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The existence of *Anoplotrupes stercorosus* (Scriba, 1791) (Coleoptera: Geotrupidae) for Turkey is validated from Gölcük Natural Park in Isparta Province

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Abstract

Recent trip in the forest lands of Gölcük Natural Park revealed a new earth-boring dung beetle record for Isparta province: *Anoplotrupes stercorosus*. Comparative analysis of partial cytochrome oxidase subunit 1 (CO1) displayed with UPGMA dendrogram confirmed genus *Anoplotrupes*.

Key words: Geotrupidae, *Anoplotrupes stercorosus*, new record, UPGMA, Isparta

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Anoplotrupes stercorosus (Scriba, 1791) (Coleoptera: Geotrupidae) Türünün Türkiye'deki varlığı, Isparta İli Gölcük Tabiat Parkı'ndan doğrulanmıştır

Özet

Gölcük Tabiat Parkı'nın ormanlık alanlarına yapılan bir gezi sonrasında, Isparta ili için yeni bir bok böceği kaydı *Anoplotrupes stercorosus* gerçekleştirilmiştir. Karşılaştırmalı kısmi sitokrom oksidaz altünite1 (CO1) analizi *Anoplotrupes* cinsinin doğruluğunu teyit etmiştir. Aynı sonuçlar UPGMA dendrogramıyla da ortaya konulmuştur.

Anahtar kelimeler: Geotrupidae, *Anoplotrupes stercorosus*, yeni kayıt, UPGMA, Isparta

1. Introduction

This paper treats a new record from Isparta, Turkiye in the Coleopteran family Geotrupidae, *A. stercorosus*. The family members of Geotrupidae, earth-boring scarab beetles, as their common name implies, are burrowers in soil and they accommodate the burrows for their larvae with dung, fungi, humus [1]. Family is moderate-sized about 45 genera and 600 species, including those commonly called “dor beetles”. They are round or slightly elongate, very convex, and glabrous or hairly. Their coloration is usually brown or black, more or less metallic, and is occasionally patterned. Body length is from 6 to 30 mm [2]. Dung beetles mainly feed on mammals excrement. By doing so, they decompose dung, enrich the soil and effectively mix and aerate soil through tunneling in this way favoring both to pasture and animal health. Dung beetle activity is crucial in nutrient cycles. They compete with some of the flies and nematodes [3], [4]. Adults dig vertical burrows that are up to 3 m in depth. Adults of many species are nocturnal and are saprophagous, coprophagous, mycetophagous, or do not feed as adults [1].

The optimal habitat type of the *A. stercorosus* is reported as fresh forest habitats [5] similar to Gölcük Natural Park habitat which is a conserved hotspot, as described in [6].

2. Materials and methods

The examined materials of *A. stercorosus* were either collected by author from Isparta Gölcük Natural Park in 2021 or deposited in Entomological Museum of Isparta, Turkey (EMIT). The classification and nomenclature [7] was followed in here to identify species. Female and male genitalia drawings (Figure 1 and 2) of species were adopted from [7]. Leica EZ4 binocular stereo microsope was used to examine samples.

For BLAST [8] analysis, partial cytochrome oxidase subunit 1 (CO1) nucleotide sequences were gathered from NCBI database, aligned and visualized by CLUSTAL X v. 2.1 [9] programme.

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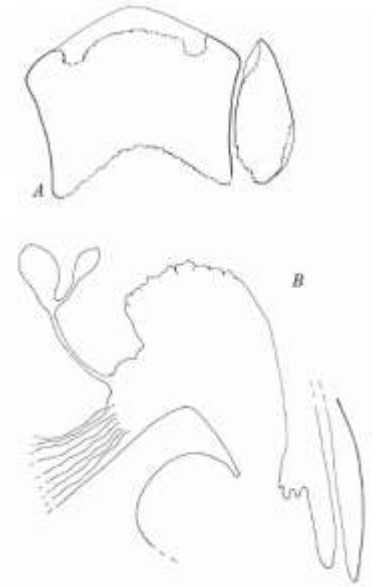

Figure 1. Female genitalia of *A. stercorosus* (Scriba)A: Dorsal view of 9th tergite and pleurite, B: Sagittal drawing of spermatheca [7].

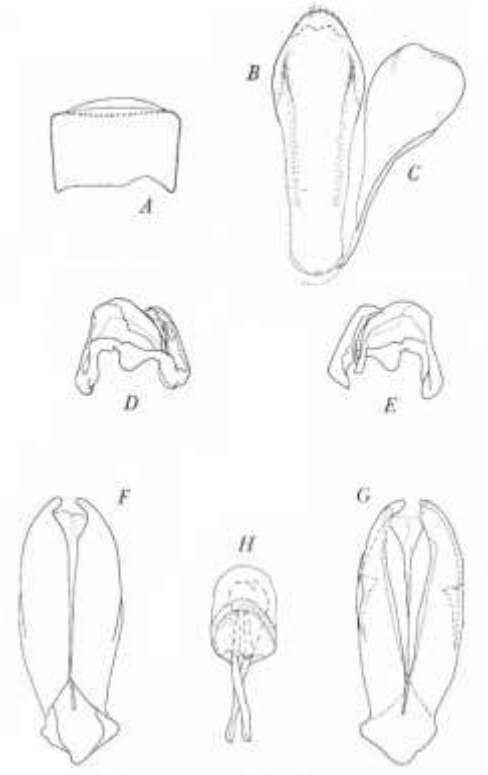

Figure 2. Male genitalia of *A. stercorosus* (Scriba), A: Tergite of the genital segment, B: Sternite, C: Pleurotergite, D: Dorsal view of paramer, E: Ventral view of paramer, F: Dorsal view of fallobase, G: Ventral view of fallobase, H: Median lobe and appandages, [7].

Materials examined:1 ♂ Gölcük Natural Park, 28.III.2021 Leg-Det: S. Bilginturan; 3 specimen Eğirdir\Isparta 02.VII. 2011 Leg Özge O.; 11 specimen Tr Isparta Gölcük 15.X.2009-24.IX.2009 Leg G. Japoshvili.

General Distribution: Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Moldavia, Norway, Poland, Portugal, Romania, Russia, Sicily, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Netherlands, Turkey, Ukraine, Yugoslavia [10]

Distribution in Turkey: Kahramanmaraş [11].

3. Results and discussion

The forest dung beetle *A. stercorosus* (Scriba, 1791) (Figure 3) is a common species encountered in Europe, Caucasus and Western Siberia [5]; [12]. However, no reliable record of the existence of this species has been found in taxonomic studies and ecological studies on the scarabeidae fauna of our country; [13], [14], [15], [16], [17]; [18], [19].

Figure 3. From left to right, dorsal and ventral view of *A. stercorosus* (Photo: Eduard Yakovlevich Berlov [25])

The authors [20] studied 625 Turkish scarab beetles including *A. stercorosus* from various types of literature, updated the checklist of the Turkish Scarabaeoidae, but authors didn't provide locality and reference data. Later, [21], [22] provided bibliographic references on the knowledge of Turkish Scarabaeoidea. Lately, occurance of *A. stercorosus* was recorded in Kahramanmaraş province for the first time [11]. However, the author didn't give any information about where the species were preserved.

In Isparta, [23] determined the coleopteran biodiversity, found one Geotrupidae species; [24] determined the insect fauna of Kovada Lake National Park and found 2 geotrupid species; [6] studied Gölcük Natural Park Coleoptera diversity, found *A. stercorosus* but deposited it in EMIT as "Geotrupidae sp.".

Thus, the first recording of the species from Isparta was realized as a result of this study.

The reason for the complexity in the distinction of *G. stercorarius* (Linnaeus, 1758) and *A. stercorosus* (Scriba, 1791) is that they have very similar morphological structures. However, some morphological structures can be used as a tool to determine the difference of the species such as ridges out side of the posterior tibia - *A. stercorosus* have two complete, transverse ridges including the apical edge of the tibia, while *G. stercorarius* have posterior tibiae each with three complete, sharp-edged, transverse ridges on the outer sides (Figure 4).

Figure 4. Two complete, transverse ridges of *A. stercorosus* (Photo: Dariusz Kowalczyk [26])

Definitely, BLAST analysis of partial CO1 nucleotide sequences of *G. stercorarius* (GB Accession HQ954132) *G. spiniger* (GB Accession KU918910) *A. stercorosus* (GB Accession KU910154) and *Lethrus apterus* (GB Accession MW402935) gathered from NCBI database clearly demonstrated the taxonomic status of species mentioned. Identity rates of nucleotide sequences were as follows; *G. stercorarius* and *G. spiniger* (93%); *G. stercorarius* and *A. stercorosus* (88%). Nucleotide sequence of *L. apterus* was used as outgroup in UPGMA dendrogram (Figure 5) created by CLUSTAL X v. 2.1.

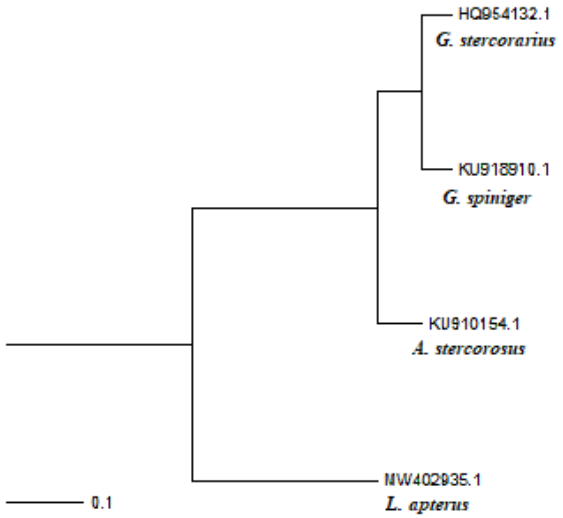

Figure 5. UPGMA dendrogram of CO1 nucleotide sequences of species

As a result of the BLAST analysis, nucleotide arrangements of *G. stercorarius* and *G. spiniger* were closely related but arrangement of *A. stercorosus* was highly differentiated. For this reason, it is appropriate to evaluate the current taxonomic status of genus *Anoplotrupes* separately.

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