Türk. entomol. derg., 2021, 45 (3): 351-360
DOI: http://dx.doi.org/10.16970/entoted.952885

ISSN 1010-6960
E-ISSN 2536-491X

Original article (Orijinal araştırma)

Descriptions of *Geostiba dindymosensis* sp. n. and *Geostiba yagmuri* sp. n. (Coleoptera: Staphylinidae: Aleocharinae), and additional records for *Geostiba* Thomson, 1858 from Turkey

Geostiba dindymosensis sp. n. ve *Geostiba yagmuri* sp. n. (Coleoptera: Staphylinidae: Aleocharinae) türlerinin deskripsiyonları ve Türkiye'den *Geostiba* Thomson, 1858 için ek kayıtlar

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Abstract

As a result of field survey in the western Anatolia, Turkey (Aydın, Balıkesir, Denizli, İzmir, Kütahya, Manisa, Muğla) between 2014 and 2016, two new species of the subgenus *Tropogastrosipalia* Scheerpeltz, 1951 belonging to the genus *Geostiba* Thomson, 1858 are described and illustrated: *Geostiba dindymosensis* sp. n. from Kütahya and *Geostiba yagmuri* sp. n. from Balıkesir and Manisa. These two new species are compared with morphologically similar and geographically close species. Also, a map illustrating the distributions of these species is provided. Additional records of *Geostiba aydinica* Assing, 2006, *Geostiba biformis* Assing, 2006 and *Geostiba nifica* Assing, 2006 are presented. These three species are recorded for the first time since their descriptions.

Keywords: Aleocharinae, *Geostiba*, new species, Staphylinidae, Turkey

Öz

Batı Anadolu (Türkiye)'da (Aydın, Balıkesir, Denizli, İzmir, Kütahya, Manisa, Muğla) 2014-2016 yılları arasında yapılan arazi çalışmaları sonucunda, *Geostiba* Thomson,1958 cinsinden *Tropogastrosipalia* Scheerpeltz,1951 alt cinsinin iki yeni türü, Kütahya'dan *Geostiba dindymosensis* sp. n. ile Balıkesir ve Manisa'dan *Geostiba yagmuri* sp. n. bilim dünyasına tanıtılmıştır. Bu yeni türler, morfolojik olarak benzer ve coğrafi olarak yakın yayılışa sahip türlerle karşılaştırılmıştır. Ayrıca, bu türlerin yayılışlarını gösteren bir harita da verilmiştir. *Geostiba aydinica* Assing, 2006, *Geostiba biformis* Assing, 2006 ve *Geostiba nifica* Assing, 2006 türleri için ek kayıtlar verilmiştir. Bu üç tür, tanımlanmalarından bu yana ilk kez kaydedilmiştir.

Anahtar sözcükler: Aleocharinae, *Geostiba*, yeni türler, Staphylinidae, Türkiye

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Received (Alınış): 15.06.2021 Accepted (Kabul ediliş): 11.08.2021 Published Online (Çevrimiçi Yayın Tarihi): 12.08.2021

Introduction

The genus *Geostiba* Thomson, 1858 (Coleoptera: Staphylinidae: Aleocharinae) is one of the most studied taxa of the subfamily Aleocharinae with 443 species in the Palearctic Region (Schülke & Smetana, 2015; Assing, 2018; 2019; Örgel, 2018; Assing et al., 2019; Örgel & Anlaş, 2020). These species are classified into 13 subgenera. Twenty-seven species are not included in any subgenus.

In Turkey, the genus *Geostiba* contains 86 species, with 81 species known only from Turkey. (Anlaş, 2009; Örgel & Anlaş, 2020) and these species belong to the subgenera *Sibiota* Casey, 1906, *Sipalotricha* Scheerpeltz, 1931, *Tropogastrosipalia* Scheerpeltz, 1951 and the nominal subgenus, with one species without subgeneric assignment (Schülke & Smetana, 2015). *Tropogastrosipalia* spp. are distinguished from those of other subgenera of *Geostiba* by the male primary and secondary sexual characters (presence of a process of abdominal tergite VII, an unmodified abdominal sternite VIII, and a crystal process of the aedeagus), have very restricted distributions and are represented a high diversity. In general, *Tropogastrosipalia* spp. inhabit the alpine and subalpine zones (Assing, 2016a, b; 2017a, b). The Anatolian mountain ranges provide appropriate habitats for the species belonging to the subgenus. Until 2000, only seven *Tropogastrosipalia* spp. had been known in Anatolia (Anlaş, 2009). Thirty-nine species were described in the studies carried out by Volker Assing between 2000-2011 (Assing, 2000; 2001; 2003; 2004; 2005; 2006; 2007; 2009; 2010; 2011). In addition, Assing's studies, four species were described from western Anatolia by Örgel (2018) and Örgel & Anlaş (2020). In all, 50 species are known from Anatolia and all of them are endemic to the certain mountains and their environs (Pace, 1983; Assing, 2000; 2001; 2003; 2004; 2009; 2011; 2016a, b; 2017a, b; Örgel, 2018; Örgel & Anlaş, 2020).

The main aims of this study were to contribute to Anatolian biodiversity studies and determine the Turkish *Geostiba* fauna.

Materials and Methods

The material studied was collected using aspirators in Aydın, Balıkesir, Denizli, İzmir, Kütahya, Manisa, Muğla Provinces of western Anatolia between 2014 and 2016. Dissection techniques followed that of Hanley & Ashe (2003). The morphological studies were carried out by a Stemi 508 (Zeiss Oberkochen, Germany) stereomicroscope. Photographs were taken with a Zeiss Axiocam ERC5s digital camera. Adobe Photoshop 2020 was used for focus stacking. CorelDRAW Graphics Suite X7 was used for editing photographs. Google Earth Pro was used to create the map. Primary and secondary sexual characters of the species are described following the terminology of Assing (2006; 2010). Head length was measured from the anterior margin of the frons to the posterior margin of the head, length of the pronotum was measured along the median line; elytral length was measured along suture from the apex of the scutellum to the posterior margin; the length of the median lobe of the aedeagus was measured from the apex of the ventral process to the base of the capsule. The material is deposited in Alaşehir Zoological Museum, Manisa, Turkey (AZMM).

RESULTS

Additional faunistic records for three species are given and two new species are described of the subgenus *Tropogastrosipalia* from western Anatolia. The subgenus *Tropogastrosipalia* is now represented by 52 species in Turkey.

Descriptions of new species

***Geostiba* (*Tropogastrosipalia*) *dindymosensis* sp. n. (Figures 1a-I and 3)**

Type material. Holotype: Turkey, ♂, "TR- Kütahya Province, Gediz district, 5 km SE of Uğurluca, Murat Mountain, 2082 m, 38°56'38" N, 29°38'22" E, 05.IV.2014, leg. Yağmur & Örgel / Holotypus ♂ *Geostiba* (*Tropogastrosipalia*) *dindymosensis* sp. n. det. S. Örgel 2021" (AZMM).

Paratypes (22 exs.). Turkey, 8♂♂, 8♀♀, same locality and date as holotype; ♂, Kütahya Province, Gediz district, 3 km E of Karaağaç, Murat Mountain, 1754 m, 38°56'15" N, 29°35'45" E, 03.V.2015, leg. Örgel; ♂, 2♀♀, Kütahya Province, Gediz district, 7 km SE of Uğurluca, Murat Mountain, 2191 m, 38°56'58" N, 29°40'18" E, 24.V.2015, leg. Örgel; ♂, Kütahya Province, Gediz district, 8 km E of Karaağaç, Murat Mountain, 1764 m, 38°56'11" N, 29°38'34" E, 24.V.2015, leg. Örgel; ♀, Kütahya Province, Gediz district, 3 km S of Uğurluca, Murat Mountain, 2073 m, 38°57'04" N, 29°36'26" E, 19.VI.2016, leg. Örgel (AZMM).

Etymology. Murat Mountain, where this new species was discovered, was called Dindymos in ancient times. The specific epithet is derived from this name.

Description. Body 2.5-3.2 mm. Head dark brown; pronotum and elytra reddish-brown, but pronotum darker than elytra; abdomen with segments I-III reddish-brown, IV-VII black VIII-IX dark brown, anterior portion of all abdominal segments darker than posterior; legs yellowish-brown; antennae with segments I, II yellowish-brown, III-XI reddish-brown.

Head 0.98 times as wide as long (Figure 1a), with fine microreticulation; eyes 1/3 as long as postocular region.

Pronotum distinctly oblong (Figure 1a), 1.23 times as long as wide; 1.28 times as wide as head; covering scutellum; posterior margin truncate in the middle; microreticulation more pronounced than that on the head.

Elytra 0.58 times as long as and 1.13 times as wide as pronotum (Figure 1a); lateral margins slightly elevated; sutural carina strongly elevated, extending about half length of elytral suture (Figure 1c); microreticulation less pronounced than that on the pronotum; punctuation distinctly granulose; hind wings absent.

Abdomen 0.95 times as wide as elytra; only tergites VII modified, process of tergite VII short and stout in lateral view (Figure 1d), wide and acute apically in dorsal view (Figure 1g); posterior margin of sternite VIII convex, setae unmodified (Figure 1e).

Median lobe of aedeagus 0.28 mm; crystal process wide, tall, acute apically and slightly closer to ventral process in lateral view (Figure 1h).

Spermatheca as in Figure 1i.

Sexual dimorphism. Pronotum, elytra, and abdomen with sexual dimorphism. Female pronotum distinctly shorter than male pronotum and posterior margin truncate in the middle. Female elytra without sutural carinae and female abdominal tergite VII unmodified.

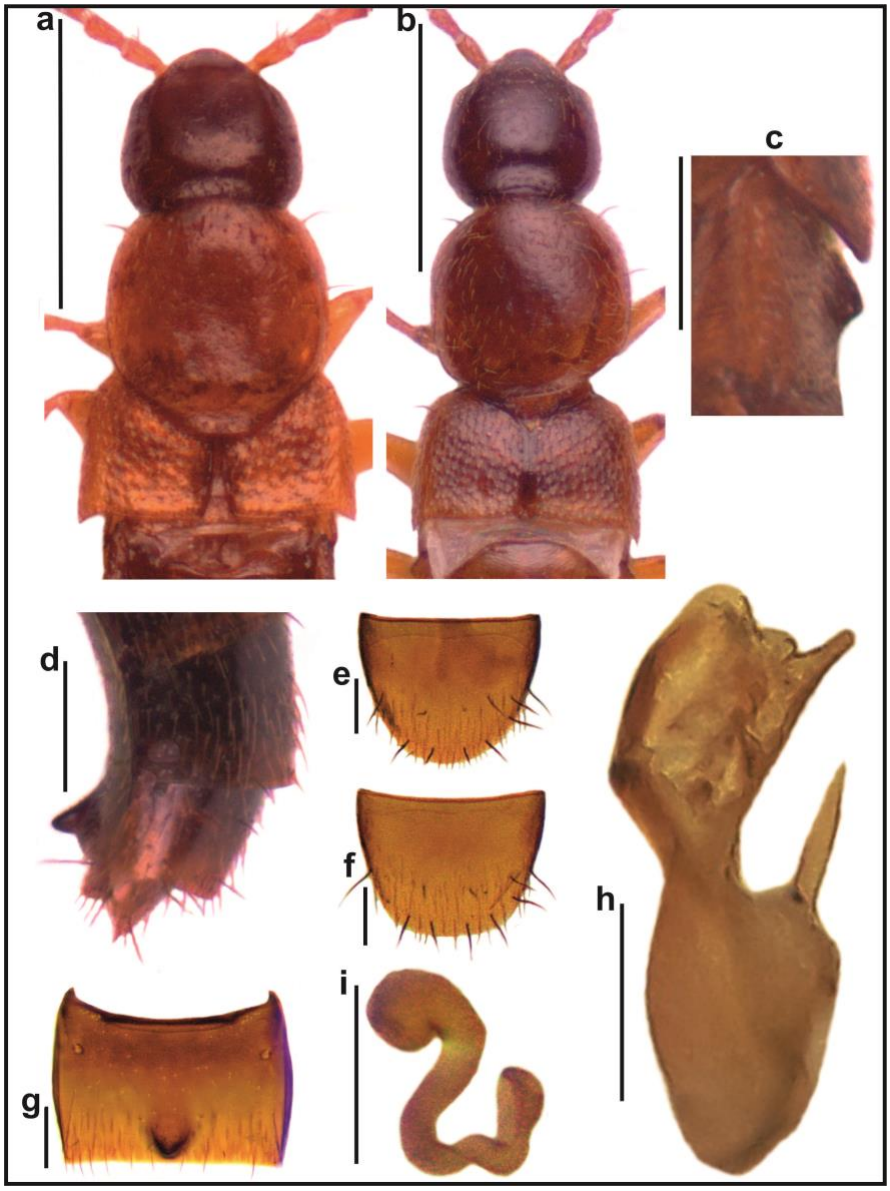

Figure 1. *Geostiba* (*Tropogastrosipalia*) *dindymosensis* sp. n.: a) male forebody; b) female forebody; c) male elytra in lateral view; d) posterior portion of abdominal segments of male in lateral view; e) male abdominal sternite VIII in dorsal view; f) female abdominal sternite VIII in dorsal view; g) male abdominal tergite VII in dorsal view; h) median lobe of aedeagus in lateral view; and i) spermatheca. Scale bars: 0.5 mm (a, b); 0.2 mm (c, d); 0.1 mm (e-i).

Differential diagnosis. Regarding similar external and sexual characters, the new species is similar to *Geostiba ahirensis* Örgel & Anlaş, 2020 and *Geostiba sandiklica* Örgel & Anlaş, 2020, but distinguished by the different shapes of the posterior margin of the male pronotum, elevations of the sutural carinae on the male elytra, modifications of the male abdominal tergites III and IV, widths of the process of the male abdominal tergite VII and different shapes of the crystal process of the median lobe of aedeagus. In *G*. *dindymosensis* sp. n. the posterior margin of the pronotum is truncate in the middle, whereas in *G*. *ahirensis* and *G*. *sandiklica* the posterior margin of the pronotum is convex in the middle. The sutural carinae on the elytra in *G*. *dindymosensis* sp. n. are more elevated than that in *G*. *ahirensis* and *G*. *sandiklica*. In *G*. *dindymosensis* sp. n. tergites III and IV are unmodified, whereas in *G*. *ahirensis* tergites III and IV have a tubercle. The process of the male abdominal tergite VII in *G*. *dindymosensis* sp. n. is wider than that of *G*.

ahirensis and *G*. *sandiklica*. The crystal process of the median lobe of aedeagus is similar to that of *G*. *sandiklica*. However, in *G*. *sandiklica* it is distinctly narrowed towards the apex, while in *G*. *dindymosensis* sp. n. it is narrowed only apically. In *G*. *ahirensis* the crystal process is wider than that of *G*. *dindymosensis* sp. n. and *G*. *sandiklica*. Morphologically (especially regarding the shape of the posterior margin of the male pronotum), this new species is the most similar to *Geostiba kazika* Assing, 2010 and *Geostiba extensicollis* Assing, 2010 (the posterior margin of the male pronotum truncate to indistinctly concave in both species). The new species is distinguished from these species by different shapes of the sutural carinae on the male elytra and crystal process of the median lobe. In *G*. *dindymosensis* sp. n. the sutural carinae (extending from apex of scutellum along approximately 1/2 of suture) are wide and highly elevated, whereas in *G*. *kazika* they extend from the apex of the scutellum along 2/3 of the suture and in *G*. *extensicollis* they extend from the apex of the scutellum almost to posterior margin of the elytra, and the sutural carinae are narrow and moderately elevated in both species. The crystal process in *G*. *dindymosensis* sp. n. is longer and wider than that in *G*. *kazika* and *G*. *extensicollis* (Table 1).

Distribution and bionomics. The new species was collected from Murat Mountain (Figure 3). This mountain is located in the eastern central division of western Anatolia. Murat Mountain has been an important area for endemism. For example, *Astenus kumlutasi* Anlaş, 2015, an endemic staphylinid species, is known from this mountain (Anlaş, 2015), and also this mountain has some other endemic insect species, e.g., *Camponotus ruseni* Karaman, 2012 (Karaman, 2012). Additionally, Murat Mountain is isolated by some valleys and rivers. Therefore, the new species is most probably endemic to Murat Mountain. As a result of more careful investigation of such isolated mountain systems, especially in terms of species with limited mobility and special habitat preferences, it is predicted that many new species will be detected in many different groups for the scientific world. In addition, the importance of detecting the insect fauna of Turkey is again revealed.

***Geostiba* (*Tropogastrosipalia*) *yagmuri* sp. n. (Figures 2a-l and 3)**

Type material. Holotype: Turkey, ♂, "TR- Balıkesir Province, Bigadiç district, 7 km N of Bozbük, Alaçam Mountains, 1548 m, 39°24'03" N, 28°33'15" E, 01.IV.2016, leg. Örgel & Yaman / Holotypus ♂ *Geostiba* (*Tropogastrosipalia*) *yagmuri* sp. n. det. S. Örgel 2021" (AZMM).

Paratypes (21 exs.). Turkey, 7♂♂, 11♀♀, same locality and date as holotype; 3♂♂, Manisa Province, Akhisar district, 20 km SW of Sındırgı, 408 m, 39°07'59" N, 28°00'33" E, 13.IV.2015, leg. Anlaş & Örgel (AZMM).

Etymology. The species is dedicated to Dr. Ersen Aydın Yağmur (Manisa), a specialist on scorpions, who have helped in the collection of some of the material used in this study.

Description. Body 2.7-3.3 mm. Head black; pronotum and elytra reddish-brown, but anterior portion of elytra darker than posterior portion; abdomen with segments I-III reddish-brown, IV-VII black, VIII-IX dark brown; legs and antennae reddish-brown.

Head approximately as wide as long, with fine microreticulation (Figure 2a); eyes half as long as postocular region in lateral view.

Pronotum weakly oblong; 1.09 times as long as wide (Figure 2a); 1.17 times as wide as head; not covering scutellum; posterior margin weakly convex; microreticulation more pronounced than that on the head.

Elytra 0.54 times as long as and 1.15 times as wide as pronotum (Figure 2a); lateral margins slightly elevated; sutural carina slightly elevated, extending about 1/3 length of elytral suture (Figure 2c); microreticulation less pronounced than that on the pronotum; punctuation distinctly granulose; hind wings absent.

Abdomen 0.98 times as wide as elytra; only tergites VII modified, process of tergite VII short and stout in lateral view (Figure 2d), narrow and acute apically in dorsal view (Figure 2g); posterior margin of sternite VIII convex, setae unmodified (Figure 2e).

Median lobe of aedeagus 0.31 mm; crystal process very thin, tall and acute apically, slightly closer to ventral process in lateral view (Figure 2h).

Spermatheca as in Figure 2i.

Sexual dimorphism. Pronotum (weakly), elytra, and abdomen with sexual dimorphism. Female pronotum weakly shorter than that in male. Female elytra without sutural carinae and female abdominal tergite VII unmodified.

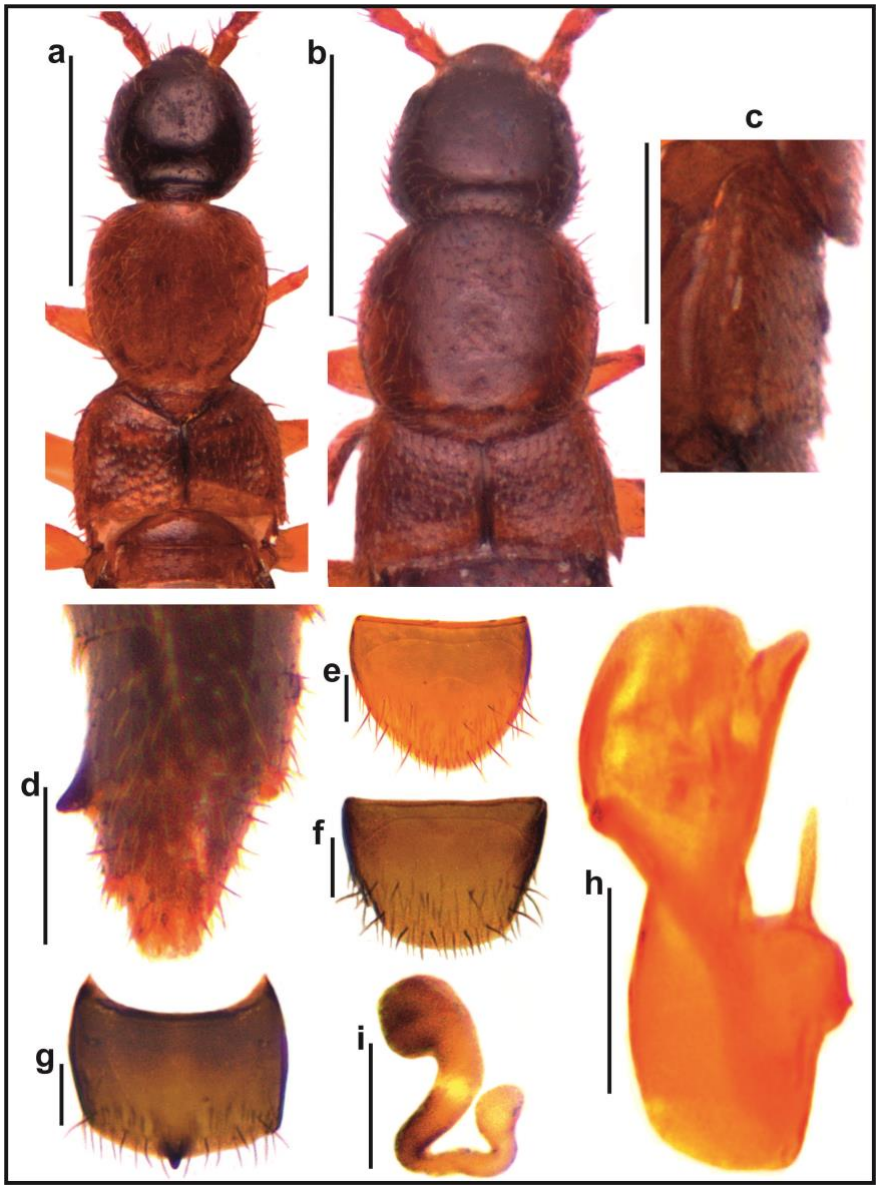

Figure 2. *Geostiba* (*Tropogastrosipalia*) *yagmuri* sp. n.: a) male forebody; b) female forebody; c) male elytra in lateral view; d) posterior abdominal segments of male in lateral view; e) male abdominal sternite VIII in dorsal view; f) female abdominal sternite VIII in dorsal view; g) male abdominal tergite VII in dorsal view; h) median lobe of aedeagus in lateral view; and i) spermatheca. Scale bars: 0.5 mm (a, b); 0.2 mm (c, d); 0.1 mm (e-i).

Differential diagnosis. Based on the shape of the posterior margin of the male pronotum, the new species is similar to *Geostiba atromontis* Assing, 2006. The posterior margin of the male pronotum is convex in the both species. But these species distinguished by the different shape of process of male abdominal tergite VII. In *G. yagmuri* sp. n. it is much shorter than that in *G. atromontis*. Additionally, the carinae in the posterior angles of the elytra of *G. yagmuri* sp. n. are narrower than those in *G. atromontis*. *G. yagmuri* sp. n. From these species *G. dindymosensis* sp. n. can be distinguished by the shape of the posterior margin in the male pronotum. In *G. yagmuri* sp. n. the posterior margin of the male pronotum is convex, whereas in *G. dindymosensis* sp. n. this part is truncate in the middle. In addition, the male pronotum in *G. yagmuri* sp. n. is shorter than that in *G. dindymosensis* sp. n. The sutural carinae on the male elytra and the crystal process of the median lobe of these two species are also different. In *G. yagmuri* sp. n. the sutural carinae on the male elytra are weakly elevated, whereas in *G. dindymosensis* sp. n. they are strongly elevated and the crystal process of the median lobe is thinner and shorter in *G. yagmuri* sp. n. than that in *G. dindymosensis* sp. n. (Table 1).

Distribution and Bionomics. The specimens were collected under stones in meadows between 408 and 1548 m. The new species is probably endemic of the Alaçam Mountains, Balıkesir and Manisa Provinces (Figure 3). Alaçam Mountains has been an important area for endemism. For example, *Sunius ciceki* Anlaş, 2016, an endemic staphylinid species, is known from this mountain (Anlaş, 2016, 2018).

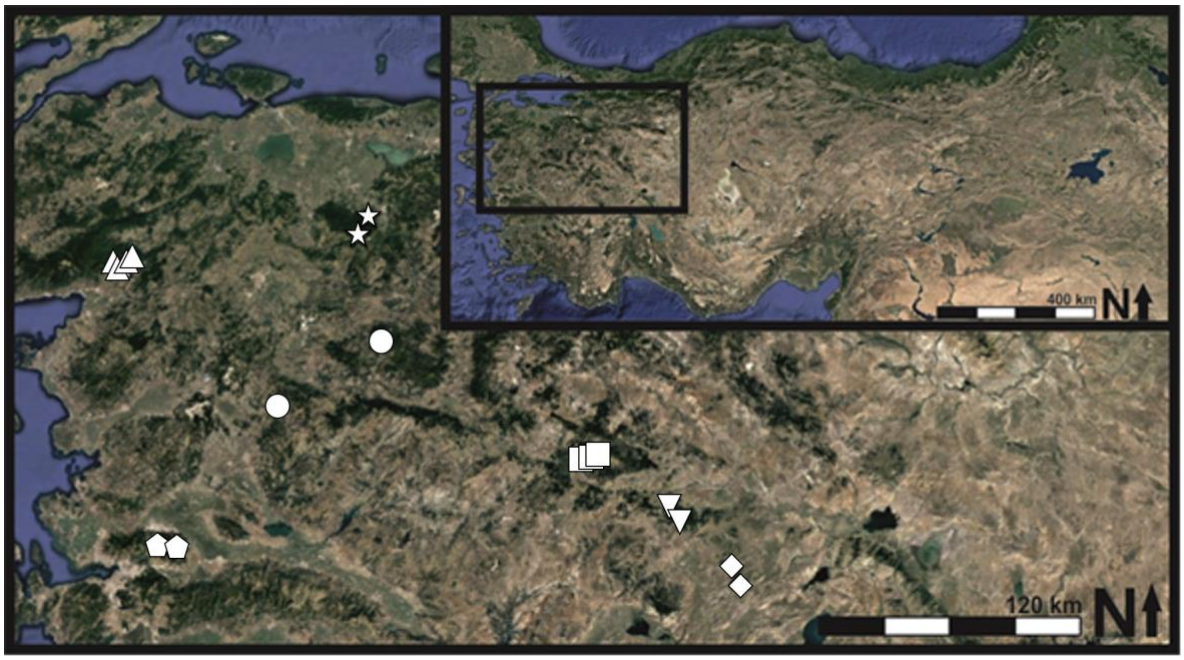

Figure 3. Distribution of *Geostiba dindymosensis* sp. n. (squares); *Geostiba yagmuri* sp. n. (circles); *Geostiba ahirensis* (inverted triangles); *Geostiba sandiklica* (diamonds); *Geostiba atromontis* (pentagons); *Geostiba kazika* (triangles); *Geostiba extensicollis* (stars).

Additional records

***Geostiba* (*Tropogastrosipalia*) *aydinica* Assing, 2006**

Material. Aydın: 4 km N of Karaköy, İmambaba Hill, 37°57’06" N, 27°53’56" E, 1644 m, 24.III.2014, 6♂♂, 3♀♀, leg. Anlaş & Örgel (AZMM).

Distribution. *Geostiba aydinica* is only known from Aydın Mountains (Aydın Province) (Assing, 2006) and recorded for the first time since its description.

***Geostiba* (*Tropogastrosipalia*) *biformis* Assing, 2006**

Material. Denizli: Çameli, 2 km SE of Kalınkoz, Değirmentaşı Hill, 37°07'21" N, 29°20'35" E, 1497 m, 04.V.2014, 3♂♂, ♀, leg. Yağmur & Örgel, same data but 18.IV.2015, 16♂♂, 46♀♀, 5 km SE of Kale, 37°25'37" N, 28°53'30" E, 1335 m, 11.IV.2015, 2♂♂, ♀, leg. Yağmur & Örgel, Tavas, 8 km SE of Nikfer, Bozdağ ski center road, 37°19'57" N, 29°10'47" E, 2033 m, 03.V.2014, 9♂♂, 26♀♀, leg. Yağmur & Örgel, Tavas, 3 km NE of Alpa, Gölgeli Mountains, 37°14'16" N, 29°04'07" E, 1900 m, 26.IV.2014, 2♂♂, 8♀♀, leg. Yağmur & Örgel; Muğla: 7 km SE of Özlüce, 37°15'56" N, 28°26'57" E, 1605 m, 22.III.2014, 7♂♂, 17♀♀, leg. Anlaş & Örgel (AZMM).

Distribution. Distribution of *G. biformis* is confined to Eastern Menteşe Mountains (Muğla Province) and Gölgeli Mountains (Denizli Province) (Assing, 2006) and is recorded for the first time since its description.

***Geostiba* (*Tropogastrosipalia*) *nifica* Assing, 2006**

Material. İzmir: Kemalpaşa, 7 km SW of Çiniliköy, Nif Mountain, 38°23'03" N, 27°21'56" E, 1274 m, 16.III.2014, 4♂♂, ♀, leg. Yağmur & Örgel (AZMM).

Distribution. *Geostiba nifica* was only known from Nif Mountain (İzmir Province) (Assing, 2006) and recorded for the first time since its description.

Table 1. Morphological features of *Geostiba dindymosensis* sp. n.; *Geostiba yagmuri* sp. n.; *Geostiba extensicollis*; *Geostiba kazika*; *Geostiba ahirensis*; *Geostiba atromontis* and *Geostiba sandiklica*

♂	Posterior margin of pronotum	Lateral margins of elytra	Sutural carinae	Abdominal tergite VII (lateral view)	Crystal process of aedeagus
G. dindymosensis sp. n.	truncate	weakly elevated	extending about half length of elytral suture	short and stout	strong, wide and tall
G. yagmuri sp. n.	weakly convex	weakly elevated	extending about 1/3 length of elytral suture	short and stout	narrow and short
G. extensicollis	truncate to indistinctly concave	not elevated	extending along elytral suture	short, stout, suberect	somewhat variable shape
G. kazika	truncate to indistinctly concave	not elevated	extending about 2/3 length of elytral suture	short and stout	short and slender
G. ahirensis	weakly convex	distinctly elevated	extending about half length of elytral suture	short and stout	very wide and tall
G. atromontis	broadly convex	weakly elevated	extending about half length of elytral suture	long, acute, and erect	thin
G. sandiklica	weakly convex	not elevated	extending about 1/3 length of elytral suture	short and stout	moderately broad

Acknowledgments

I am most grateful to my colleagues for making their staphylinid collections available to me. Special thanks to the anonymous reviewers provided helpful comments on earlier drafts of the manuscript.

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