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Description of a New Species of the Genus *Troglophilus* Krauss, 1879 (Orthoptera: Rhaphidophoridae) from Northern Anatolia, Turkey

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ABSTRACT

In this paper a new species of cave crickets *Troglophilus* (Orthoptera, Rhaphidophoridae) from northern Anatolia is described as *Troglophilus aspegi* Taylan and Şirin sp. nov.. Considering the other already recognised nine species in Anatolia, there are now total 10 species of *Troglophilus* that currently inhabit the caves and epigean habitats of Turkey. The new species is restricted to National Park of Küre Dağları in Bartin province and known only in one locality (Sipahiler cave). *Troglophilus aspegi* is morphologically distinguishable from the other nine *Troglophilus* species present in Turkey due to their small size, male tenth tergite, ovipositor shape, reddish-light brown body color. New species differs from the morphologically closest *T. tatyanae* for body color, tenth tergite and epiphallus shape in male, subgenital plate shape in both sexes, length of the appendages and spinulation of the legs. On the other hand, these new data show that geographical distribution of *Troglophilus* is not only restricted with north eastern Anatolia but also in caves from north western section of Blacksea Region of Turkey.

Key words: Orthoptera, Rhaphidophoridae, *Troglophilus*, cave crickets, Turkey.

INTRODUCTION

The family Rhaphidophoridae includes ten subfamilies (Eades *et al*., 2014) and members of the subfamilies Troglophilinae and Dolichopodainae are distributed from the Pyrenees to Transcaucasia and the north of Iran with over 70 species belonging to the genera *Troglophilus* Krauss 1879 and *Dolichopoda* Bolivar 1880 (Karaman *et al*., 2011; Di Russo and Rampini, 2014). The genus *Dolichopoda* contains more than fifty species distributed in caves and epigian habitats, seven of which were described from different regions of Turkey by several authors (Bolivar, 1899; Bey-Bienko, 1969; Di Russo and Rampini, 2006; Di Russo *et al*., 2007; Rampini and Di Russo, 2008; Rampini *et al*., 2012).

At present *Troglophilus* Krauss, 1879 is distributed in southern Europe, ranging from Mediterranean basin to Anatolia, discontinuously and including 19 known species (Taylan *et al*., 2012; Eades *et al*., 2014). Until now, nine species of *Troglophilus* have been described from different regions of Anatolia by several authors. These are

T. escalerai Bolivar, 1899, *T. adamovici* Us 1974, *T. gajaci* Us 1974, *T. bicakcii* Rampini and Di Russo 2003, *T. tatyanae* Di Russo and Rampini 2007, *T. ferzenensis* Taylan, Di Russo, Cobolli, Rampini 2012, *T. fethiyensis* Taylan, Di Russo, Cobolli, Rampini 2012, *T. alanyaensis* Taylan, Di Russo, Cobolli, Rampini 2012 and *T. ozeli* Taylan, Di Russo, Cobolli, Rampini 2012 (Bolivar, 1899; Us, 1974; Rampini and Di Russo, 2003; Di Russo and Rampini, 2007; Taylan *et al*., 2012).

In Turkey, the genus *Troglophilus* has its highest species richness in southern and western Anatolia with 8 species while only one species has a distribution in northern Anatolia (Taylan *et al*., 2011, 2012). In this paper we present the description of a new cave cricket species belonging to the genus *Troglophilus* from western Blacksea region of Anatolia, and discuss the relationship between morphological and geographical closest taxa by using morphological data. In addition, we provide some remarkable points of the distribution patterns of this species.

MATERIAL AND METHODS

During field studies in 2012-2013, specimens of *Troglophilus* Krauss, 1879 were encountered in Sipahiler cave (Fig. 1). Samples were collected by hands searching on walls and grounds of cave through the all day. In this case the collectors were equipped with both a LED head and hand lamps. The collected specimens were preserved in 70% alcohol. The morphological characteristics of specimens were measured or countered using a digital camera attached to a stereo microscope (Optica SZM-SMD stereo microscope) and photographed using a Nikon D40 camera. Examined specimens in this study were deposited in Namik Kemal University, Department of Biology, Museum of Entomology, Tekirdag, Turkey (NKUEM, Collection of Deniz Şirin) and personal collection of M.S. Taylan (PCT).

RESULTS

Morphological characters of the collected samples were able to easily place that new species in the genus *Troglophilus* (Subfamily: Troglophilinae), because knees of fore and middle femur possess no movable spines while metatarsus of the hind legs has apical spines.

Troglophilus aspegi Taylan and Şirin *sp. nov.*

Diagnosis. *Troglophilus aspegi* sp. nov. differs from all the known Turkish species for its relative small body size, male tenth tergite, ovipositor shape, reddish-light brown body color. This new species shows similarity to *T. tatyanae* for the ovipositor shape, but it distinguished from that species for the body color, shape of subgenital plate, male tenth tergite and epiphallus, length of the appendages and spinulation of the legs. Furthermore, *T. aspegi* is different from the other Anatolian *Troglophilus* taxa for distinctive morphological characteristics, such as the shape of male tenth tergite and epiphallus, subgenital plate in both sexes and shape of the ovipositor.

Material examined: Holotype male: Turkey, Bartın, Sipahiler, Sipahiler Cave, 41°37'775'' N; 32°29'442'' E, 170 m, 13.01.2012, Leg. M.S. Taylan and D. Sirin (NKUEM).

Paratypes: same date and collector: 1♂, 2♀♀ (NKUEM); same locality and collector, 24.04.2012, 1♀ (PCT); same locality and collector, 04.02.2013, 2♂♂ (PCT).

Type-locality. The Sipahiler Cave is located at 170 m above sea level on the slope of Kayadibi, 18 km south of Bartın (Fig. 1).

Description. Male (holotype). The length of the body relatively small (11.3 mm), body colour reddish-light brown (Fig. 2). Legs rather elongated, fore femora longer than middle ones. Fore and mid femora unarmed. Hind femora armed with one spine on the ventral inner edges. Fore tibia longer than middle tibia. Fore tibia armed with nine pairs of spines on the ventral edges. Middle tibia with nine spines on the ventral edge 4-5 spines on both upper and lower edges. The hind tibia longer than middle ones, bearing 72-77 variable spines on both internal and external sides of the upper edges and homogeneous 32-35 spines occuring on the ventral edge. First article of hind tarsum laterally compressed and armed with 8 tiny spines.

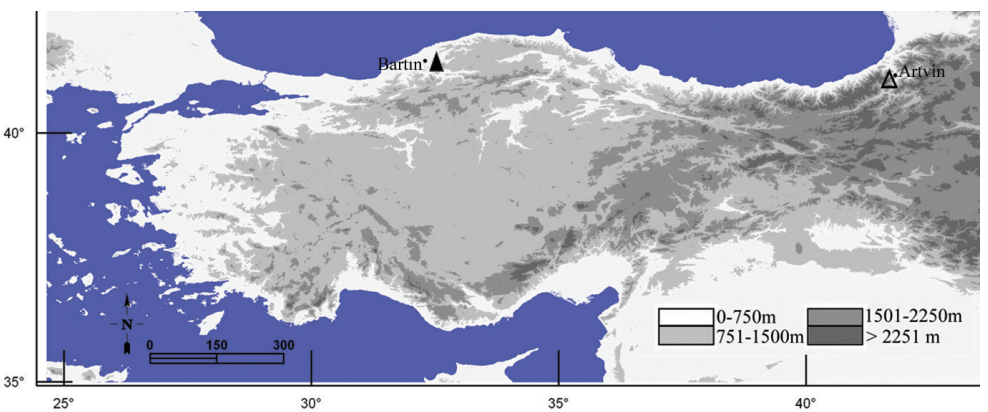


Fig. 1. The localities of *Troglophilus aspegi* sp. nov. and most similar species in Anatolia: (▲) represent the record of *Troglophilus aspegi* sp. nov.; (∆) the record of *T. tatyanae.*

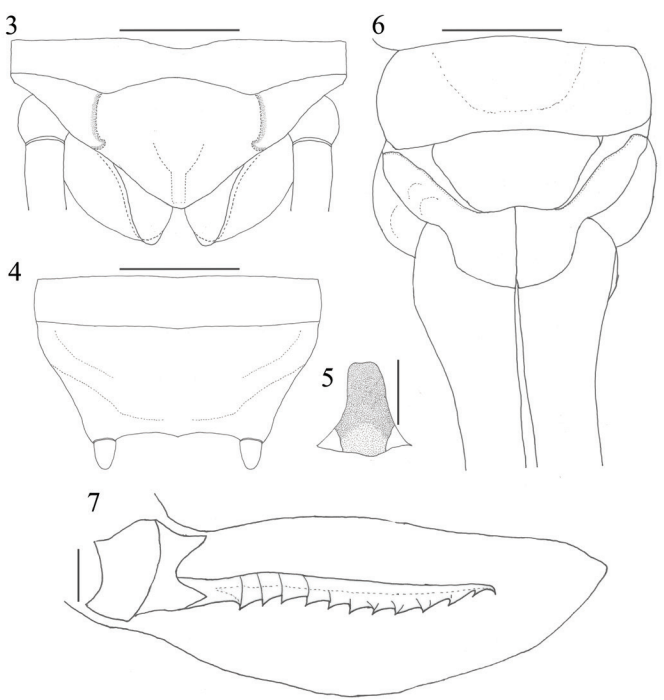
Fig. 2. *Troglophilus aspegi* sp. nov. in the cave habitats.

Tenth tergite (Fig. 3) showing strong concavity in the middle of posterior edge and convex in the middle of inferior edge. Subgenital plate trapezoidal (Fig. 4), and almost straight at posterior edge curved and carring two short styli. Copulatory apparatus (epiphallus) sclerificated (not membranous) and rectangular (Fig. 5).

Lenght (mm): body 11.3; pronotum 3.8; fore femur 7.0; middle femur 6.5; hind femur 13.2; fore tibia 7.1; middle tibia 7.0, hind tibia 15.3; hind tarsus 4.5; 1st article of hind tarsus 3.0.

Female. Body length relatively small ranging between 13.6 and 14.2 mm (ovipositor excluded), and the general form of the female similar to the male. The subgenital plate almost trapezoidal (Fig. 6), with two evident rounded lobes separated by a distinct concavity. The ovipositor having an average length of 8.5 mm (Fig. 7), more than half as long as body (3/5 ratio). The superior valves concave on the superior edge, showing a slightly pointed apex, ventral edge distinctly convex, attaining their greatest width nearly at the middle of the length. The inferior valves narrow and sclerotized showing 12-13 strong denticles.

Etymology. The new taxon takes its name from the Society of Anatolian Speleological Group (ASPEG) which is a cave research society in Turkey and supports researches including one of the authors of this paper, who is also a member of the society in question.



Figs. 3-7. *Troglophilus aspegi* sp. nov. Holotype male: 3. Tenth tergite, dorsal view; 4. Subgenital plate, ventral view; 5. Copulatory organ. Female: 6. Subgenital plate, ventral view; 7. Ovipositor, lateral view. (Scale bars: 1 mm.)

DISCUSSION AND CONCLUSION

Concerning the ovipositor shape, *Troglophilus aspegi* sp. nov. is similar to *Troglophilus escalerai* and *T. ozeli* (Bolivar, 1899; Taylan *et al*., 2012), but it differs from both species in length and width of denticles on inner valves of the ovipositor. *Troglophilus aspegi* sp. nov. shows similarity to *T. alanyaensis* for the body color, but the body color of *T. alanyaensis* is the reddish-brown (Taylan *et al*., 2012), while *T. aspegi* sp. nov. has a reddish light brown body color (Fig. 2).

The new species differs from *T. tatyanae,* which occurs in the same climatic and geographic area (Di Russo *et al*., 2007), by such distinctive morphological characters as coloration of the body, male tenth tergite, copulatory organ, subgenital plate in both sexes, ovipositor shape, and denticulation of appendages.

T. aspegi sp. nov. has a reddish-light body coloration, in male tent tergit posterior edge strongly convex in the middle and inferior edge concave in the middle, subgenital plate dorsal edge almost straight, in female subgenital plate dorsal edge strongly curved in the middle (as two lobes), epiphallus rectangular and sclerotized, ovipositor strongly convave on posterior edge in the middle and it attains greatest width in the middle, almost pointed apex, whereas these characters in *T. tatyanae* are the following: strongly brown coloration, and, in male, tenth tergit posterior edge convex and moderately incised in the middle, the subgenital plate dorsal edge moderately incised in the middle, in female subgenital plate dorsal edge slightly curved in the middle and lateral edge almost straight, the copulatory apparatus (epiphallus) subconical and membranous, ovipostior lateral edge almost straight, ovipositor widened in basal and gradually narrow to apically, attaining greatest width between the end of the 1/3 and the beginning of the 2/3 and almost rounded in apex (Di Russo *et al*., 2007).

The new species lacks extensions or protuberances on the tenth male tergite, as in all other species described from Turkey; however, this character also appears in *T. spinulosus* from Crete and *T. marinae* from Santorini islands in Aegean (Boudou-Saltet, 1978; Rampini and Di Russo, 2003), suggesting a monophyletic relationship of Anatolian *Troglophilus* with Aegean *Troglophilus.*

Until now, the distribution of the genus *Troglophilus* in Northern Anatolia was known to be limited to a single locality in the Eastern Blacksea Region (North Eastern Anatolia), where it is syntopic with *D. noctivaga* (Di Russo *et al*., 2007). But our new data show that the geographical distribution of *Troglophilus* is not only restricted to north eastern Anatolia but also to caves in north western section of Blacksea Region of Turkey, which typically has wet forest and poor karstic areas and climatic conditions of which are characterized by a permanent humid-temperate climate. Because of these environmental conditions, cave crickets show a widened epigian distribution in Blacksea Region, leading to species richness of cave crickets in Black Sea region not much as in Western and Southern Anatolia. Similar results were observed also for *Dolichopoda noctivaga* which shows a widened distribution in the whole Blacksea Region (Taylan *et al*., 2011). These new data exposed a new distribution pattern of genus *Troglophilus* in Anatolia. With the addition of these data some missing

biogeographical patterns and phylogenetically controversial relationships which were reported in previous studies will be able to be resolved (Taylan *et al*. 2013). In Taylan *et al*. (2013) representing pyhlogenetical research of all Anatolian *Troglophilus* taxa, the relationships between *T. tatyanae* and other taxa are still controversial. We think that the population of *T*. *aspegi* will shed light on understanding "true picture" of evolutionary relationships of Anatolian *Troglophilus* in future studies.

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