Catalog of Georgian Earth-boring dung beetles (Coleoptera: Geotrupidae)

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Abstract

A summarized list of Georgian earth-boring dung beetles is given, together with Georgian names, distribution data, and suggestions for national red list status according to IUCN Red List categories and criteria.

Key words

Sakartvelo, South Caucasus, distribution, red list

Introduction

The earth-boring beetles (Coleoptera: Geotrupidae) are part of the order Coleoptera, with an approximate number of 350 species described worldwide (Schoolmeesters 2010). According to current classification, the family is divided into three subfamilies (Cunha et al. 2011; Nikolajev et al. 2016), of which only the Geotrupinaea are represented in Georgia (Dzambazishvili 1979; Nikolajev et al. 2016).

Georgia (69,700 km$^2$) is located in the center of the Caucasus biodiversity hotspot and harbors a diverse fauna (Myers et al. 2000). The entomofauna of Georgia has been studied for centuries. As the largest and most diverse order of animals, beetles are relatively well studied in Georgia (Tarkhnishvili et al. 2013; Mumladze et al. 2020). One of the first lists of beetles of the Caucasus was published by Radde (1899). However, the most significant work about Georgian earth-boring dung beetles is done by Yason Dzambazishvili, who provided rather comprehensive data on their distribution (Dzambazishvili 1979; 2000). Since these works, new distributional data have appeared in the public databases (Tarkhnishvili et al. 2013; GBIF 2023), social media (that proved to be a valuable tool for gathering data for Georgia (lankoshvili et al. 2021)), collections (see below), and knowledge of the country-scale distribution of earth-boring dung beetles has increased. The aim of this paper is to provide a list of earth-boring beetles, including updated distribution data and maps, and to evaluate the conservation status of Georgian representatives of the family according to IUCN Red List Categories and Criteria (IUCN 2012).

Materials and methods

The occurrences of Georgian earth-boring beetles were compiled from the papers of Dzambazishvili (1979; 2000) and Japoshvili et al. (2022), web-databases (Georgian Biodiversity Database (GBD) (Tarkhnishvili et al. 2013), Global Biodiversity Information Facility (GBIF) (GBIF Secretariat 2023), Zoological Institute of the Russian Academy of Science (ZIN) (https://www.zin.ru/Animalia/Coleoptera/eng/geotrupi.htm) and Ukrainian Biodiversity Information Network (https://ukrbin.com/) (UkrBIN 2022) and Dry collections deposited in Agricultural University of Georgia (EI-AUG), Zoological Institute of Ilia State University (ISUZI)
as well as personal collection of Dr. Giorgi Chaladze (CGC). In addition, previously unpublished original material recently collected within the framework of the Caucasus Barcode of Life (CaBOL; https://ggbc.eu/) project was also included. For the occurrence data without exact geographic coordinates (part of the literature data and collection material), I geo-referenced literature-based sampling locations using Google Earth Pro v. 7.3.6, with an estimated precision of 100 m. Guidelines of the International Union for Conservation of Nature (IUCN) were used to evaluate species conservation statuses for Georgia (IUCN 2012, 2019). The area of occupancy (AOO) is given based on a 10 km² grid cell count overlaid on the country’s territory, and the extent of occurrence (EOO) was estimated for only Georgia. Maps were made in QGIS Desktop 3.16.3. Photos of voucher specimens (Figs. 3 and 4) were taken using a Canon EOS 550D camera with a Canon EF 100mm f/2.8 Macro USM and a Raynox DCR-250 Super Macro Snap-On Lens. Specimens depicted in Figs. 4 and 7 were taken using a Canon EOS 60D camera with a Canon MP-E 65mm f/2.8 1–5x Macro Photo Lens mounted on a Novoflex Castel-L Focusing Rack. Digital images were prepared using Zerene Stacker image stacking software and Adobe Photoshop CS6. As for the rest of the voucher specimens, pictures of Maxim Smirnov (amateur entomologist and photographer, Ivanovo, Russia) were used (Figs. 2, 6, and 7).

The nomenclature is given according to the Catalogue of Palearctic Coleoptera (Nikolajev et al. 2016). Georgian names are proposed by the author.

**Results**

**Order Coleoptera Linnaeus, 1758**

**Family Geotrupidae Latreille, 1802**

**Geotrupes (Glyptogeotrupes) molestus** (Faldermann, 1836)

Georgian name. აბეზარა (ფრთაგლუვა) ფუნაგორია.

Global distribution. The species is generally distributed in the Caucasus. Out of Georgia, it is known from Armenia (Baraud 1992) and Turkey (Nikolajev et al. 2016; Rozner and Rozner 2009; Baraud 1992).

**Distribution in Georgia.** 1 ♀; Samtskhe-Javakheti region, Zekari pass; N41.81667°, E42.83333°; 1969 m a.s.l.; 14/15 June 2014; Leg. D Fominikh; ZIN (Fig. 2A).

IUCN red list status. NE. National red list status. DD. The species from Georgia is so far known only from a single locality. Most probably, the species occupies a large area in Georgia; however, at this moment, the data is insufficient to assess its conservation status.

**Geotrupes mutator** (Marsham, 1802)

Georgian name. მწვანე ცვალებადი ფუნაგორია.

Global distribution. North Africa; nearly all of continental Europe and England; the Caucasus; and Asia Minor (Baraud 1992; Shokhin 2007).
Figure 2. *Geotrupes molestus*. **A** - Habitus, dorsal side (photo credit to Maxim Smirnov); **B** – Distribution map. Black square represents the area of occupancy (AOO) in Georgia.

Figure 3. *Geotrupes mutator*. **A** - Habitus, dorsal side (photo credit to Armen Seropian); **B** - Distribution map. Black squares represent the area of occupancy (AOO) in Georgia, and green polygon shows the extent of occurrence (EOO).

Figure 4. *Geotrupes (stercorarius) olgae*. **A** - Habitus, dorsal side (photo credit to Armen Seropian); **B** - Distribution map. Black squares represent the area of occupancy (AOO) in Georgia, and green polygon shows the extent of occurrence (EOO).
Distribution in Georgia. • 6 inds; Mtksheva-Mtianeti, Khvesha; N42.400524°, E44.689348°; 1458 m a.s.l.; 17 September 2004; leg. G Chaladze; CGC. • Lisi lake; N41.74442°, E44.74013°; Dzambazhivili 1979. • Gldani; N41.8088°, E44.834°; Dzambazhivili 1979. • Soganlug; N41.6398°, E44.9161°; Dzambazhivili 1979. • Manglis; N41.6966°, E44.3739°; Dzambazhivili 1979. • Mejirshevi; N42.1299°, E44.2145°; Dzambazhivili 1979. • Kazbegi (Stepantsminda); N42.6600°, E44.6412°; Dzambazhivili 1979. • Roskha; N42.4829°, E44.9285°; Dzambazhivili 1979. • Kubolo; N42.4741°, E44.9421°; Dzambazhivili 1979. • Amga; N42.6695°, E44.9267°; Dzambazhivili 1979. • Gomi; N42.0211°, E43.7268°; Dzambazhivili 1979. • Borjomi; N41.8400°, E43.3908°; Dzambazhivili 1979. • Bakuriani; N41.7512°, E43.5296°; Dzambazhivili 1979. • Kveabiskevi; N41.7755°, E43.2445°; Dzambazhivili 1979. • Tela; N41.9169°, E45.4774°; Dzambazhivili 1979. • Lagodekhi; N41.8411°, E46.2834°; Dzambazhivili 1979. • Surroundings of Paravani Lake; N41.5303°, E43.8877°; EIAUG. • Dighomi village; N41.7827°, E44.7012°; Tarkhnishvili et al. 2013 (Fig 3A). • Tskoushi; N42.6665°, E44.0278°; Dzambazhivili 1979. • Tskoushi; N42.6665°, E44.0278°; Dzambazhivili 1979. • Telavi; N41.9169°, E45.4774°; Dzambazhivili 1979. • Surroundings of Paravani Lake; N41.5303°, E43.8877°; EIAUG. • Dighomi village; N41.7827°, E44.7012°; Tarkhnishvili et al. 2013 (Fig 3A). • Tsikoushi; N42.6665°, E44.2834°; Dzambazhivili 1979. • Surroundings of Paravani Lake; N41.5303°, E43.8877°; EIAUG. • Dighomi village; N41.7827°, E44.7012°; Tarkhnishvili et al. 2013 (Fig 3A). • Skouri; N42.6833°, E42.1666°; Dzhambazishvili 1979. • Latali; N43.0000°, E43.8093°; Dzambazhivili 1979. • Lichi; N42.1540°, E43.4786°; Dzambazhivili 1979. • Jvari; N42.1963°, E43.5941°; Dzambazhivili 1979. • Kulbaki; N42.6311°, E43.3908°; Dzambazhivili 1979. • Chkhuteli; N42.6501°, E42.7869°; Dzambazhivili 1979. • Bandza; N42.3515°, E43.2813°; Dzambazhivili 1979. • Lebarde; N41.7512°, E43.5296°; Dzhambazishvili 1979. • Lichi; N42.1540°, E43.4786°; Dzambazhivili 1979. • Jvari; N42.1963°, E43.5941°; Dzambazhivili 1979. • Kirkhi; N42.5988°, E44.1422°; Dzambazhivili 1979. • Bediani; N41.5999°, E44.2167°; Dzambazhivili 1979. • Sakhrioni (Edikilisa); N41.5919°, E43.9331°; Dzambazhivili 1979. • Dmanisi; N41.3302°, E44.2072°; Dzambazhivili 1979. • Borjomi; N41.8400°, E43.3908°; Dzambazhivili 1979. • Surami; N42.0265°, E43.5526°; Dzambazhivili 1979. • Nagutini; N42.2429°, E43.7177°; Dzambazhivili 1979. • Borjomi; N41.8400°, E43.3908°; Dzambazhivili 1979. • Sakhrioni (Edikilisa); N41.5919°, E43.9331°; Dzambazhivili 1979. • Dmanisi; N41.3302°, E44.2072°; Dzambazhivili 1979. • Red Bridge; N41.5988°, E44.1422°; Dzambazhivili 1979. • Bediani; N41.5999°, E44.2167°; Dzambazhivili 1979. • Sakhrioni (Edikilisa); N41.5919°, E43.9331°; Dzambazhivili 1979. • Dmanisi; N41.3302°, E44.2072°; Dzambazhivili 1979. • Lamarkhva; N42.3515°, E43.2813°; Dzambazhivili 1979. • Lebarde; N41.7512°, E43.5296°; Dzhambazishvili 1979. • Lichi; N42.1540°, E43.4786°; Dzambazhivili 1979. • Jvari; N42.1963°, E43.5941°; Dzambazhivili 1979. • Kulbaki; N42.6311°, E43.6390°; Dzambazhivili 1979. • Chkhuteli; N42.6501°, E42.7869°; Dzambazhivili 1979. • Bandza; N42.3515°, E43.2813°; Dzambazhivili 1979. • Lebarde; N41.7512°, E43.5296°; Dzhambazishvili 1979. • Lichi; N42.1540°, E43.4786°; Dzambazhivili 1979. • Jvari; N42.1963°, E43.5941°; Dzambazhivili 1979. • Kulbaki; N42.6311°, E43.6390°; Dzambazhivili 1979. • Chkhuteli; N42.6501°, E42.7869°; Dzambazhivili 1979. • Bandza; N42.3515°, E43.2813°; Dzambazhivili 1979. • Lebarde; N41.7512°, E43.5296°; Dzhambazishvili 1979.
Figure 5. Distribution map of *Geotrupes spiniger* for Georgia. Black squares represent the area of occupancy (AOO) in Georgia, and the green polygon shows the extent of occurrence (EOO).

Figure 6. *Trypocopris (Trypocopris) caspius*. A – Habitus, dorsal side (photo credit to Maxim Smirnov); B - Distribution map. Black squares represent the area of occupancy (AOO) in Georgia, and the green polygon shows the extent of occurrence (EOO).

Figure 7. *Trypocopris inermis*. A – Habitus, dorsal side (photo credit to Maxim Smirnov); B - Distribution map. Black squares represent the area of occupancy (AOO) in Georgia, and the green polygon shows the extent of occurrence (EOO).
1979. • Latali; N43.0000°, E42.6164°; Dzhambazishvili 1979. • Mestia; N43.0334°, E42.6897°; Dzhambazishvili 1979. • Goddekhi; N41.8411°, E46.2834°; Dzhambazishvili 1979. • Mestia; N43.0334°, E42.6897°; Dzhambazishvili 1979. • Latali; N43.0000°, E42.6164°; Dzhambazishvili 1979. • Ushguli; N42.9173°, E43.0149°; Dzhambazishvili 1979. • Gulripshi District, Azhara; N43.1106°, E41.7024°; Dzhambazishvili 1979. • Latali; N43.0000°, E42.6164°; Dzhambazishvili 1979. • Bediani; N41.6003°, E44.2164°; Dzhambazishvili 1979. • Telavi; N41.9169°, E45.4774°; Dzhambazishvili 1979. • Lagodekhi; N41.8411°, E46.2834°; Dzhambazishvili 1979. • Mestia; N43.0334°, E42.6897°; Dzhambazishvili 1979. • Latali; N43.0000°, E42.6164°; Dzhambazishvili 1979. • Ushguli; N42.9173°, E43.0149°; Dzhambazishvili 1979. • Gulripshi District, Azhara; N43.1106°, E41.7024°; Dzhambazishvili 1979.

**IUCN red list status.** NE.

**National red list status.** LC. Species is widespread and common all over Georgia. AOO is 620 km² and EOO is 56893 km² (Fig. 4B). The population trend is unknown, and direct threats have not been indicated. Based on its generally large distribution area and continuous occurrence, *G. (S) olgae* should be evaluated as "Least Concern".

**Geotrupes spiniger** (Marsham, 1802)

**Georgian name.** ყინძისხვები ფუნაგორია.

**General distribution.** Europe and Western Asia east to Northern Iran. Fairly common throughout the distribution range (Shokin 2019).

**Distribution in Georgia.** • Tbilisi; N41.7142°, E44.8234°; Dzhambazishvili 1979. • Pasanauri; N42.3526°, E44.6875°; Dzhambazishvili 1979. • Gomi; N41.9203°, E44.3792°; Dzhambazishvili 1979. • Kaburi; N41.7055°, E44.0005°; Dzhambazishvili 1979. • Bediani; N41.6003°, E44.2164°; Dzhambazishvili 1979. • Telavi; N41.9169°, E45.4774°; Dzhambazishvili 1979. • Lagodekhi; N41.8411°, E46.2834°; Dzhambazishvili 1979. • Mestia; N43.0334°, E42.6897°; Dzhambazishvili 1979. • Latali; N43.0000°, E42.6164°; Dzhambazishvili 1979. • Ushguli; N42.9173°, E43.0149°; Dzhambazishvili 1979. • Gulripshi District, Azhara; N43.1106°, E41.7024°; Dzhambazishvili 1979.

**IUCN red list status.** NE.

**National red list status.** LC. Species is widespread and common all over Georgia. AOO is 620 km² and EOO is 56893 km² (Fig. 4B). The population trend is unknown, and direct threats have not been indicated. Based on its generally large distribution area and continuous occurrence, *G. (S) olgae* should be evaluated as "Least Concern".

**Trypocopris (Trypocopris) caspius** (Motschulsky, 1845)

**Syn:** *Geotrupes caucasicus* Weise, 1879 (Dzhambazishvili 1979).

**Georgian name.** ცხვირრქოსა ფუნაგორია.

**Global distribution.** Central Caucasus. It is recorded from the Greater Caucasus in Azerbaijan, Zakatala State Reserve (Shokin 2019). According to Nikolajev et al. (2016) *Trypocopris caspius* is distributed not only in Georgia but also in the South European Territory of Russia, Iran, and Turkey.

**Distribution in Georgia.** • 1 ind; Guria, Bakhmaro; N41.854648°, E42.326441°; 1961 m a.s.l.; 26 May 2021; leg. G Chaladze; CaBOL-1009607. • 2 inds; Imereti region, 6 km South of Samre; N41.877933°, E42.769081°; 1460 m a.s.l.; 06 June 2006; leg. A Putchkov; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A) • 1 ind; Khevsureti, Basin of River Roshka; leg. G Chaladze; CGC. • 1 ind; Adjara, 3.70 km South of Karapeti; N41.520688°, E42.269459°; 2136 m a.s.l.; 20 June 2017; leg. S Svellov; ZIN (Fig 6A)
West limbs of Bzybsky Mt. Range, Anaschtur Village; ZIN (Fig 7A).

**IUCN red list status.** NE.

**National red list status.** VU. This species is an endemic to western Great Caucasus (Dzhambazishvili 1979). Georgian populations represent the southern margin for the species distribution, with relatively small AOO (70 km²) and EOO (3,121 km²) (Fig. 7B) in the country. Given the endemic status of the species with marginal populations in Georgia, its national conservation status should be defined as "Vulnerable".

**Discussion**

This paper provides a list of all species known so far in Georgia. However, as shown in Fig. 1, many places within Georgian territory remain unobserved for earth-boring beetles. According to Shokhin (2007), *Trypocopris inermis* is distributed in the Western Caucasus, from Krasnodar Krai to Karachay-Cherkessia. Therefore, its presence in the Svaneti region of Georgia can not be excluded, and additional studies are needed to delineate the southern border of its distribution.

Recently, one more earth-boring dung beetle, *Odontus armiger* (Scopoli 1772), was reported from Lagodekhi Protected Areas (north-eastern Georgia) by Japoshvili et al. (2022). In addition, the species was also reported from south-western Georgia (Makhinjauri) in GBIF based on citizen science data (de Vries and Lennemans 2023). However, both records need to be further confirmed, and given the data, no conservation status can be evaluated at any level of uncertainty.

Additional data is required for *Geotrupes molestus*, as its distribution has not been properly studied. In the literature, only the Caucasian mountains of Armenia (Baraud 1992) and Turkey (Nikolajev et al. 2016) are indicated. In Georgia, this species was found in Zekari Pass; therefore, field data from Goderdzi Pass through the Javakheti Highland to the Armenian border is needed in order to understand the distribution range of *G. molestus* in Georgia.

Three homonyms are known for *Geotrupes caucasicus* (Nikolajev et al. 2016; GBIF 2022). *G. caucasicus* Weise, 1879, was listed for Georgia by Djambazishvili (1979); nowadays, this species is known as *Trypocopris (Trypocopris) caupius* (Motschulsky, 1845). Other two homonyms, *G. caucasicus* Sharp, 1871, which is a synonym of *G. (Glytogeotrupes) moles* (Feldermann, 1836), and *Geotrupes caucasicus* Schneider & Leder, 1878 which is a synonym of *Trypocopris vernalis* (Linnaeus, 1758) have never been reported from Georgia.

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