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DISTRIBUTION AND HABITAT OF *CARABUS HUNGARICUS* (COLEOPTERA: CARABIDAE) IN SERBIA AND RECOMMENDATION FOR MONITORING

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Abstract

The distribution of *Carabus hungaricus* in Serbia has not been summarized so far. There are only a few published records of this beetle in Serbia. Due to new findings, it was necessary to update the distribution of this species in Serbia. Recent field research revealed that the largest suitable habitat is the Deliblato Sands in the South Banat District, where this species is common. Other important areas are located near the Romanian border in the vicinity of the city of Vršac and near Mužlja (in the neighborhood of the city of Zrenjanin, Central Banat District), where the northernmost population in Serbia is located. In addition to this overview of distribution, we propose monitoring methodology for *C. hungaricus*. We believe that regular monitoring can bring the necessary attention to the disappearing steppe habitats and that the results can help to manage them appropriately in the future.

KEY WORDS: steppe, ground beetles, Banat, Natura 2000, conservation

Introduction

Carabus (*Pachystus*) *hungaricus* Fabricius, 1792 is a western Palaearctic ground beetle species with a disjunct range extending from steppe habitats in the Czech Republic (South Moravian Region) in the west, to the Volga River in the east. This emblematic ground-dwelling steppe carabid is listed throughout its range in the national and regional Red Data Books and is protected where its habitat is also threatened (Bérces & Elek, 2013). The subspecific classification of the species is not fully settled. One of the accepted views is that there are three subspecies, *hungaricus* Fabricius, 1792, *mingens* Quensel, 1806 and *scythus* Motschulsky,

1847 (Turin *et al.*, 2003). Some researchers suggest two additional subspecies, *gastridulus* Fischer von Waldheim, 1823 and *cribellatus* M. F. Adams, 1812 (Brezina, Huber & Marggi, 2017). However, the taxon *cribellatus* M. F. Adams, 1812 is a separate *Carabus* species according to Turin *et al.* (2003).

Carabus hungaricus is a flightless, black-colored, medium-sized (body length 22-28 mm) ground beetle (Fig. 1) (Turin *et al.*, 2003). The center of the western distribution of the nominotypic subspecies is in the lowlands of the Carpathian Basin. We must mention that two other forms (varieties) were described: *viennensis* Kraatz, 1877 from Vienna and the South Moravian Region, and *frivaldskyanus* Breuning, 1933 from the Serbian and Romanian Banat region. Some authors incorrectly use the latter two as subspecies (Lie, 1995; Bérces *et al.*, 2008; Retezár & Szél, 2021).

The typical habitat of *C. hungaricus* is tall-grass steppe on sandy soils, but it also occurs on loess and dolomite. In the Carpathian Basin, its main habitat type is the Pannonian sand steppe (6260), a Site of Community Importance in the Natura 2000 network. The xerophilic-silvicolous character of *C. hungaricus*, which inhabits deciduous forests in the lowlands of Serbia (Pavićević *et al.*, 1997), is questionable. At the time of preparing the CD on the tribe Carabini of Serbia (Pavićević *et al.*, 1997), only a few records of *C. hungaricus* were known.

Carabus hungaricus is an autumn breeder with winter larvae and overwintering adults. The longest life span observed in a capture-recapture experiment was five years for a female. The beetle's main activity period is in the autumn (mid-September to mid-October) when it reproduces. It has another, smaller peak of activity in the first half of June, when tenerals emerge (Bérces & Elek, 2013).

Figure 1. A female of *Carabus hungaricus* from the vicinity of Alibunar, a town on the northern edge of the Deliblato Sands (photo by: N. Vesović).

The population size, dispersal ability, individual movements and habitat use of *C. hungaricus* have been studied in detail. Surprisingly high population estimates, ranging from 1,000-7,000 individuals, indicate that the populations studied in Hungary are large and that the species is the most numerous ground beetle in dry grassland habitats (Bérces *et al.*, 2018; Bérces & Elek, 2013). Estimated daily displacements from capture-recapture studies ranged from 8.4 to 20.3 m/day, depending on the study location, sampling design and spatial arrangement of microhabitats (Elek *et al.*, 2014). In the same study, a single individual covered a distance of 1 km during one season. In a radio telemetry study, 10 individuals were monitored for seven days. The beetles moved at an average of 0.21 m/h for the slowest beetle and 1.29 m/h for the fastest. The study also showed that the beetles avoided areas covered with shrubs, but invaded areas covered with common juniper (Bérces & Růžičková, 2019).

All these facts emphasize that disjunctly distributed *C. hungaricus* populations can be numerous and have a strong dispersal ability. Individuals utilize the dense, relatively moist microhabitats within the matrix habitat and can travel distances of up to one kilometer as the crow flies. However, shrubs and trees are dispersal barriers, so this beetle is strongly restricted to the treeless steppe habitat type (Čížek *et al.*, 2012; Bérces & Růžičková, 2019).

Although the distribution and habitat of *C. hungaricus* are well known, no recent account of its occurrences in Serbia has been published. In this study, we attempt to summarize the data on the distribution of *C. hungaricus* in Serbia. We also propose a monitoring methodology to collect data and estimate population size.

Materials and Methods

Published and unpublished records were compiled in a comprehensive GIS database. Literature data were georeferenced to best match and validated with new records when possible. In some cases, it was not possible to determine the exact location of old collection specimens. In such cases, the center of the appropriate geographic unit is used.

Fieldwork was focused on suitable habitat types. Particular attention was paid to confirming locations previously reported in publications or known only from collections. Live-capture trapping and hand collection were conducted. Coordinates were obtained in the field with a handheld GPS receiver. To locate new populations of *C. hungaricus*, we analyzed Google Earth satellite imagery and selected candidate sites based on habitat characteristics.

Our main goal was to collect as much data as possible on the recent distribution of *C. hungaricus* in northern Serbia, which belongs to the Pannonian biogeographic region. All occurrences of *C. hungaricus* stored in the GIS database were mapped using the QGIS software.

Results

Findings in the Deliblato Sands

It has long been assumed that the Deliblato Sands, situated in the lowlands of the Serbian Banat, is the only place in Serbia where *C. hungaricus* occurs. We summarize all published data on findings of the species from the Deliblato Sands and also provide data on new findings from the same area.

In the area of Brandibul, the village of Šušara, Petrik (1958) found one specimen on 22 September 1950, and another on 25 September 1951 at the site of Prirodni Spomenici, the village of Šušara. On 19 June 1987 one

specimen and on 1 April 1989 two specimens were observed by Béla Tallósi near the village of Šušara (Béla Tallósi, personal communication).

On 30 July 1995, László Ádám found a single specimen in the southeastern Deliblato Sands near the village of Dubovac. The specimen is kept in the Hungarian Natural History Museum in Budapest.
Ćurčić (2003) noted that Ivan Petrov had caught a female specimen in the Deliblato Sands on 29 June 1996, without giving further details on the exact location.

Sándor Bérces and Béla Tallósi observed a total of 30 adult beetles near the village of Šušara on 6 October 2006, 27-28 May 2021 and 3-4 October 2021. Gabor Mesaroš observed 23 and 3 specimens in Brandibul and Velika Pustara near the village of Šušara on 1 October 2022, respectively.

In the northwestern part of the Deliblato Sands, near the village of Banatski Karlovac, a single specimen was captured by Juraj Litavský on 29 May 2015 (Juraj Litavský, personal communication). In the same area, Nikola Vesović found 53 and 76 specimens in the village of Banatski Karlovac and in the town of Alibunar, respectively, in the period from 21 June to 5 July 2020. Gabor Mesaroš observed 15 specimens on the Velika Tilva hill near the village of Banatski Karlovac on 1 October 2022.

Matic Gabor sampled from a total of 15 sites along the road between Šušara and Deliblato villages in the Deliblato Sands between 28 April and 2 May 2019. Because the timing was suboptimal for capturing *C. hungaricus*, only one specimen was collected, and another specimen was found by chance (Gabor, 2021).

Findings outside the Deliblato Sands

The occurrence of *C. hungaricus* is also reported from a previously unknown area, approximately 70 km north of the Deliblato Sands, from the vicinity of the Zrenjanin (Mužlja precisely), where a single specimen was found in dry grassland (Majzlan & Litavský, 2017).
New *C. hungaricus* populations were recently found in the lowlands between the city of Vršac and the Serbian-Romanian border. On 10 October 2017 and 19 September 2021, Zoran Gavrilović photographed a specimen of *C. hungaricus* in the outskirts of Mali Žam, near the Serbian-Romanian border (Gavrilović, 2016-2018; Zoran Gavrilović, personal communication). On 30 July 2020, Gabor Mesaroš also found a single specimen there. Zoran Gavrilović and Gabor Mesaroš each found one specimen near the city of Vršac in Vrela (hippodrome) on 19 September 2021 and 1 October 2022, respectively.
Gabor Mesaroš found one specimen of *C. hungaricus* recently, on 1 October 2022, near the Veliko Središte graveyard.

We have compiled all available information on *C. hungaricus* occurrences in Serbia in Table I and presented it on a map (Fig. 2).

Questionable data

We must mention a questionable record of *C. hungaricus* near the city of Ruma (Tallósi, 1984). Tallósi in his M.Sc. thesis cites the personal communication of Egon Pretner and writes “in the vicinity of Ruma, according to our assumptions on Mt. Fruška Gora, it could live in a thermophilic, heliophilic environment, but so far it has not been found”.

Table I. Summary of *Carabus hungaricus* specimens observed annually per site, indicated by number of individuals.

Locality	Deliblato Sands					Outside the Deliblato Sands				
Year	Alibunar	Banatski Karlovac	Deliblato	Dubovac	Šušara	Not specified	Mali Žam	Mužlja	Veliko Središte	Vrela (hippodrome) Vršac
1950					1					
1951					1					
1987					1					
1989					2					
1995				1						
1996						1				
2006					28					
2015		1								
2016								1		
2017							1			
2019			1		1					
2020	76	53					1			
2021					5		1			1
2022		15			26				1	2

Discussion and Conclusions

While summarizing the Serbian occurrence data of *C. hungaricus*, we faced the problem that the data are available only in hard-to-access textual sources such as manuscripts and dissertations and in inaccessible private collections.

The first mention of *C. hungaricus* in the Banat region dates back to the 19th century (Dejean, 1837). In Dejean's iconography on the beetle fauna of Europe, *Carabus mingens* is listed as a synonym of *C. hungaricus*, with distribution in Russia, Hungary and Banat. In his monumental monograph on *Carabus*, Breuning (1932-1937) described a new infrasubspecific taxon, a race named *frivaldszkyanus* from the Banat region, occurring in Timișoara, Remetea Mică (Romania) and the Deliblato Sands (Serbia). There are two specimens in Breuning's collection with no information on collectors or collection dates (Lie, 1995). There is a specimen from the Banat region in the Hungarian Natural History Museum in Budapest, but it is impossible to determine if it is from present-day Romania or Serbia. The collector of this specimen was Carl Adolf Fuss, and the most plausible collection period was between 1850 and 1860 (Győző Szél, personal communication). In identification keys of the Carabidae of Hungary and Romania, *C. hungaricus* is mentioned inhabiting Deliblato Sands area without further details (Csiki, 1905-1908, 1946; Panin, 1955). Gradojević (1963) stated in his doctoral dissertation that *C. hungaricus* is rare in the Deliblato Sands area.

Recent observations indicate that *C. hungaricus* is widespread in the Deliblato Sands area. The beetles can be found under trash and abandoned corn stalks or even seen running on the surface during the day. The number of observed beetles differed considerably in and outside Deliblato Sands. In Deliblato Sands, the maximum number of individuals observed in one day was 28 (in 2006, Šušara), while the maximum number of caught specimens was 76 in a two-week period (in 2020, Alibunar).

We were able to demonstrate that *C. hungaricus* populations also occur in some new, unexplored locations outside the Deliblato Sands. At each site, only a few individuals were found probably due to the non-systematic survey.

We believe that the relatively low amount of *C. hungaricus* data is due to inappropriate scheduling of the capture and search periods for this species. Late autumn is rarely recognized as a good collection period, so the main activity of *C. hungaricus* can easily be missed. The optimal time for monitoring is from the second half of September to mid-October.

Carabus hungaricus populations can survive for a long time in small, degraded grassland fragments until they start to become shrubby. Notably, the beetle can disperse quite well, and deciduous trees, shrubs and forests act as barriers. Management prescriptions for protected areas must take all of these factors into account.

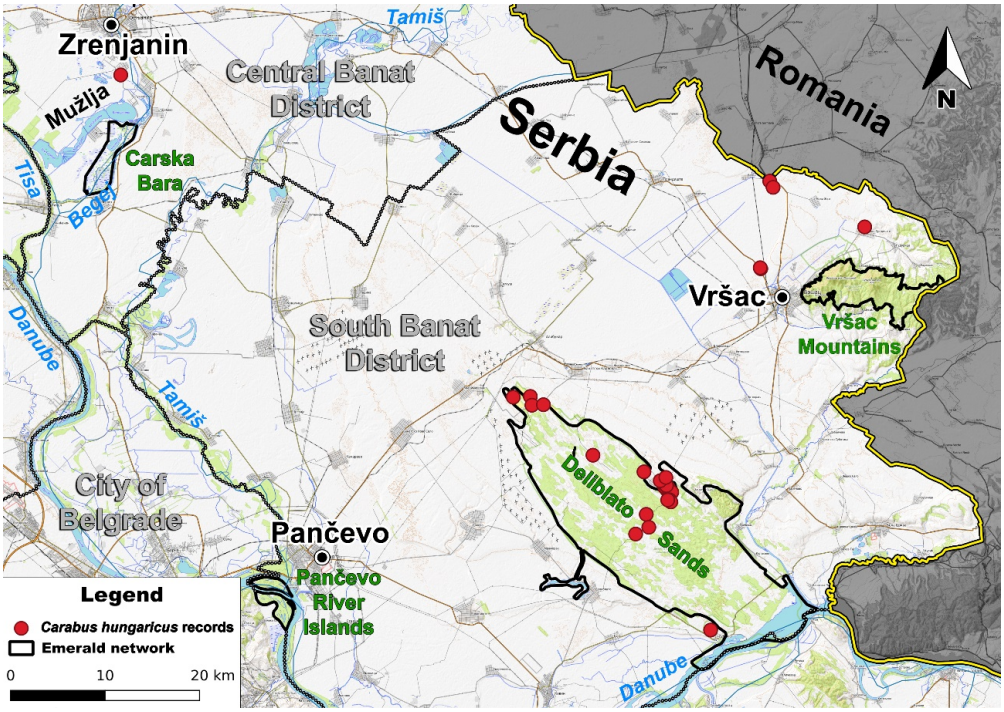

Figure 2. Map of *Carabus hungaricus* records in the Banat region of Serbia.

Proposed monitoring methodology for *C. hungaricus*

Monitoring should focus on both the extent of suitable habitat and the presence or size of *C. hungaricus* populations.

1. The main habitat type is Pannonian sandy grassland, but in many cases, degraded forms, sometimes ruins of the original habitat, are still suitable for the species.

2. The methods used to detect the species are hand-searching and trapping in suitable habitats. Searching at night with a flashlight is ideal for observing beetles running on the surface, but hand-searching at night under stones or anything that can serve as shelter can also be successful. The best results are obtained by trapping both with a killing agent or live-capture pitfall trapping. At least 10 pitfall traps should be used per

site. Traps can be placed 0.5-5 m apart. Trapping should last from one week to several weeks (depending mainly on the amount of rainfall, if the traps are not protected from rain). The best period for trapping and searching is when the adults of the species are most active during the autumn mating season, i.e., from 10 September to 15 October. The second-best period is between 15 May and 20 June. For the activity period of *C. hungaricus*, see Bérces & Elek (2013). It is important that live-catch traps be emptied every 1-4 days.

3. The best method to determine population size is to mark and recapture individuals. In this case, a high density of traps should be used. The configuration of the traps is not so important, but it is easier to find the traps if they are placed in a rectangular formation. In our opinion, not less than 64 traps (8 x 8 grid) should be used to catch enough beetles for statistical analysis. Traps must be emptied every 3-4 days and the interval between two visits should be the same throughout the survey.

In this method, the unit of measurement is the number of individuals marked and recaptured. For more complex measurements, statistical methods such as POPAN or Robust Design can be used to estimate population numbers using the statistical software R or the program MARK. For more details on the mark-recapture method, see Čížek *et al.* (2012), Pokluda *et al.* (2012), Bérces & Elek (2013) and Elek *et al.* (2014). Populations of *C. hungaricus* can remain undetected for very long periods of time, and inaccurate information about distribution and habitat can lead to unintended habitat degradation. The dry steppe is often considered a worthless area, suitable mainly for sand-mine development, construction of solar power stations or logistic depots, afforestation with exotic plants such as *Robinia pseudoacacia* L., *Paulownia* spp., etc., or landfill production.

We strongly advise decision-makers to reconsider the management of steppe habitats, especially in light of the study results that point to their fundamental importance. Grassland ecosystems are disappearing rapidly in Europe, so we need to protect what is left (Kirschner *et al.*, 2020). In order to protect the steppe ecosystem and its associated endangered specialized species for future generations, we believe regulations must be included in agricultural subsidy programs.

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References

Bérces, S., Csóka, A., & Elek, Z. (2018). Befolyásolja-e a kísérleti elrendezés a magyar futrinka (*Carabus hungaricus*) populációjának becsült paramétereit? Módszertani esettanulmány a táborfalvai hosszú távú fogás-jelölés-visszafogás kutatásokról (Does the experimental design influence the estimated parameters of the *Carabus hungaricus* population in Hungary? A methodological case study of long-term catch-mark-recapture research in the village of Táborfalva). In M. Korda (Ed.), *Természetvédelem és Kutatás a Turjánvidék Északi részén* (Nature Conservation and Research in the Northern Part of the Turjánvidék, Central Hungary) (Vol. 10, 679-696). Duna-Ipoly Nemzeti Park Igazgatóság, Budapest.

Bérces, S., & Elek, Z. (2013). Overlapping generations can balance the fluctuations in the activity patterns of an endangered ground beetle species: long-term monitoring of *Carabus hungaricus* in Hungary. *Insect Conservation and Diversity*, *6*(3), 290-299. https://doi.org/10.1111/j.1752-4598.2012.00218.x

Bérces, S., & Růžičková, J. (2019). Habitat use of an endangered beetle *Carabus hungaricus* assessed via radio telemetry. *Acta Zoologica Academiae Scientiarum Hungaricae*, *65*, 335-348. https://doi.org/10.17109/AZH.65.4.335.2019

Bérces, S., Szél, Gy., Ködöböcz, V., & Kutasi, Cs. (2008). The distribution, habitat, and the nature conservation value of a Natura 2000 beetle, *Carabus hungaricus* Fabricius, 1792 in Hungary. In L. T. Erwin, L. Penev, & T. Assmann (Eds.), *Back to the Roots and Back to the Future: Towards a New Synthesis Between Taxonomic, Ecological and Biogeographical Approaches in Carabidology* (pp. 363-372). Pensoft Publishers, Sofia-Moscow.

Breuning, S. (1932-1937). *Monographie der Gattung Carabus L. Bestimmungs-Tabellen der europäischen Coleopteren: Vol. 1-7.* E. Reitter, Troppau, 1610 pp.

Brezina, B., Huber, C., & Marggi, W. (2017). Subtribe Carabina Latreille, 1802. In I. Löbl & D. Löbl (Eds.), *Catalogue of Palaearctic Coleoptera.: Vol. 1. Archostemata-Myxophaga-Adephaga* (Revised and Updated Edition, 70-207). Brill, Leiden-Boston.

Čížek, L., Hauck, D., & Pokluda, P. (2012). Contrasting needs of grassland dwellers: habitat preferences of endangered steppe beetles (Coleoptera). *Journal of Insect Conservation*, *16*(2), 281-293. https://doi.org/10.1007/s10841-011-9415-6

Csiki, E. (1905-1908). *Magyarország bogárfaunája I. Vezérfonal a magyar szent korona országainak területén előforduló bogarak megismerésére. Általános rész. Adephaga: 1. Caraboidea [The beetle fauna of Hungary I. A guide to the beetles of the countries of the Hungarian Holy Crown. General part. Adephaga: 1. Caraboidea].* Magyar Nemzeti Múzeum, Budapest, 546 pp.

Csiki, E. (1946). *Die Käferfauna des Karpaten-Beckens. I. Allgemeiner Teil und Caraboidea: Vol. 4.* Magyar Nemzeti Múzeum, Budapest, 798 pp.

Ćurčić, S. B. (2003). *Raznovrsnost, uporedno-morfološka, razvojna i filogenetska svojstva familije Carabidae (Coleoptera, Insecta) u Srbiji [Diversity, Comparative Morphological, Developmental and Phylogenetic Characteristics of the Family Carabidae (Coleoptera, Insecta) in Serbia]* [M.Sc. thesis]. Faculty of Biology, University of Belgrade, Belgrade, 291 pp.

Elek, Z., Drag, L., Pokluda, P., Čížek, L., & Bérces, S. (2014). Dispersal of individuals of the flightless grassland ground beetle, *Carabus hungaricus* (Coleoptera: Carabidae), in three populations and what they tell us about mobility estimates based on mark-recapture. *European Journal of Entomology*, *111*(5), 663-668. https://doi.org/10.14411/eje.2014.080

Gabor, M. (2021). New data on the presence of *Carabus hungaricus* (Coleoptera: Carabidae) in Deliblato Sands (Serbia). *Acta entomologica slovenica*, *29*(2), 201-206.

Gavrilović, Z. (2016-2018). Nove vrste dnevnih leptira i ostalih vrsta insekata u vršačkom kraju. *Godišnjak Prirodnjačkog društva "Gea"*, *16-18*, 20-22.

Gradojević, Z. (1963). *Naselja Arthropoda travnih zajednica Deliblatske peščare i njihova sukcesija [Settlements of Arthropoda of the Grass Communities of the Deliblato Sands and Their Succession]* [Ph.D. dissertation]. Faculty of Sciences, University of Belgrade, Belgrade, 239 pp.

Kirschner, P., Záveská, E., Gamisch, A., Hilpold, A., Trucchi, E., Paun, O., Sanmartín, I., Schlick-Steiner, B. C., Frajman, B., Arthofer, W., Steiner, F. M., & Schönswetter, P. (2020). Long-term isolation of European steppe outposts boosts the biome's conservation value. *Nature Communications*, *11*(1), 1968. https://doi.org/10.1038/s41467-020-15620-2

Lie, P. (1995). Beiträge zur Kenntnis des *Carabus hungaricus frivaldskyanus* Breuning neuentdeckt im Banat, Rumänien (Coleoptera, Carabidae). *Folia Entomologica Hungarica*, *56*, 85-88.

Majzlan, O., & Litavský, J. (2017). Na pôdne strátum lužných lesov v okolí riek Tisa a Begej (Topical affinity of beetles (Coleoptera) to soil in floodplain forests along the Tisa and Begej rivers (Republic of Serbia)). *Entomofauna Carpathica*, *29*(2), 13-26.

Panin, S. (1955). *Coleoptera, familia Carabidae* Vol. 10(2). Editura Academiei Republicii Populare Romîne, Bucharest, 148 pp.

Pavićević, D., Mesaroš, G., Ognjanović, J., & Bjelić-Mesaroš, J. (1997). *Catalogus Faunae Jugoslaviae. Carabini of Yugoslavia and Adjacent Areas. CD ROM Encyclopaedia*. Ecolibri & Bionet, Belgrade.

Petrik, A. (1958). Entomofauna Deliblatske peščare. *Rad Vojvođanskih muzeja*, *7*, 87-113.

Pokluda, P., Hauck, D., & Čížek, L. (2012). Importance of marginal habitats for grassland diversity: fallows and overgrown tall-grass steppe as key habitats of endangered ground-beetle *Carabus hungaricus*. *Insect Conservation and Diversity*, *5*(1), 27-36. https://doi.org/10.1111/j.1752-4598.2011.00146.x

Retezár, I., & Szél, Gy. (2021). *The Genus Carabus in the Carpathian Basin (Coleoptera, Carabidae). Systematics, Faunistics and Iconography*. Szerzői Kiadás, Budapest, 347 pp.

Tallósi, B. (1984). *Prilog poznavanju faune trčuljaka (Col. Carabidae) u nekim šumskim zajednicama Fruške gore [Contribution to the Knowledge of the Ground Beetle Fauna (Col. Carabidae) in Some Forest Communities of Fruška Gora]* [M.Sc. thesis]. Faculty of Sciences, University of Novi Sad, Novi Sad, 5-26.

Turin, H., Penev, L., Arndt, E., Assmann, T., Makarov, K., Mossakowski, D., Szél, G., & Weber, F. (2003). Chapter 5. Species account. In H. Turin, L. Penev, & A. Casale (Eds.), *The Genus Carabus in Europe. A Synthesis. Fauna Europaea Evertebrata. Volume 2* (pp. 151-286). Pensoft Publishers & European Invertebrate Survey, Sofia-Moscow-Leiden.

РАСПРОСТРАЊЕНОСТ И СТАНИШТЕ *CARABUS HUNGARICUS* (COLEOPTERA: CARABIDAE) У СРБИЈИ И ПРЕПОРУКА МОНИТОРИНГА

ШАНДОР БЕРЦЕШ, ГАБОР МЕСАРОШ и НИКОЛА ВЕСОВИЋ

Извод

До сада нису постојали сажети подаци о распрострањењу врсте *Carabus hungaricus* у Србији. Постоји свега неколико објављених налаза овог тврдокрилца у Србији. Због нових сазнања било је потребно ажурирати распрострањеност ове врсте у Србији. Недавна теренска истраживања показала су да је највеће погодно станиште Делиблатска пешчара у јужнобанатском округу, где је ова врста честа. Остала значајна подручја налазе се у близини границе са Румунијом у околини града Вршца и код Мужље (приградско насеље града Зрењанина, средњобанатски округ), где је пронађена најсевернија популација у Србији. Поред овог прегледа распрострањења, предлажемо и методологију за праћење популација *C. hungaricus*. Сматрамо да редовно праћење може скренути неопходну пажњу на степска станишта која нестају и да резултати могу помоћи да се њима у будућности управља на одговарајући начин.

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