



A Further New Steppe Ground Beetle Species for the Bulgarian Fauna: *Amara (Parapercosia) taurica* (Motschulsky, 1845) (Coleoptera: Carabidae) Appeared in the Karst Refugium of the Chepan Planina Mountain

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Abstract: *Amara (Parapercosia) taurica* (Motschulsky, 1845) (Coleoptera: Carabidae) is a rare ground beetle found sporadically through the virgin steppes of Southeastern Europe, Caucasus, Turkey, Kazakhstan and the south of Western Siberia. This study reports the first record of this steppe species in Bulgaria. One male specimen was collected by a pitfall trap in the Chepan Planina Mountain (part of the Western Stara Planina Mts.) in central-western Bulgaria, in the period July–September 2023. In addition, 14 other members of the family Carabidae were found during the same study. Of them, *Cymindis axillaris* is recorded for the first time from the Western Stara Planina Mts. This study is also the second record of *Ophonus parallelus* in the Stara Planina Mts. The relatively low anthropogenic pressure in the studied habitat and the adjacent areas is believed to be a crucial factor for the survival of vulnerable steppe elements, including *A. taurica*.

Key words: *Amara taurica*, Carabidae, new record, Bulgaria, steppe fauna

Introduction

The tribe Zabrinini Bonelli, 1810 is one of the largest, most diversified, widespread and species-rich groups of the family Carabidae. Representatives of its largest genus *Amara* Bonelli, 1810 (623 species) are often dominant in various, mostly open, habitats (e.g., TEOFILOVA 2021). The subgenus *Parapercosia* Tschitschérine, 1899 includes only one species, *Amara (Parapercosia) taurica* (Motschulsky, 1845) (HIEKE 2011a, 2017). *Amara taurica* is a rare, typical dweller of residual virgin steppes of South-eastern Europe, Caucasus, Turkey, Kazakhstan and the south of Western Siberia (KRYZHANOVSKIJ 1983, PUTCHKOV 2012, HIEKE 2017). It was initially collected and described (as *Celia taurica*) from the “Tauride”

(Crimea) (MOTSCHULSKY 1845). In the recent past, *A. taurica* was considered an endemic of grasslands (“yaylas”) of the Crimean (“Tauric”) Mountains (PETRUSENKO & PETRUSENKO 1968). Later, KRYZHANOVSKIJ et al. (1995) summarised the data on its distribution as “Southern Russian Plain, Ciscaucasia, the Caucasus Major, Southern West Siberia, plains of Kazakhstan and southern and southwestern Altai”. It is also reported from the border areas between Europe and Asia, in the Republic of Bashkortostan (BAYANOV et al. 2015). PUTCHKOV (2011, 2012, 2018) studies the ecology and distribution of *A. taurica* in Ukraine and defines it as an inhabitant of steppes in the southern subzone of left-Dnieper-bank (eastwards), northern subzone of the forest-steppe zone of left-Dnieper-bank (south-east) and steppes

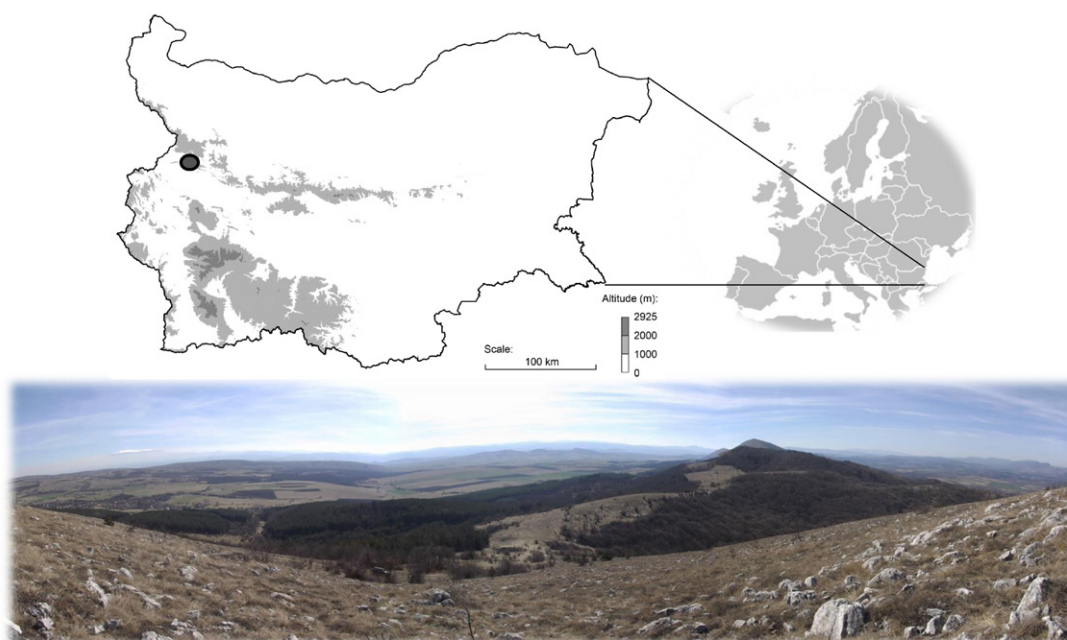


Fig. 1. Location and view of the sampling site where *Amara taurica* was collected, with the highest point of the Chepan Planina Mountain (Petrovski Krast Peak) at the back.

of Crimean Peninsula, including Crimean Mountains (with south-eastern coastal beach) (all in SE Ukraine). In Greece, the species is known from only one locality, in the Chelmos Mt., the Peloponnisos (HIEKE 2011b). Although *A. taurica* is relatively widespread, it is always rare and found with single catches (FOROSCHUK 2011, HIEKE 2011b, PUTCHKOV 2012, TILLY 2012, KOMAROV, online).

In Bulgaria, ground beetles are relatively well studied. Nevertheless, the knowledge about Bulgarian carabid fauna is still being complemented by various additions and contributions. Just recently, another typical steppe element from the genus *Amara*, *A. (Percosia) equestris pastica* Dejean, 1831, was confirmed for Bulgaria (TEOFILOVA 2023), and before that, the first country record of the rare and protected steppe indicator *Carabus (Tomocarabus) bessarabicus* Fischer von Waldheim, 1823 was reported (TEOFILOVA & KODZHABASHEV 2022).

The aim of this study is to present another steppe element, i.e. the ground beetle *Amara taurica*, recorded for the first time in Bulgaria, as well as to add some new data on its ecology and habitats conservation significance.

Materials and Methods

The material for this study was collected using pitfall trapping between 13 March and 10 December 2023, during an investigation of the biodiversity in the Chepan Planina Mountain (part of the Western Stara

Planina Mts., Fig. 1). The pitfall traps were made out of cut 2 L plastic bottles, buried at the level of the ground surface and filled with 8% formaldehyde. Six traps were set in the chosen sampling site.

A single specimen of *Amara taurica* was collected in the period 18 July – 9 September 2023. It was determined by the author and the identification was also confirmed (based on photos) by Prof. Kirill Makarov (Moscow State Pedagogical University, Moscow, Russia). The beetle is stored in the author's collection at the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia.

The main identification features of *A. taurica* are the body shape and size, the chaetotaxy of the middle femora, prosternal process and sternites as well as the shape and characteristics of the pronotum (HIEKE 2011b, PUTCHKOV 2012).

The nomenclature is according LÖBL & LÖBL (2017).

Results

One male specimen of the ground beetle *A. taurica* was found in the eastern part of the Chepan Planina Mt. in central-western Bulgaria, thus showing the presence of this species in the country.

Systematics

Family Carabidae Latreille, 1802

Subfamily Harpalinae Bonelli, 1810 (or Pterostichinae Bonelli, 1810 in some classifications)

Tribe Zabrinini Bonelli, 1810

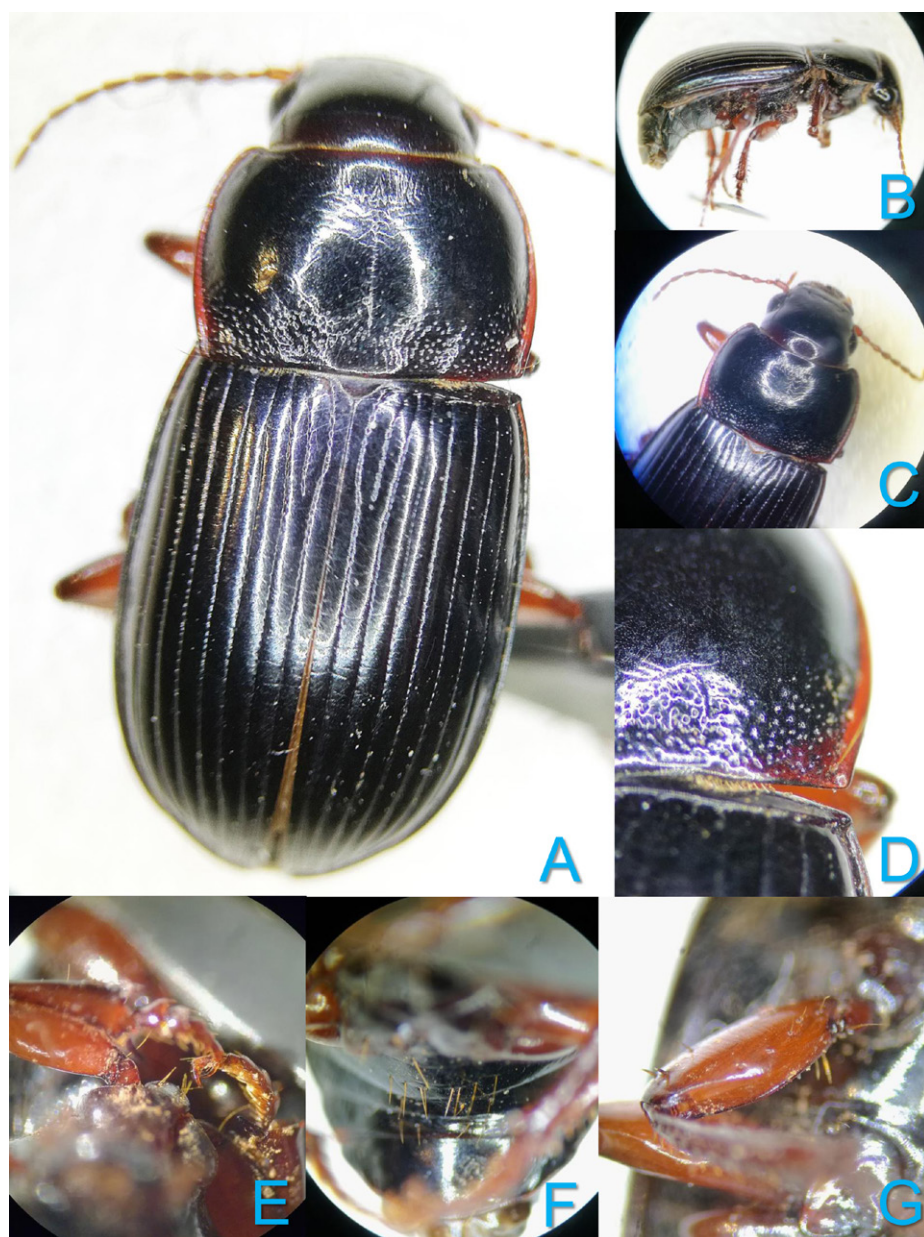


Fig. 2. Habitus (A), lateral view (B), head and pronotum (C), pronotal base and posterior angle, and elytral humeral tooth (D), chaetotaxy of the prosternal process (E), chaetotaxy of the abdominal sternites (F) and ventral view with chaetotaxy of the middle femora (G) of the specimen of *Amara taurica* from Bulgaria (various magnifications).

Genus *Amara* Bonelli, 1810 (Sun beetles)

Subgenus *Parapercosia* Tschitschérine, 1899

***Amara (Parapercosia) taurica* (Motschulsky, 1845)**

Synonyms: *Celia taurica* Motschulsky, 1845; *Percosia timida* Motschulsky, 1844; *Zabrus cognatus* Chaudoir, 1846; *A. (Parapercosia) suwortzewi* Tschitschérine, 1899; *Z. matthiesseni* Reitter, 1913; *Z. fallaciosus* Müller, 1946; *Z. altaicus* Jedlička, 1957 (FREUDE 1986, KRYZHANOVSKIJ et al. 1995, HIEKE 2011a, 2017).

New data

Bulgaria, Chepan Planina Mt., NE Malo Malo-

vo Vill., 42°57'N, 23°04'E, 1016 m a.s.l., dry stony slope with single bushes, at southern exposure (Fig. 1), pitfall trap, leg. T. Teofilova & N. Kodzhabashev, 1♂ (Fig. 2), 18 July – 9 September 2023.

During the present study, other 14 carabid species (570 specimens) were captured in the pitfall traps, along with *A. taurica* (Table 1). Of them, *Cymindis axillaris* (Fabricius, 1794) is reported for the first time from the region of the Western Stara Planina Mts. This is also the second record of *Ophonus parallelus* (Dejean, 1829) in the whole Stara Planina Mts. after TEOFILOVA & KODZHABASHEV (2022).

Table 1. Carabid species collected together with *Amara taurica* in the same sampling period (dry summer) and through the whole period of sampling (13 March – 10 December 2023)

Species	Number of specimens for the studied periods					%
	13 March– 15 May	15 May– 18 July	18 July– 9 Sept.	9 Sept.– 10 Dec.	Total	
	Humid spring	Humid summer	Dry summer	Dry autumn		
<i>Calathus</i> (<i>Calathus</i>) <i>distinguendus</i> Chaudoir, 1846	3	6	75	198	282	49.4
<i>Carabus</i> (<i>Tomocarabus</i>) <i>convexus</i> Fabricius, 1775	73	28		6	107	18.7
<i>Carabus</i> (<i>Procrustes</i>) <i>coriaceus</i> Linnaeus, 1758		2	10	49	61	10.7
<i>Carabus</i> (<i>Pachystus</i>) <i>cavernosus</i> I. Frivaldszky von Frivald, 1838	1	18	7	24	50	8.8
<i>Pterostichus</i> (<i>Feronidius</i>) <i>incommodus</i> Schaum, 1858		29	8		37	6.5
<i>Laemostenus</i> (<i>Pristonychus</i>) <i>terricola</i> (Herbst, 1784)	1		4	11	16	2.8
<i>Myas</i> (<i>Myas</i>) <i>chalybaeus</i> (Palliard, 1825)		3		1	4	0.7
<i>Harpalus</i> (<i>Harpalus</i>) <i>caspius</i> (Steven, 1806)		3			3	0.5
<i>Cymindis</i> (<i>Cymindis</i>) <i>axillaris</i> (Fabricius, 1794)				2	2	0.3
<i>Harpalus</i> (<i>Harpalus</i>) <i>subcylindricus</i> Dejean, 1829	2				2	0.3
<i>Harpalus</i> (<i>Harpalus</i>) <i>tardus</i> (Panzer, 1796)		2			2	0.3
<i>Philorhizus</i> <i>notatus</i> (Stephens, 1827)				2	2	0.3
<i>Amara</i> (<i>Parapercosia</i>) <i>taurica</i> (Motschulsky, 1845)			1		1	0.2
<i>Ophonus</i> (<i>Metophonus</i>) <i>parallelus</i> (Dejean, 1829)		1			1	0.2
<i>Trechus</i> (<i>Trechus</i>) <i>quadristriatus</i> (Schrank, 1781)				1	1	0.2
Total number of specimens	80	92	105	294	571	

Discussion

Morphological data

Amara taurica is a distinct species and it is not very likely to be misidentified. According to MOTSCHULSKY (1845), it looks very similar to Central and North American *A. insignis* Dejean, 1831 and *A. californica* Dejean 1828, but differs in the shape of its corselet (prothorax). Very similar to *A. taurica* is also *A. equestris pastica*, which has a pronotum of different shape (with distinct fovea and very weak punctuation of the base), acute angled denticle at the elytral shoulder and its abdominal sternites have only two (rarely three) setiferous punctures (PUTCHKOV 2012).

The identified specimen of *A. taurica* possesses all taxonomic characteristics specific to the subgenus and species (MOTSCHULSKY 1845, HIEKE 2011b, PUTCHKOV 2012): plump zabroid beetle with convex body; black, with bluish sheen; 12.0 mm long; antennae, palps and legs red-brown; pronotum transverse, short and broad, hardly constricted towards anterior margin, with indistinct foveae, densely punctate base and sides and slightly obtuse, rounded at the top hind angles; prosternal process margined and with eight setae; posterior margin of

mesofemora with five setae; abdominal sternites 3–5 with eight, four and five setiferous punctures in the middle, respectively; shoulder denticle small, almost rectangular.

Distribution

According to the last edition of the Catalogue of the Palaearctic Coleoptera, the current range of *A. taurica* covers Croatia, Albania, Greece, Ukraine, Central European and the South European territory of Russia, Turkey, Armenia, Georgia, Iran, West Siberia, Kazakhstan and Turkmenistan (HIEKE 2017). However, the record from Croatia seems doubtful, while that from Albania has been discussed as possibly wrong or doubtful (see GUÉORGUEV 2007). This outlines the current finding as the probable most western documented locality of the species. The significance of the studied region in Western Bulgaria as a possible refugium of vulnerable steppe fauna has already been noted along with the recent discovery in the country of the rare steppe species *Carabus bessarabicus* (from the Chepan Planina Mountain and Tri Ushi Mountains) (TEOFILOVA & KODZHABASHEV 2022) and *A. pastica* (from the Golo Bardo and Tri Ushi Mountains) (TEOFILOVA 2023).

Ecological data

According to the literature, *A. taurica* is a rare or very rare (with single catches or occasionally collected at light), mesoxerophilic typical virgin steppes' dweller (FOROSCHUK 2011, PUTCHKOV 2012, TILLY 2012, KOMAROV, online). PRISNYI et al. (2010) define *A. taurica* as an "eastern steppe species, probably previously unidentified due to its rarity". Confirming this rarity, FOROSCHUK (2011) found it in only one of the studied localities in the Streltsovskaya Steppe site. In accordance with that, although our whole research continued for almost three years, including about 30 suitable habitats (sampling sites), we hardly managed to collect only one specimen of *A. taurica*.

The species is poorly studied but it is most probably nocturnally active zoophytophagous element with spring-summer activity and overwintering imago (PUTCHKOV 2012). Our collection period was between 18 July and 9 September but this is not a precise time span allowing accurate phenological conclusions, especially based on a single specimen.

The species has been previously collected at 900–980 m a.s.l. in the border areas of the Tigirek Strict Nature Reserve (NW Altai), at latitude of about 50° (VOLYNKIN et al. 2011), which is comparable with our data: 1016 m a.s.l. at latitude of 42°.

Habitats where *A. taurica* has been found look quite similar. MAKAROV et al. (2009) collected it from semidesert steppe habitats in the environs of the Lake Elton. PRISNYI et al. (2010) report it from the "unique area of the northern Yamskaya Steppe" in northern Belgorod Region. FOROSCHUK (2011) found it on ordinary chernozem soils in Streltsovskaya Steppe (protected area consisting of 100% fescue steppes, part of the Lugansk Nature Reserve). The species is also reported as haloxene, from trap collections in the Steppe Zavolzhye of Samara Oblast (TILLY 2012). It has also been found in Belgorod Region during a study of the possible expansion (or, eventually, recovery) of the ranges of some steppe species, including protected *Carabus (Pachystus) hungaricus* Fabricius, 1792 (PRISNYI et al. 2013). The biotope of *A. taurica* in Bulgaria is not a typical steppe but it has many features of such habitat. It is a xerothermophytic southern karst slope with some steppe herbaceous elements and single bushes (*Syringa vulgaris*, *Rosa*, *Crataegus*), mostly resembling the habitat type of the Subcontinental peri-Pannonic scrub (code 40A0 of the EU Habitats Directive, Annex I).

As previously reported, arable farming in natural steppes causes the decline in populations of their fauna as a whole, including most of the

rare and protected steppe species (see TEOFILOVA & KODZHABASHEV 2022, TEOFILOVA 2023). Main problems encountered in the steppe zones of Russia are: soil disruption due to oil and gas production and mining; soil erosion, secondary salinization and soil deflation; loss of productive land; ravine formation; deforestation and degradation of forests; deterioration of natural meadows; depletion and pollution of water resources and exhaustion of fish resources and commercial fauna; violation of the regime of specially protected areas; air pollution (CHIBILYOV et al. 2021). The low anthropogenic pressure in the studied habitat seems to be crucial for the survival of the vulnerable steppe species such as *A. taurica*, the recently-discovered in Bulgaria rare steppe species *Carabus hungaricus*, also known from the Chepan Planina Mt. (TEOFILOVA & KODZHABASHEV 2022) and *A. pastica* (TEOFILOVA 2023) as well as other steppe indicators such as *Carabus hungaricus* (TEOFILOVA & KODZHABASHEV 2022). All three species were collected in similar mesoxerophytic and stony habitats with vegetation consisting of many steppe grasses and single bushes and bush tussocks characterised by minimum or low human impact. The anthropogenic activities in the habitat of *A. taurica* are limited due to the stony substrate, steep slope and low humidity, preventing the grazing of farm animals or agriculture. This part of the mountain is also not very popular as a destination for tourists.

Community relationships

Ten of the 14 carabid species captured together with *A. taurica* in the pitfall traps (Table 1) were also present in the habitat where the other new for the Bulgarian fauna steppe species, *Carabus bessarabicus*, was collected (TEOFILOVA & KODZHABASHEV 2022). These were *Calathus distinguendus*, *Carabus cavernosus*, *C. coriaceus*, *C. convexus*, *Harpalus caspius*, *H. tardus*, *Laemostenus terricola*, *Ophonus parallelus*, *Philorhizus notatus* and *Pterostichus incommodus*. Five species (*C. distinguendus*, *C. cavernosus*, *C. coriaceus*, *H. subcylindricus* and *L. terricola*) were also found in the biotopes where the second recently reported for Bulgaria steppe ground beetle, *A. pastica*, was collected (TEOFILOVA 2023). In the present study, *Calathus distinguendus* and *Carabus cavernosus* were present during all four sampling periods. *Calathus distinguendus* was also dominant (almost superdominant, with 49% of the total numbers) during the whole sampling period, and superdominant (71%) for the period when *A. taurica* was collected. This species was superdominant in both sites where *A. pastica* was collected, too (TEOFILOVA 2023).

Amara taurica is considered rare or very rare (e.g. PRISNYI et al. 2010; PUTCHKOV 2012) and the present study confirms that fact. For the whole nine-month period of research, its single catch represented 0.2% of all 571 collected specimens; for the period, when it was collected this number was 0.96%. Certainly, a calculation based on one specimen is not very relevant but still it gives some information about species abundance. Only future studies would give more clear vision about the ecology of *A. taurica*.

Conclusions

Ongoing faunal and ecological studies continue to bring additions and contributions to the knowledge of ground beetles in Bulgaria. This paper represents the first record of the steppe ground beetle *A. taurica* in Bulgaria. The new records of rare or stenotopic animals, such as the one presented here, could aid their and their habitats' conservation. Despite the fact that *A. taurica* has relatively wide distribution – from Altai to Greece and Albania and its occurrence in Bulgaria was very likely (Kirill Makarov, pers. comm.), the finding of this rare throughout its range species, is quite important. The presence of other rare steppe indicators, such as *Carabus bessarabicus*, *Carabus hungaricus* and *Amara pastica*, shows once again the significance of the region where they were found – Chepan Planina Mountain. The survival and preservation of the vulnerable steppe fauna (as a whole, not only the ground beetles) seems strongly dependant on the preservation of the specific steppe refugia, which in Bulgaria are very scattered but still existing in some areas with low or no anthropogenic load. Therefore, these refugia should be of prime conservational importance.

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References

- BAYANOV M. G., KNISS V. A. & KHABIBULLIN V. F. 2015. Catalogue of animals of Bashkortostan. Ufa: RIC BashSU. 348 p. (In Russian)
- CHIBILYOV (Jr.) A. A., MELESHKIN D. S. & GRIGOREVSKY D. V. 2021. The spatial analysis of landscape ecological stability and ecological security in the steppe regions of Russia. *Acta Biologica Sibirica* 7: 593–607. <https://doi.org/10.3897/abs.7.e78450>
- FOROSCHUK P. V. 2011. Specific composition and belonging to biotopes of ground-beetles (Coleoptera: Cicindelidae, Carabidae) of Lugansk Nature Reserve. In: Pahomov A. E. (Ed.): Biodiversity and role of animals in ecosystems: extended abstracts of the VI international conference. Ukraine, Dnipropetrovsk: Dnipropetrovsk University Press, pp. 231–234.
- FREUDE H. 1986. Revisión der zur (?) Gattung “*Zabrus*” Clairville, 1806 gehörenden Arten mit Bestimmungstabellen (Col. Carabidae). *Atti del Museo Civico di Storia Naturale di Trieste* 39(1): 133–150.
- GUÉORGUIEV B. V. 2007. Annotated Catalogue of the Carabid Beetles of Albania (Coleoptera: Carabidae). Sofia–Moscow: PENSOFT Publishers. 200 p.
- HIEKE F. 2011a. Aktueller katalog der gattung *Amara* Bonelli, 1810. On-line-publikation, Stand: 1.II.2011, Berlin, 167 p. Available at: <http://download.naturkundemuseum-berlin.de/fritz.hieke/Amkatal.doc>
- HIEKE F. 2011b. Genus *Amara*. In: Arndt E., Schnitter P., Sfenthourakis S. & Wrase D. (Eds.): Ground Beetles (Carabidae) of Greece. Sofia–Moscow: PENSOFT Publishers, pp. 277–288.
- HIEKE F. 2017. Subtribe Amarina C. Zimmermann, 1832. In: Löbl I. & Löbl D. (Eds.): Catalogue of Palaearctic Coleoptera. Archostemata–Myxophaga–Adephaga. Vol. 1. Revised and updated edition. Leiden–Boston: Koninklijke Brill NV, pp. 794–828. <https://doi.org/10.1163/9789004330290>
- KOMAROV E. V. (online publication). Annotated list of ground beetles (Carabidae) of the Lower Volga region. Available at: <https://www.zin.ru/animalia/coleoptera/rus/carabvol.htm>. Accessed December 2023.
- KRYZHANOVSKIY O. L. 1983. Fauna of USSR. Coleoptera, 1, 2. Adephaga. Families Rhisodidae, Trachypachidae; family Carabidae. Leningrad: Nauka. 320 p. (In Russian)
- KRYZHANOVSKIY O. L., BELOUSOV I. A., KABAK I. I., KATAEV B. M., MAKAROV K. V. & SHILENKOV V. G. 1995. A checklist of the ground-beetles of Russia and adjacent lands (Insecta, Coleoptera, Carabidae), Series Faunistica № 3. Sofia–Moscow: PENSOFT Publishers. 271 p.
- LÖBL I. & LÖBL D. 2017. Catalogue of Palaearctic Coleoptera. Archostemata–Myxophaga–Adephaga. Vol. 1. Revised and updated edition. Leiden–Boston: Koninklijke Brill NV. 1443 p. <https://doi.org/10.1163/9789004330290>
- MAKAROV K. V., MATALIN A. V. & KOMAROV E. V. 2009. Fauna of beetles of the environs of Lake Elton. In: TISHKOV A. A. (Ed.): Animals of clayey semidesert in Transvolga region (fauna conspecta and ecological characteristics). Moscow: KMK Scientific Press, pp.95–134.
- MOTSCHULSKY V. I. 1845. Remarques sur la collection de Coleopteres russes de Motschulsky. *Bulletin de la Société Impériale des Naturalistes de Moscou* 18: 3–127.
- PETRUSENKO A. A. & PETRUSENKO S. V. 1968. The Mediterranean elements in the Carabidae (Coleoptera) fauna of Ukraine. *Vestnik Zoologii* 6: 47–52. (In Russian, English Summary)
- PRISNYI A. V., PRISNYI YU. A. & MUSINA A. V. 2010. Complex of ground-beetles of a reserved site “Yamskaya Steppe” and of beside located territories in a zone of influence of

- Lebedinsky ore-dressing combine. Nauchnye Vedomosti, Series Estestvennye Nauki 74 (10): 34–40.
- PRISNYJ A. V., NEGIN E. V. & PRISNYJ Yu. A. 2013. Dynamics of a regional climate within a century, microclimate and change of areas of insects. 2. New and little-known species of insects for Southern of Middle-Russian Upland. Nauchnye Vedomosti, Series Estestvennye Nauki 146 (22): 111–120.
- PUTCHKOV A. 2011. Ground beetles of the Ukraine (Coleoptera, Carabidae). In: Kotze D. J., Assmann T., Noordijk J., Turin H. & Vermeulen R. (Eds.): Carabid beetles as bio-indicators: biogeographical, ecological and environmental studies. ZooKeys 100: 503–515. <https://doi.org/10.3897/zookeys.100.1545>
- PUTCHKOV A. V. 2012. Ground beetles of the genus *Amara* Bonelli, 1810 (Coleoptera, Carabidae) in the fauna of Ukraine. Vestnik Zoologii 46 (5): 395–412. (In Russian)
- TEOFILOVA T. 2023. Confirmation of the presence of the steppe ground beetle *Amara equestris pastica* Dejean, 1831 (Coleoptera: Carabidae) in Bulgaria with notes on its taxonomic status. Zoology and Ecology 33(2): 152–157. <https://doi.org/10.35513/21658005.2023.2.6>.
- TEOFILOVA T. M. & Kodzhabashev N. D. 2022. *Carabus (Tomocarabus) bessarabicus* Fischer von Waldheim, 1823 (Coleoptera: Carabidae) – new steppe element for the Bulgarian fauna from the karst refugium of the Chepan Planina Mt. In Special Issue: Mega-Diversity of Beetle Species – Perspective on Taxonomy, Systematics, Morphological Evolution and Zoogeographical Patterns of Coleoptera (Arthropoda, Insecta). Diversity 14 (12): 1123, 11 p. <https://doi.org/10.3390/d14121123>.
- TILLY A. S. 2012. Ground beetles (Coleoptera, Carabidae) of saline soils on the Steppe Zone of Samara region. Izvestiya Samarskogo Nauchnogo Tsentra Rossiyskoy Akademii Nauk 14 (1): 125–131. (In Russian, English Summary)
- VOLYNKIN A. V., TRILKAUSKAS L. A., BAGHIROV R. T-O., BURMISTROV M. V., BYVALTSEV A. M., VASILENKO S. V., VISHNEVSKAYA M. S., DANILOV Yu. N., DUDKO A. Yu., DUDKO R. Yu., KNYSHOV A. A., KOSOVA O. V., KOSTROV D. V., KRUGOVA T. M., KUZNETSOVA R. O., KUZMENKIN D. V., LEGALOV A. A., LVOVSKY A. L., NAMYATOVA A. A., NEDOSHIVINA S. V., PERUNOV Yu. E., RESCHIKOV A.V., SINEV S. Yu., SOLOVAREV V. V., TYUMASEVA Z. I., UDALOV I. A., USTYUZHANIN P. Ya., FILIMONOV R. V., TSHERNYSHEV S. E., TSHESNOKOVA S. V., SHEIKIN S. D., SHCHERBAKOV M. V. & YANYGINA L.V. 2011. Invertebrates of the Tigirek Strict Nature Reserve (an annotated check-list). Proceedings of the Tigirek State Natural Reserve 4: 165–226.

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