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The Serbian in relation to the world's *Brachycerus* fauna (Brachycerinae: Brachycerini)

by

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Abstract. This paper unifies literature and new data on the presence of *Brachycerus* in Serbia and its surroundings (mainly the rest of the Balkan Peninsula). The new data are based on specimens from the first author's collection and from available Serbian online databases. They were analyzed in the wider context of the general distribution and ecological needs of *Brachycerus* species in general. The presence of two species in Serbia, *Brachycerus foveicollis* and *B. sinuatus*, is confirmed. The possible presence of *B. muricatus* (garlic weevil) in Serbia based on a 133-year-old record is doubtful, and *B. undatus* in Montenegro is documented for the first time and confirmed for Croatia and Greece, as well as *B. aegypticus* in Crete.

Keywords. *Brachycerus*, Serbia, fauna, ground weevils, Mediterranean species, aridity-adapted, biodiversity.

Introduction

Practically every 20th species on our planet is a weevil, and it is possible that "every plant has its weevil" according to Proches (2003) after research into the weevil fauna of Baviaanskloof (South Africa). The genus *Brachycerus* also hides in this multitude of weevils. It is one of 12 genera of the subfamily Brachycerinae (Oberprieler et al. 2007), one of the basal, primitive groups, debatably phylogenetically positioned among the other weevils with short rostrum, not used in preparing sites for oviposition (Thompson 1992, Marvaldi 1997). The subfamily Brachycerinae in a wider sense is represented by about 1,200 species, including besides Brachycerini the Cryptolaryngini, Erirhinini, Ocladiini, Raymondionymini, and Tanysphyrini (Oberprieler et al. 2007). The Brachycerini are restricted to the Old World, which suggests that *Brachycerus* is despite of some seemingly primitive characters (non-geniculate antennae, simple tarsi) much younger than the oldest weevil families (e.g., Nemonychidae, Belidae). Brachycerini must have evolved after the separation of South America, India and Australia from the Gondvanan landmass in the Cretaceous period around at least 105 million years B.C. (Blakey 2024).

But the date of *Brachycerus* origin remains largely in the dark, as the oldest available fossil records of *Brachycerus* come from the Oligocene (Tertiary) of Europe, earliest 34 million years B.C. (Alonso-Zarazaga & Lyal 1999, p. 62). Comparatively old or older fossil evidence from Africa is missing. Origin of *Brachycerus* is the Afrotropical Region with highest species richness in the South African deserts and semideserts. Enough time to move through Africa, to colonize the climatically similar Mediterranean basin (hot and dry summer, winter rain), and to generate a second smaller diversity center with separate species formation (see for example Osella et al. 1998). Adults are robust, flightless, and usually coarsely sculptured, with a relatively short, thick, and non-sexually dimorphic rostrum bearing non-geniculate antennae. All species are preferably ground-dwelling (Elmetwaly & Hamed 2019).

According to the latest Palaearctic catalogue (Alonso-Zarazaga et al. 2023), the taxonomical position of genus *Brachycerus* is:

Family Curculionidae
Subfamily Brachycerinae Billberg, 1820
Tribe Brachycerini Billberg, 1820
Subtribe Brachycerina Billberg, 1820
genus ***Brachycerus*** Olivier, 1789.

The first impression of the habitus of beetles of the genus *Brachycerus* is – especially under high magnification – that they are terrifying-looking (Figs. 1-6, 8, and 9): black, covered in deeply rough-carved armor like intimidating knights, and an excellent inspiration for directors of SF films about aliens, largely confirming our impression of an ancient genus. These beetles are often larger than 1 cm, globose, with heads and legs covered by erect black bristles. The short, robust rostrum is expanded laterally into huge carinae or as an obtuse projection over the deep lateral or lateroventral antennal scrobes and separated by a dorsolateral groove from the frons (which possesses a longitudinal ridge in the middle). The stout, short, non-geniculate antennae possess eight anntennomeres, the first a bit longer than wide, the others more or less as long as wide or a bit longer, and an ovate, not subdivided club with oblong apico-lateral bristly grooves (Friedman & Sagiv 2010). The eyes are surrounded by the orbit sometimes projecting dorsally to the forehead (in lateral view) (Elmetwaly & Hamed 2019).

The genus *Brachycerus* comprises about 500 species (Louw 1990) that are widespread in Africa (best represented in southern Africa), southern Europe, and the Middle East (Procheş 2003). An impressive contribution to *Brachycerus* knowledge was given by Haaf (1957, 1958) in the form of detailed and precise descriptions of 340 African species. A recent biogeographical study showing patterns of *Brachycerus* species distribution confirmed their South African-centered richness -with over 100 species in some ecoregions (Hickman et al. 2017). Recently three species, two from Europe and one from Africa, were introduced to and registered as agricultural pests in New Zealand (Ministry for Primary Industries New Zealand 2019).

Zumpt (1937) listed 38 Palaearctic *Brachycerus* species and subspecies with detailed zoogeographical data. This number has increased to 51 taxa in the Palaearctic region in the latest updated weevil catalogue - Europe is inhabited by 24, Asia by 27 taxa, and North Africa by 21 (Alonso-Zarazaga et al. 2023). The leading countries for *Brachycerus* diversity in Europe are the southernmost countries in the Mediterranean region. In Asia, most species are present in the Middle East region, while in the North African species numbers vary from 1 to 13 per country (Elmetwaly & Hamed 2019, Stüben 2022, Alonso-Zarazaga et al. 2023). Keys for the identification of the species are given by Zumpt (1937), Friedman & Sagiv (2010) and Skuhrovec et al. (2013). The latter published a pictorial key on 21 European species with distribution maps and host plant information.

A total of nine *Brachycerus* species has been registered in Serbia and the surrounding countries: five each in Croatia and Bulgaria, four in Romania, three in Bosnia and Herzegovina, two each in Albania and North Macedonia, whilst from Hungary, Montenegro, and Serbia only one species each was known (Alonso-Zarazaga et al. 2023).

Despite their relatively large body and seemingly easy detection of adults in nature, there are still recent discoveries of new *Brachycerus* species (Arzanov 2005, 2011; Friedman & Sagiv 2010, Colonnelli et al. 2016). This paper aims to unify literature and new data on the presence of *Brachycerus* in Serbia and its surroundings (mainly the rest of the Balkan Peninsula) and to relate the Serbian to the world's *Brachycerus* fauna.

A brief history of *Brachycerus* research in Serbia and on the Balkan Peninsula

There is a scarce number of published data on *Brachycerus* in the territory of Serbia and the Balkan Peninsula in general.

In his contribution about the fauna of the historical Kingdom of Serbia, Mihailo Bobić dealt with the Coleoptera of Kruševac and its surroundings (Bobić 1891). In this work, which improved the knowledge of the Serbian entomofauna considerably, containing 125 beetle species or genera, the very first mentioning of *Brachycerus muricatus* Oliv. (garlic weevil) was given, unfortunately, without any locality details.

Zumpt (1937) listed in his review 8 taxa for the Balkan Peninsula and six in the territory of the historical kingdom of Yugoslavia: 4 for Greece (*foveicollis, graecus* [as subspecies of *lutosus*], *junix*, and *sinuatus* [both as sensu stricto species]), 1 for Yugoslavia (*sinuatus* as *sinuatus* s. str.), 2 for Herzegovina (*undatus undatus* and *lutosus lutosus* Gyll.), 1 for (North) Macedonia (*sinuatus sinuatus* Ol.), and 1 for Bulgaria (*foveicollis*), 4 for Dalmatia (*albidentatus*, *junix* [as *junix* s. str.], *undatus* *undatus*, and *algirus* F.) and 3 for the Balkan Peninsula as a whole (*lutosus* (as *lutosus* s. str.)*, muricatus* (as *algirus*) and *undatus* [as *undatus* s. str.]); Serbia is not mentioned specifically for any taxon or locality. Angelov (1978) listed six *Brachycerus* species for the Bulgarian fauna (*algirus*, *muricatus*, *junix*, *cinereus*, *undatus*, and *sinuatus*).

In the work of Pešić (2003), based on material of the Balkan Peninsula and deposited in the Natural History Museum in London (NHM), the species *muricatus* (Olivier, 1790) (as *algirus*), *sinuatus* Olivier, 1807, and *undatus* (Fabricius, 1798) were confirmed in Greece. There are also two specimens of *B. undatus* from Dalmatia (Croatia) in the NHM collection, but not a single *Brachycerus* specimen from Serbia.

Materials and methods

The work is primarily based on the specimens from the first author's collection, collected by different researchers from a few places in ex-Yugoslavia and Greece, during the period 1961–2021. Material was simply collected by hand. These data are combined with records taken from the literature, and/or published online in active Serbian biological databases - Alciphron (HabiProt 2014-2023) and Biologer (Popović et al. 2020). The BIORAS database, which was edited by weevil expert Gabor Mesaroš, is unfortunately no longer operational. The descriptions of the habitat and ecology in general presented here are based on personal observations and data from literature.

Results

Collated data of *Brachycerus* spp. records from Serbia and surrounding countries come from the author's collection, literature, and the valid, above-mentioned databases. The species are arranged chronologically, starting with the Serbian records, and then unpublished data on findings in nearby countries are presented.

Fig. 1. *Brachycerus foveicollis* specimens in Nedeljko Košanin's collection in the Natural-History Museum in Belgrade. (photographed by Aleksandar Stojanović, the Natural History Museum Belgrade curator, September 9, 2023)

Records from Serbia

***Brachycerus foveicollis* Gyllenhal, 1833** (Figs. 1 - 4)

This weevil species with a body length of 7-13 mm is distributed in Eastern Europe, on the Balkan Peninsula, and in the Middle East (Skuhrovec et al. 2013; Stančić 2013; Alonso-Zarazaga et al. 2023). According to Scherf (1964) this species appears to live on *Muscari comosum* (L.) Mill. and *Ornithogalum umbellatum* L. (both Asparagaceae); Skuhrovec et al. (2013) reported about *Muscari neglectum* Guss. ex Ten. as a host plant in southern Slovakia, and Podlussány (2007) added *Ornithogalum comosum* L. for Hungary.

Fig. 2. Specimen of *Brachycerus foveicollis* from Stančić's collection. (Stančić, 2013)

The oldest data on the presence of this species in Serbia are given by Košanin (1904), based on the material he collected from 1898 to 1900 and from 1903 to 1904, and deposited in the Natural History Museum in Belgrade. There are two specimens, with data about the locality only written in Cyrillic letters — the first Београд, and the second Ритопек (Fig. 1). In Serbian Latin, translated as Beograd (engl. Belgrade), and Ritopek — a village on the right bank of Danube, approximately 19 km southeast of central Belgrade. In Fig. 7, they are presented as findings 1 and 2, respectively. These records are also included in the Biologer database (https://biologer.rs/index.php/groups/33/species/22340).

The third location in Fig. 7 is the village Topolovnik (in Veliko Gradište municipality, approximately at geographic coordinates 44°43'51.7"N 21°26'16.5"E), on the right-hand side of the Danube, where Stančić collected eight examples in May 1955 on open biotopes under agricultural crops on loess hills. These are deposited in his personal collection and one example is shown in Fig. 2 (Stančić 2013). This record is also registered in the Alciphron database.

The fourth discovery (Figs. 3 & 7) is of a single specimen labeled Jastrebac, VIII 1961, leg. D. Čubrilović, determined by S. Pešić and revised by A.-L.-L. Friedman on May 6th, 2019. It is deposited in S. Pešić's weevil collection at the University of Kragujevac, Faculty of Science.

Fig. 3. Specimen of *Brachycerus foveicollis* collected on Jastrebac. (photo S. Pešić, September 11, 2023)

The fifth *B. foveicollis* record (Fig. 7) represents three specimens collected on March 6th, 2019, in the vicinity of the city of Niš, at an altitude of approximately 200 m, leg. Slobodan Stevčić (Fig. 4). It is documented by photographs in both databases (https://alciphron.habiprot.org.rs/listing-186868-brachycerus-foveicollis & https://biologer.rs/index.php/groups/33/species/22340).

Fig. 4. Specimen of *Brachycerus foveicollis* collected near Niš, photographed by Slobodan Stevčić, March 6, 2019. (https://alciphron.habiprot.org.rs/listing-186868-brachycerus-foveicollis and https://biologer.rs/index.php/groups/33/species/22340)

The most recent, sixth *B. foveicollis* record from Serbia (Fig. 7) was made on February 22, 2023, collected and photographed by Danilo Ugrnov in the vicinity of Kikinda (UTM square DR 37 according to the Alcyphron database, https://alciphron.habiprot.org.rs/listing-186868-brachycerus-foveicollis).

***Brachycerus sinuatus* Olivier, 1807** (Fig. 5)

Brachycerus sinuatus is a 9-18 mm long weevil, distributed in Sicily, south-eastern and eastern Europe, and the Middle East (Angelov 1978; Skuhrovec et al. 2013; Alonso-Zarazaga et al. 2023). The records registered in this paper are shown on the map in Figure 7 as blue dots numbered 1 and 2 in order of discovery.

This is the only *Brachycerus* species mentioned for Serbia in the Palaearctic catalogue (Alonso-Zarazaga et al. 2023), thanks to its discovery in the territory of Preševo, near the border between Serbia and North Macedonia, in spring 2019 (Pešić et al. 2020). Due to this recent addition, Serbia was not included in an earlier version of the catalogue (Alonso-Zarazaga et al. 2017).

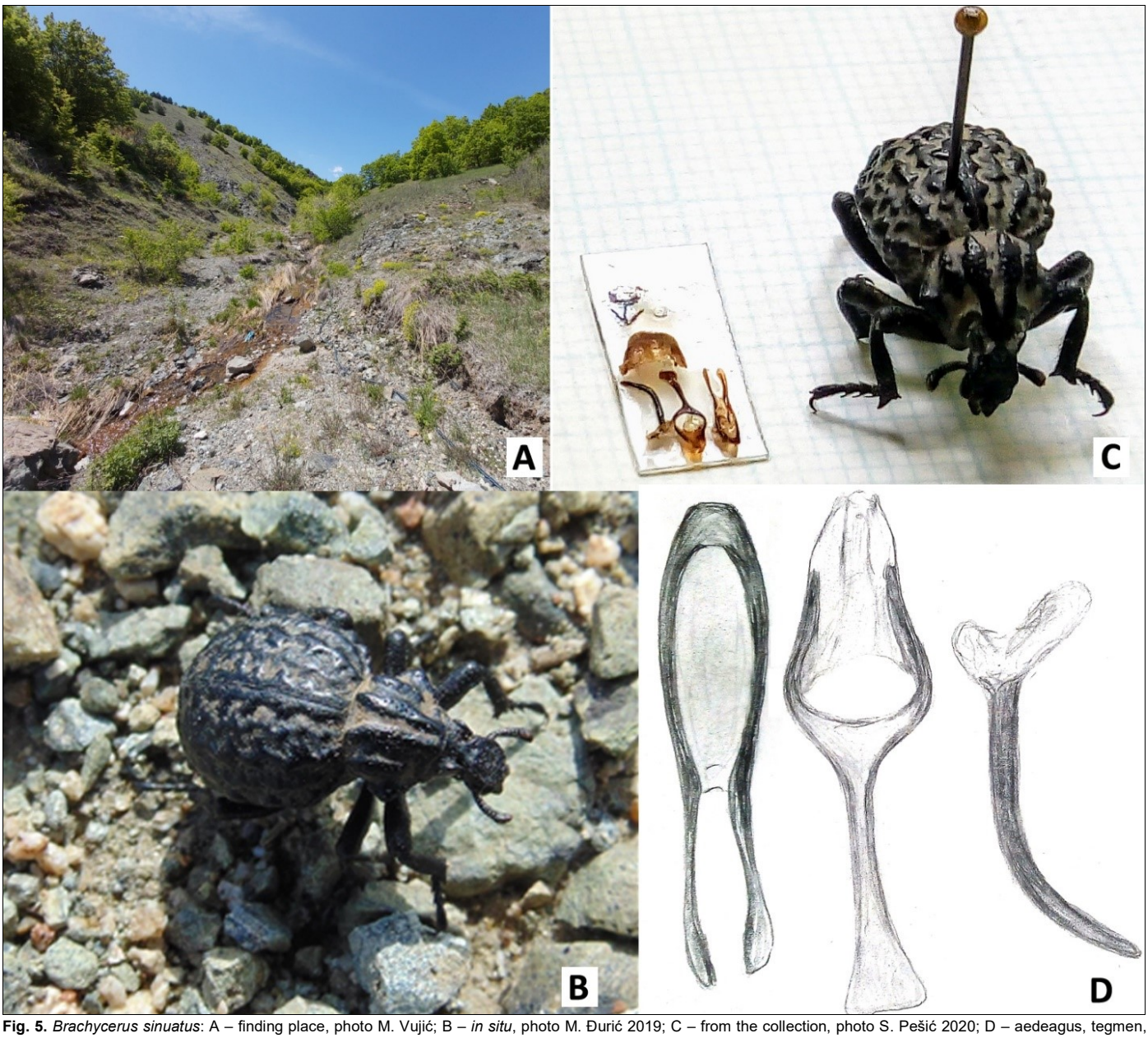

Fig. 5. *Brachycerus sinuatus*: A – finding place, photo M. Vujić; B – *in situ*, photo M. Đurić 2019; C – from the collection, photo S. Pešić 2020; D – aedeagus, tegmen, and spiculum ventrale. (Recombined from Pešić et al. 2020)

Details of the locality, habitat, and ecological conditions for the two male specimens collected by "HabiProt" members Bojana Nadaždin, Ivan Tot, and Milan Đurić have already been published (Pešić et al. 2020). Briefly, *B. sinuatus* was found on warm, rocky ground close to a small stream between the Miratovac and Trnava villages in Preševo municipality (UTM square EM58 in Fig. 7, blue dot 1), at approximately 550 m a.s.l., on April 25th, 2019. The area had limited vegetation composed of small fragments of sub-Mediterranean oak forests of *Quercus pubescens* Willd. and dry pastures (Fig. 5A), with flowering *Muscari* sp. present. Arzanov (2005) listed two other plant genera from the same subfamily (Scilloideae) for the eastern part of its range, *Bellevalia* and *Hyacinthella*, cited also by Skuhrovec et al. (2013). To verify identity, the aedeagus was extracted from the specimen in the first author's collection (Fig. 5D).

According to the Alciphron database (https://alciphron.habiprot.org.rs/listing-186900-brachycerus-sinuatus) and personal communications, members of the same organization, Ivan Tot and Mihailo Vujić, two more specimens were recorded on May 18, 2021 at Pčinja (UTM square EM78 in Fig. 7, blue dot 2). Specifically, this was at 42°20'58.5"N 21°53'49.2"E, on Starac Mt. in the village of Jablanica (Bujanovac municipality, Fig. 6) on a sunny mountain path over pastures with sparse vegetation, partially lined with rare fruit trees and unusual-looking oak trees because their branches were cut for livestock mats. Height and cover of vegetation are low, and geophytes had the chance to grow there, but apparently not in large numbers.

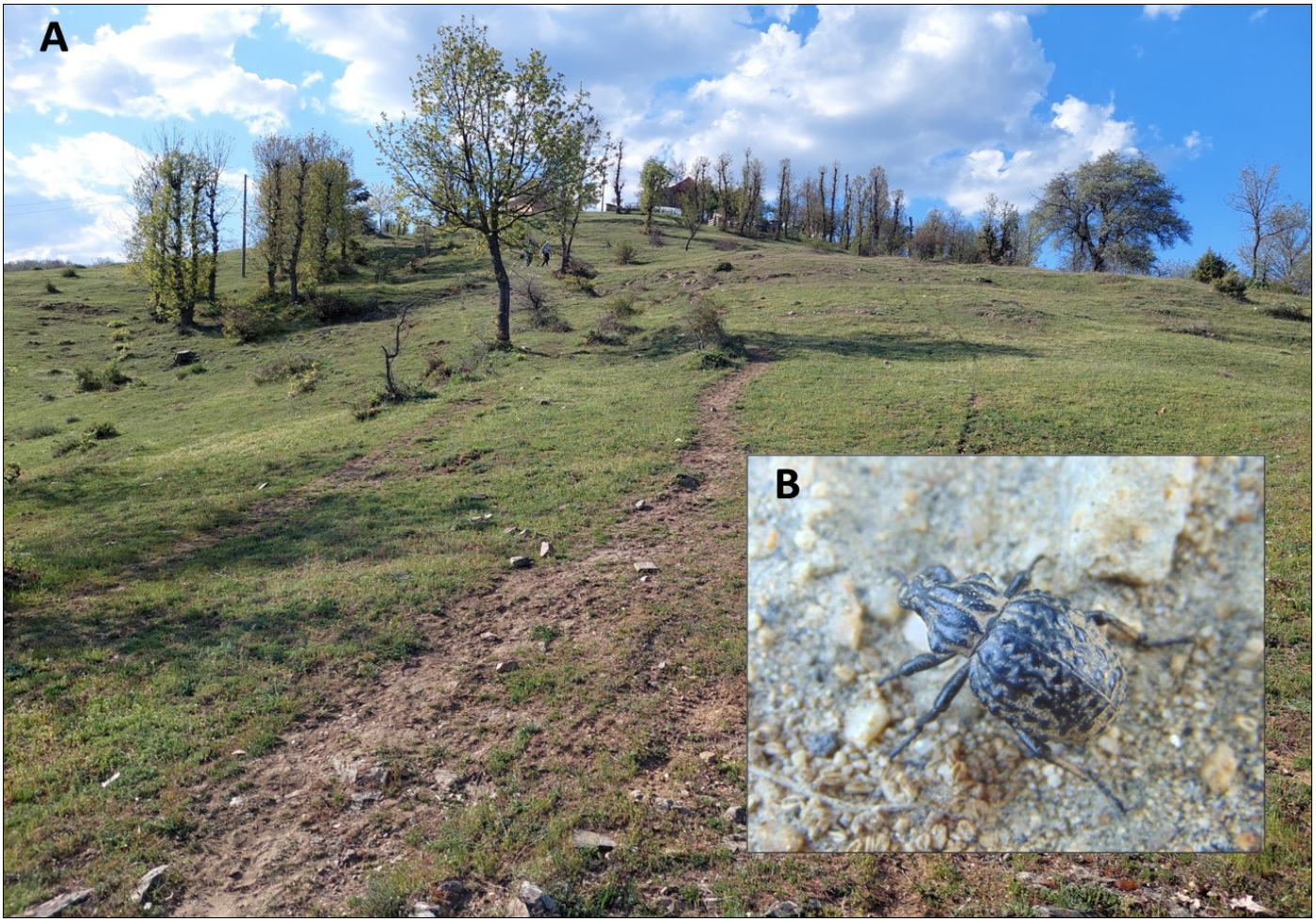

Fig. 6. *Brachycerus sinuatus*: A – habitat in Jablanica village, Starac Mt. (Photo S. Pešić, April 27, 2022); B – adult *in situ* photographed by I. Tot, May 18, 2021.

As the records of *B. sinuatus* are recent, and there is precise data on localities, we can cross-check these with other data in the literature about Pčinja (Nešić et al. 2018) and consider the ecological characteristics of its habitat. Due to the predominant presence of acidic silicate rocks in the area, acidic or weakly acidic brown soils dominate. The soil is a dry, warm, fine, sandy loam and consists mainly of coarse and fine sand particles, while there is less clay, which makes it loose, permeable to water, and well aerated. This is important to note due to the geophilic character of *Brachycerus* species.

Doubtful record from Serbia

***Brachycerus muricatus* Olivier, 1790**

Surprisingly, this species (known as a garlic weevil), with a total body length of 7-12 mm including rostrum (Skuhrovec et al. 2013), has been reported on Serbian territory only once, 132 years ago (Bobić 1891). As this is the only record of this species in Serbia, it is possible that it was a misidentification since this species inhabits the Mediterranean part of Europe (Alonso-Zarazaga et al. 2023). One of the synonyms for this species is *algirus* Fabricius, 1787, which is used in Zumpt's review, but among the confirmed localities on the Balkan Peninsula, none from Serbia were mentioned (Zumpt 1937). Adults of this species can live for two years and prefer *Allium* and *Muscari* species (Skuhrovec et al. 2013). All this should facilitate the recording and by this supports the assumption that it is a doubtful species.

In the first author's collection, there are also specimens collected outside of Serbia, in neighboring countries, so the following presents details of these records.

Records from the remaining Balkan Peninsula (outside of Serbia)

***Brachycerus undatus* Fabricius, 1798** (Fig. 8)

Brachycerus undatus is an 8 to 21 mm long weevil. It is a rather common species in southern Europe, and it is sometimes a pest on garlic, onion, and daffodil (*Allium* and *Narcissus* species; both Amaryllidaceae) (Espinosa et al. 1991, Skuhrovec et al. 2013). Germann (2003) reported about the successful breeding of *B. undatus* using the bulbs of *Drimia maritima* (L.) Stearn (= *Urginea maritima* (L.) Baker) from the Asparagaceae family and Hoffmann (1950) about feeding on the leaves of *Arum italicum* Mill. (Araceae), which shows the high adaptation power to new food resources and the use of (there are no records about a use of these plants for larval development in the wild). Novak (1952) confirmed *Allium sativum* L. (garlic) as a host plant of this weevil species at the Adriatic coast of Croatia.

Nonveiller (1984) processed the list of species recorded by the entomologist and mineralogist Ernst Friedrich Germar in 1817 during his trip to the Adriatic coast in 1811. The species *Brachycerus barbarus* Fabricius, listed under number 246, was later changed by Nonveiller (1984) to *B. barbarus* (Linnaeus, 1758). Today, this species is accepted as *B. undatus* Fabricius, 1798, because, as Nonveiller (1984) himself explained, the distribution of this species is as follows: "*B. barbarus* Linnaeus, 1758 je zapadno-mediteranska·vrsta, dok se na našem Primorju javlja *B. undatus*." // (= *B. barbarus* Linnaeus, 1758 is a western Mediterranean species, while *B. undatus* occurs on our* coast.) (*explanation: Yugoslavian coast).

The first author's collection contains the following specimens:

Croatia: Rovinj, Vilas Rubin, grass next to the garden, leg. S. Pešić: 2 specimens, 22/4/1987. (Fig. 8A).
Montenegro: Podgorica, 1 specimen, leg. G. Karaman, 11/1993. (Fig. 8B left).
Greece: Arkadia, Megalopoli, leg. Nastas Ilić: 1 specimen, 2/5/1995. (Fig. 8B right).

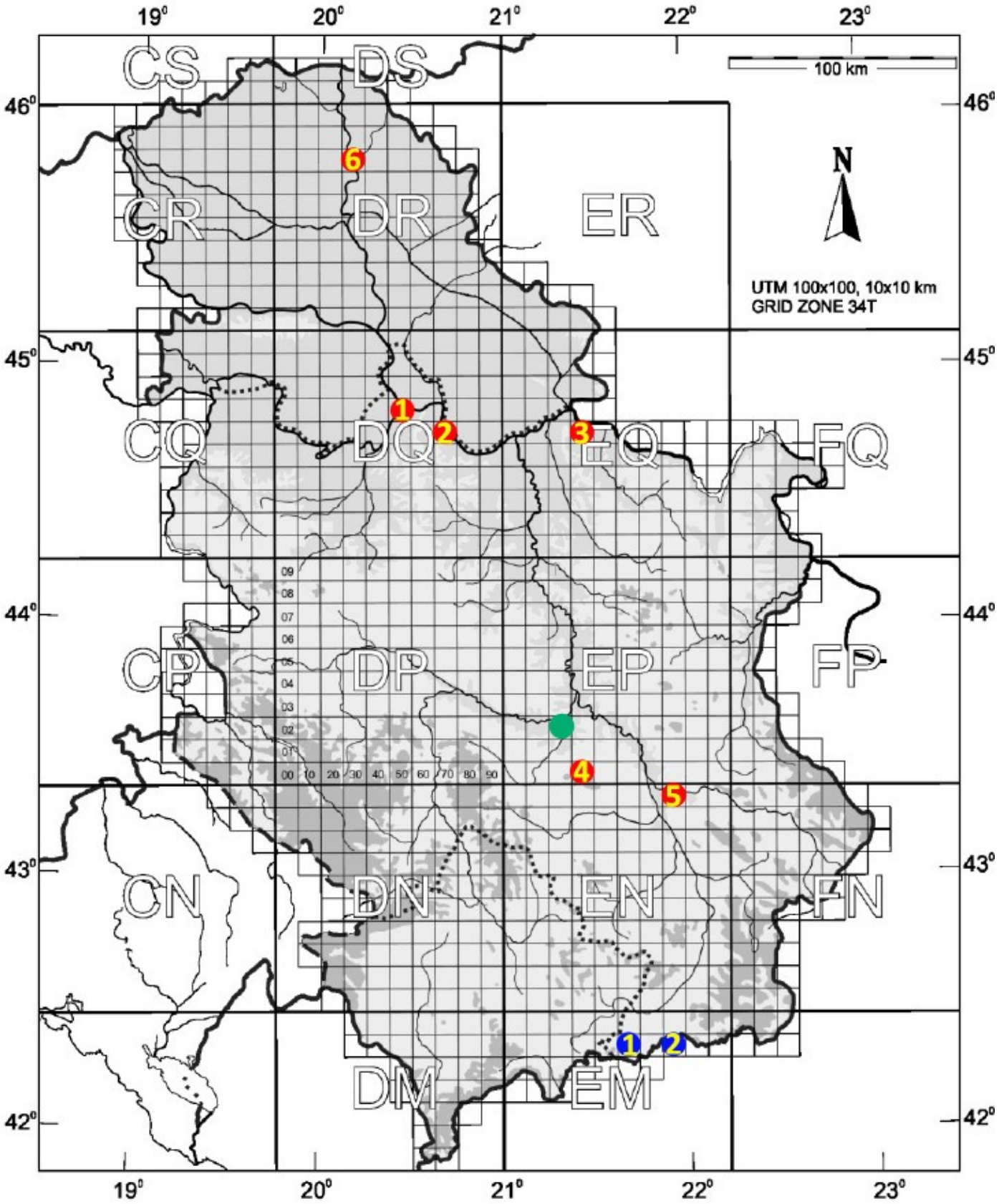

Fig. 7. UTM map of Serbia with marked positions of finding places of *Brachycerus foveicollis* (red dots), *B. sinuatus* (blue dots), chronologically numbered by recording date, and the doubtful record of *B. muricatus* (green dot).

Fig. 8. *Brachycerus undatus* – specimens from the author's collection: A – collected in Croatia; B – collected in Montenegro (left) and Greece (right). (Photo S. Pešić, October 2023)

Records from other regions (outside of the Balkans)

***Brachycerus aegyptiacus* Olivier, 1807** (Fig. 9)

This weevil, 9-20 mm long as an adult (Skuhrovec et al. 2013), is present in Europe in Italy, Croatian part of Dalmatia, and Greece (on the island of Crete). It also inhabits several Middle Eastern countries - Egypt, Cyprus, Turkey, Israel, Lebanon, Jordan, and Syria (Friedman & Sagiv 2010, Alonso-Zarazaga et al. 2023). Until now, the only known host plant of this weevil is *D. maritima* (Asparagaceae: Scilloideae) (Friedman & Sagiv 2010), which is frequently seen on the sandy beaches of Crete (Fig. 9 C & D).

The following records of this species have not been published so far. They are based on material from the first author's collection, originating from **Greece**: Kreta (=Crete), Iraklion (=Heraklion), leg. Nastas Ilić: 2 specimens, 22/12/1993; 4 specimens, 30/12/1993; 1 specimen, 3/1/1994; 1 specimen, 7/1/1994; Kreta, Galatu, s. Gergeri, 450 m, leg. N. Ilić: 2 specimens, 26/12/1993.

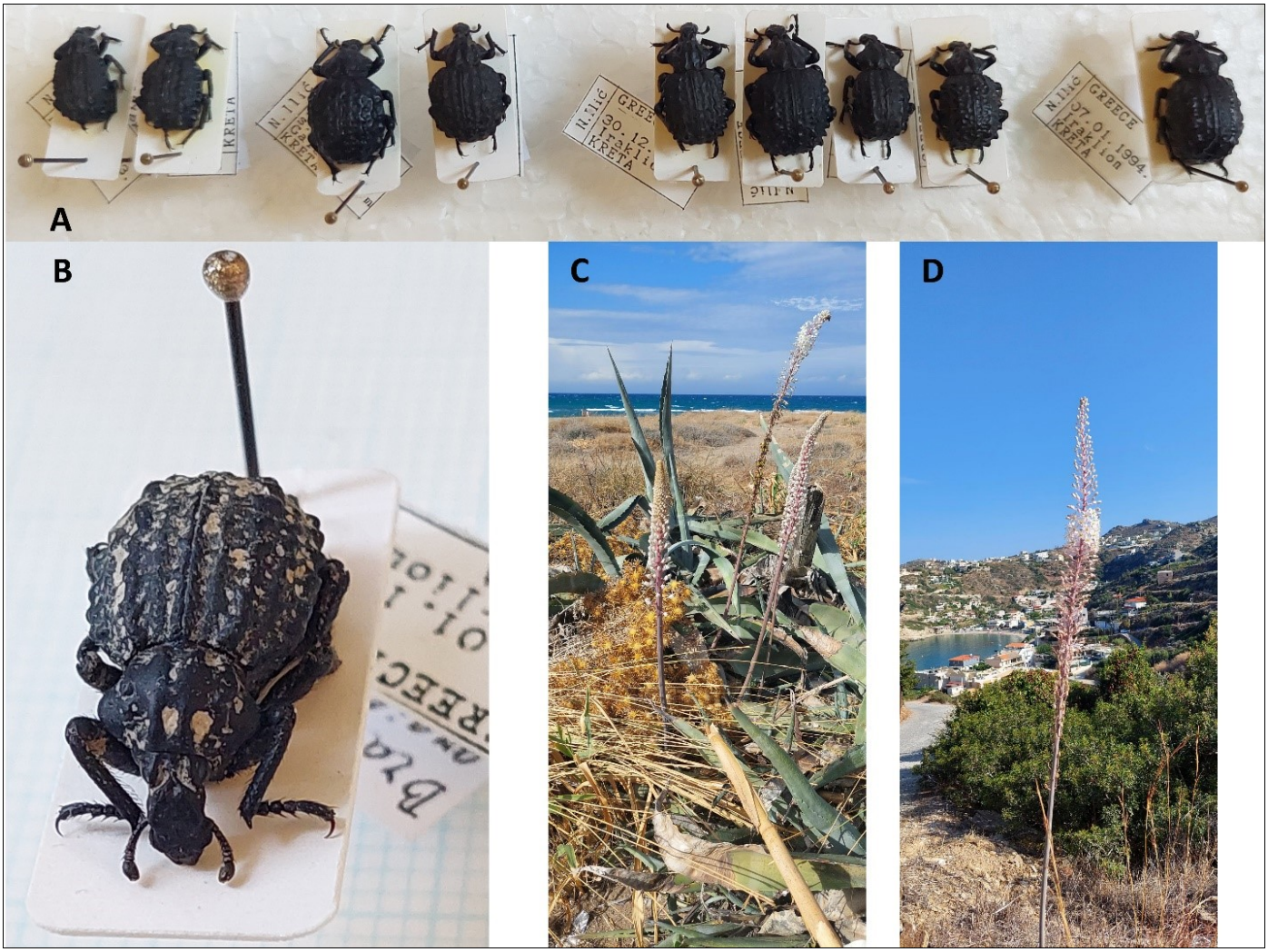

Fig. 9. *Brachycerus aegyptiacus*: A and B – specimens from author's collection; C – Ammoudara beach and D – Ligaria, possible habitats with *Drimia maritima* in Crete, Greece. (Photo S. Pešić, October 2023)

Discussion

Mode of life

In areas where people plant geophytes for cultivation some species of this genus have the potential to become noxious, and this was usually the main reason to study their biology (e.g., Hoffmann 1963). The oviposition mode for *Brachycerus* spp. is ectophytic in soil (Marvaldi 1997). The literature on Brachycerinae indicates that they are closely associated with geophytes (Hickman et al. 2017). Larval development takes place in the soil or inside the bulbs and tubers of plants of the Liliaceae (in a wider sense, including Asparagaceae, Asphodelaceae), Amaryllidaceae, and Orchidaceae (Osella et al. 1998, Podlussány 2007, Colonnelli et al. 2016; Elmetwaly & Hamed 2019).

Ecological role

Brachycerus species prefer arid climates (Procheş 2003), which are led by the world's arid biodiversity hotspot in southern Africa. The South African *Brachycerus* host plants from the genera *Haemanthus*, *Boophone* (both Amaryllidaceae), *Ornithogalum*, and *Albuca* (both Asparagaceae) grow on rocky outcrops in thickets (where they are protected from enemy rodents, mole-rats) (Procheş 2003). On the other hand, adult *Brachycerus* beetles have fused elytra and are capable only of crawling on the ground (Procheş 2003), using geophytes as their primary food source (Hickman et al. 2017), or *Aloe* sp. (Asphodelaceae) such as *B. interstitialis* (Louw 1998). The combination of their geophyte host plants that prefer a dry climate, hot areas, usually semidesert treeless landscapes, their extremely hard cuticula that prevents desiccation and the limited movement of these robust, flightless weevils resulted in restricted possibilities of biogeographical expansion limiting their distribution to the North, especially in Europe, and may explain their intensive speciation and highest global diversity in South Africa (Procheş 2003).

Centers of biodiversity

Africa is home for about 500 *Brachycerus* species (Louw 1990), and South Africa is the world's primary center of *Brachycerus* biodiversity (Osella et al. 1998, Hickman et al. 2017).

Hickman et al. (2017) concluded that the Mediterranean part of the Palaearctic (with 1-10 *Brachycerus* species present per country) is the second diversity center of this genus, as it hosts several genera of geophytes that prefer a Mediterranean climate. This area includes the southern parts of the Balkan Peninsula, including southern parts of the former Yugoslavia. Osella et al. (1998) represented an interesting parallel between Mediterranean and Southern African Curculionoidea fauna with the important place of *Brachycerus* with cited 38 and 254 taxa, respectively.

Brachycerus biodiversity and distribution on the Balkans and adjacent regions

The species number drastically increases from the North to the South. The northernmost points of discovery in Europe are for the species *B. foveicollis* in Austria, the Czech Republic, Moldavia, and Ukraine (Alonso-Zarazaga et al. 2023). In Hungary, Serbia's northern neighbor, just this species, developmentally dependent on *Muscari* and *Ornithogalum*, recorded as rare, was collected during April and May (Podlussány 2007). With its two above-confirmed *Brachycerus* species, Serbia fits exactly into the picture of the gradation of biodiversity of this genus from north to south, which coincides with the climatic picture of

the Old World, following a dry and warm climate. Two species for each are confirmed for Serbia's southern neighbors Albania and North Macedonia, while their neighbor Greece is inhabited by the remarkable number of 12 species, and only one of them (*B. graecus* Zumpt, 1937) has not been recorded on any island (Germann et al. database 2023). Crete, the southernmost part of Greece, and equipped with 7 species, is the richest *Brachycerus* biodiversity point of this country (Germann et al. database, 2023). 4 *Brachycerus* species live on the island of Sardinia (Colonnelli et al. 2011), although it is almost three times bigger than Crete, which is located five degrees of latitude further south (Germann et al. 2023). Italy is inhabited by 11, and Spain by 9 species.

A preliminary list of 12 *Brachycerus* species and 4 varieties was given for the territory of Turkey (Lodos 1977), of which 13 species have been confirmed (Alonso-Zarazaga et al. 2023), *B. orbipennis* and *B. lutulentus* were omitted. 10 species live in Israel (Friedman & Sagiv 2010), 7 each in Lebanon and Syria, 3 each in Armenia and Iran, 2 each in Turkmenistan and Yemen, and 1 in Saudi Arabia (Alonso-Zarazaga et al. 2023). Among the North African countries, the highest *Brachycerus* diversity is achieved in Morocco (13 taxa), in the Western Mediterranean region. The nearby states of Tunisia and Algeria have 11 and 9 taxa, respectively (Alonso-Zarazaga et al. 2023). In Egypt there are 8 species (Elmetwaly & Hamed 2019), in Libya 4, and on the Canary Islands 1 taxon on Fuerteventura (according to Stüben 2022) (Alonso-Zarazaga et al. 2023).

Such a richness of *Brachycerus* diversity is not surprising, given that the territory surrounding the Mediterranean Sea, the Mediterranean Basin, is one of the world's 35 biodiversity hotspots (Fig. 10; Mittermeier et al. 2011; IUCN 2017) with insects possibly underestimated at 150,000 species (Hewitt 2011). It includes the Balkan Peninsula, which may be a particularly rich region in terms of species and palaeoendemics in the Basin thanks to its position at the intersection of two large landmasses, Eurasia, and Africa (Derneği et al. 2010).

Presence in Yugoslavia and Serbia

Lodos (1977) mentioned Yugoslavia* as the place of distribution of five species (*algirus* F., *junix* Li., *lutosus* Gyll., *sinuatus* Ol., and *undatus* F.), of which the presence of one species for Serbia (*sinuatus*) and one for Croatia (*undatus*) is confirmed in this work. On the other hand, this work, documented for the first time the presence of *B. undatus* established in Montenegro. The species *B. muricatus* Ol. (synonym of *algirus* F.) lives in Croatia as well as in Bosnia and Herzegovina; for *Brachycerus junix* there is a Macedonian, and for *B. lutosus* a Montenegrian record (Alonso-Zarazaga et al. 2023). Currently, the first author's collection contains neither specimen of these two species.

*At that time, Yugoslavia consisted of Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, and Serbia.

According to Friedman & Sagiv's (2010) summary of *Brachycerus* characteristics, the two Serbian certain representatives (*B. foveicollis* and *B. sinuatus*) and Dalmatian *B. aegyptiacus* (= *B. junix*) belong to the *aegyptiacus* group, with a predominantly Ponto-Mediterranean distribution. *Brachycerus undatus* is part of another group of species, including the Dalmatian *B. albidentatus, B. lutosus* (from Bosnia and Herzegovina), and other species mainly distributed in the Western Mediterranean area; *B. muricatus* (=*algirus*) belongs to the *argillaceus* group, distributed around the Mediterranean. This is yet another testimony of the interweaving of different faunal influences on the Balkan Peninsula.

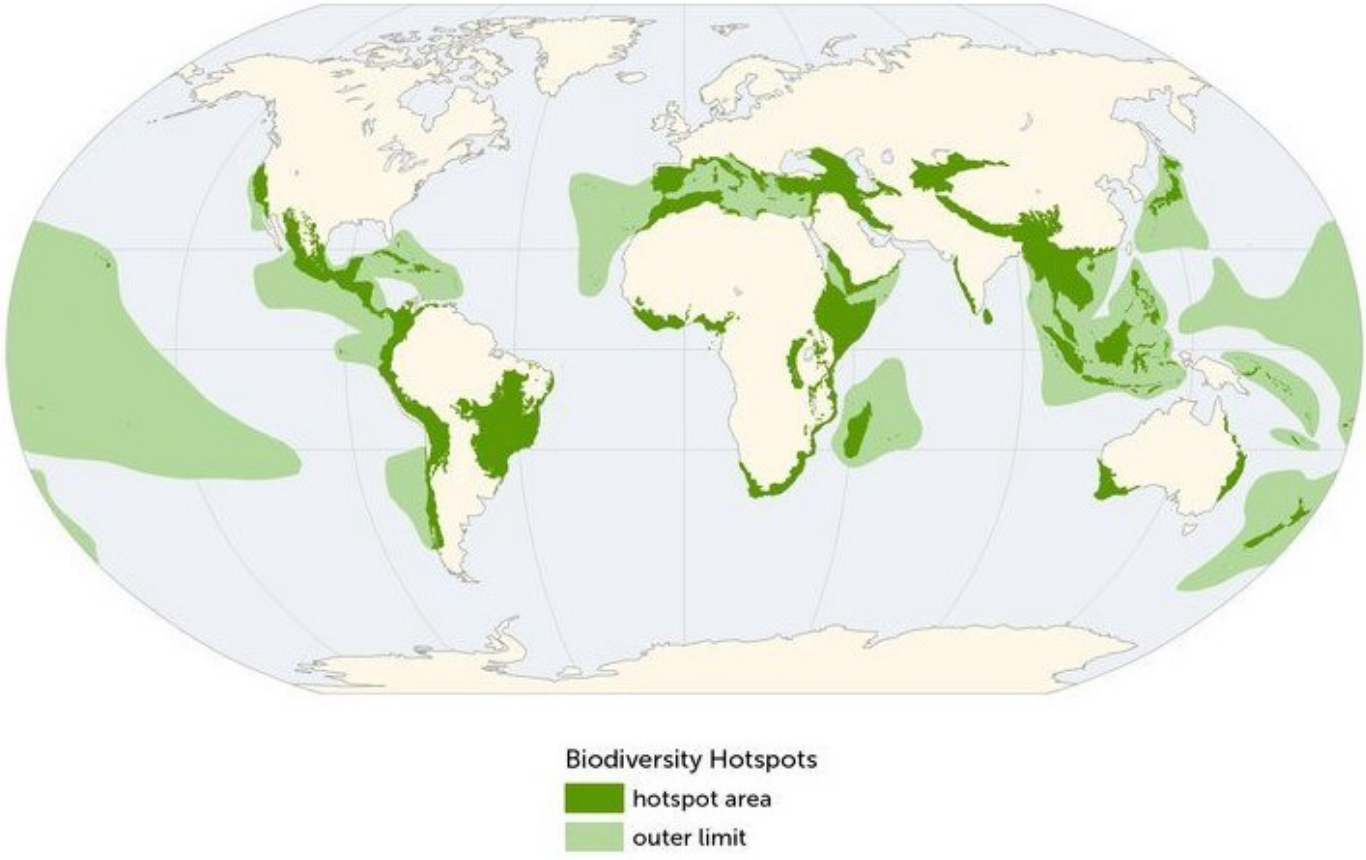

Fig. 10. Map of biodiversity hotspots in the world. (Mittermeier et al. 2011)

Serbia belongs to the Balkan Peninsula, but not to the Mediterranean Basin biodiversity hotspot; it borders its northern edge (Fig. 10). However, the map of "Threatened species richness for terrestrial species in Mediterranean basin", published by the IUCN Red List (2008), covers a much wider territory, including the whole of Serbia, which points to the possibility of joining at least the southern part of Serbia to the Mediterranean biodiversity hotspot. Therefore, the intensification of faunal research is of primary biogeographic and conservation importance in this part of Europe. This work is a modest contribution to achieving that goal.

Pčinja Valley is home to a corridor of Mediterranean species that expand their range to the north (Nešić et al. 2018), which is obviously the situation with *B. sinuatus*, too.

Pests or not? (Economic role)
Some species were known as agricultural pests in several countries of Southern Europe and Northern Africa (Hoffmann 1963, Lodos 1977). The Digital library of the Centre for Agriculture and Bioscience International (CABI) cites three of them: *B. albidentatus* as the onion weevil, and *B. muricatus* and *B. undatus* as garlic weevils (https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.9895), but without giving any details about the current significance. There is no more recent information (from this century) that *Brachycerus* species are serious pests in Europe because of the widespread use of pesticides that have reduced the presence of flightless pest species especially in economic cultures remarkably in most countries. Previously, *Brachycerus muricatus* and *B. undatus* were reported to be horticultural pests of tulip, *tassel hyacinth,* and narcissus cultivations in Italy, France, Turkey, Morocco, and Algeria (Lodos 1977). These two species were also included in the list of introduced *Allium* pests in New Zealand (Ministry for Primary Industries New Zealand, 2024, page 61). Recently, there is also the South African species *B. citriperda* registered as an introduced pest that feeds on *Citrus*, *Fortunella* and *Poncirus* (Ministry for Primary Industries New Zealand 2021: pages 105, 170 and 291, respectively). It shows at the same time that adults of certain species can use other than host plants for the weevils' nutrition. A few species are regarded potential biocontrol agents of *Asparagus* weeds (Asparagaceae) in Australia (Kleinjan & Edwards 2006).

Threat and potential indicator value
Due to strong knowledge deficits in the group of weevils mainly caused by lack of the active field entomologists for decades (Louw 1998) none of the *Brachycerus* species is included on the IUCN list of threatened species, which shows a strong deficit of knowledge rather than a lack of threats. For *Brachycerus* species main risk factors are similar as for many other insects such as habitat change intensification, fertilization, failure of grazing, and use of insecticides and so on. Taking into account that *Brachycerus* species are rather slow-moving, large, wingless weevils, that prefer habitats with sparse vegetation cover, which are usually rich in geophytes, most *Brachycerus* weevils have potential indicator function for natural open landscapes with low degree of fertilization and great species richness, even if present in medium or high abundance (which was up to now never seen in Serbia). *Brachycerus* species probably need long time for repopulation/re-colonization if once eradicated from a site, even if disjunct or local populations are affected. Findings of *Brachycherus* in Serbia are sporadic, especially of *B. sinuatus,* and should receive some degree of protection. But for now, this species could be treated as a Data Deficient. Up to now, it was found in passive, economically poorly developed parts of Serbia, so there is hope that it will manage to maintain itself in those natural habitats.

Conclusion

Brachycerus species are developmentally dependent on geophytes and soil characteristics like those in the south and the steppe areas of Serbia. This paper confirms the existence of two species, *Brachycerus foveicollis* and *B. sinuatus*. In the current warnings of experts and agricultural companies, no species of *Brachycerus* is mentioned as a pest of garlic, onion, tulip, lily, or daffodil in Serbia. Does this mean that these insects are absent from Serbia, overlooked, or that they were reduced by the application of insecticides or by other reasons and that they are practically invisible for land users and crop protectors?
The possible presence of *B. muricatus* (garlic weevil) in Serbia should be checked, not only because of an old record, but also because it lives in neighboring countries, Croatia and Bosnia and Herzegovina.

The current records suggest that the southern region of Serbia could be a northern extension of the Mediterranean Basin Biodiversity Hotspot. This statement should be confirmed by data collecting and cross-checking of available records, especially from other flightless weevil groups.

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