах в 2016 г. мы обнаружили пять особей *Carabus hungaricus*, погибших на дорогах. Этот вид является редким в Румынии. Равнина Карей расположена в нескольких километрах от местонахождения данного вида в Венгрии. Дорога окружена песчаными дюнами и влажными участками с богатой травянистой растительностью, а также с посадками *Robinia pseudoacacia*. *Carabus hungaricus* – редкий вид, имеющий зоогеографическое и природоохранное значение. Фактическое распространение *C. hungaricus* на территории исследования должно быть установлено путем изучения потенциальных местообитаний вида на данной ООПТ.

Ключевые слова: местообитание, равнина Карей, распространение, сенокосно-пастбищное угодье, ООПТ, смертность на дорогах