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RESEARCH PAPER

Some Additional Records and Details About Variability and Morphology of *Hydroscapha granulum* (Coleoptera: Myxophaga) from Turkey

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Abstract

Hydroscapha granulum is the only species belonging to family of Hydroscaphidae from Turkey. In this study, *Hydroscapha granulum* (Motschulsky 1855) samples belonging to Myxophaga subordo were collected from five different localities and taxonomical characteristics of the specimens were compared with the specimens in literatures. Differences in some taxonomical features were determined and descriptions of the species were revised according to collected specimens. In the description, some important taxonomical characteristics such as V. sternit of males, VI. tergit and VI. sternit of females, which have not mentioned recently published papers, are given for the first time. In addition, *H. granulum* was recorded for the first time from the provinces of Bursa and Manisa of western Anatolia.

Keywords: Coleoptera, Myxophaga, Hydroscaphidae, *H. granulum*, Western Anatolia.

Introduction

Myxophaga is one of the smallest suborders of Coleoptera, consisting of approximately 65 species of small to minute beetles in four families Hydroscaphidae LeConte, 1874; Lepiceridae Hinton, 1936; Torridincolidae Steffan, 1964 and Microsporidae Crotch, 1873 (Beutel and Haas 1998). Hydroscaphidae has three genera: *Scaphydra* Reichardt, 1973 (three described species from Brazil), *Yara* Reichardt and Hinton, 1976 (two described species from Brazil and Panama) and *Hydroscapha* LeConte, 1874 (18 described species from Palaearctic, Afrotropical, Nearctic, Neotropical and Oriental Regions) (Hinton, 1969a, 1969b; Löbl, 1994, 2003; Madison, 2001; Fikacek & Sipkova, 2009; Falamarzi, Pütz, Heidari, & Nasserzadeh 2010).

Taxonomy of *Hydroscapha* was mostly based on external characters since 1994. Previous authors mainly characterized the species by the combination of body size, proportions and shape of the elytra and density of superficial punctuation (e.g., Champion, 1920; Peyerimhoff, 1922). But Löbl (1994) declared that these characters were insufficient for species delimitation and variable within the species. Moreover, the author showed that only the body size in combination with the proportions of antennomeres and the morphology of terminal sclerites and genitalia of males and females were reliable characters for distinguishing the species (Fikacek & Sipkova, 2009). Although Fikacek and Sipkova conferred that some taxonomical characters for males and females were different from Löbl (1994), these characters have not been given for *H. granulum.*

In this study, differences in some taxonomical features were determined and description of the *H. granulum* were revised according to collected specimens. In the revised description, some important taxonomical characteristics such as V. sternit of males, VI. tergit and VI. sternit of females, which have not mentioned before, are given for the first time. Furthermore, *H. granulum* was firstly recorded from the provinces of Bursa and Manisa of western Anatolia.

Material and Methods

Research material was generated from adult specimens, which collected from the provinces of Bursa, Çanakkale and Manisa of western Anatolia. Specimens were collected by the aspirator and nets from the hygropetric habitats and edges of running water of the small streams. Microhabitats of the collected specimens were covered with the filamentous algae. Collected materials were preserved in 70% ethanol. Dissection procedures were done under Leica MZ 12_5 stereomicroscope. The whole abdomen was disarticulated from the specimen;

terminal abdominal sternites, tergites and genitalia were prepared as microscope slides. All photographs were taken by Olympus Camedia C-7070 digital camera attached on Olympus BX40 compound microscope and drawings were prepared using a drawing tube attached to the same microscope. All drawings were arranged by using CORELDRAW X4 software.

Results and Discussions

Order: Coleoptera
Suborder: Myxophaga Crowson, 1955
Family: Hydroscaphidae LeConte, 1874
Hydroscapha granulum (Motschulsky, 1855)

Material examined: ÇANAKKALE: Bayramiç, habitat: small stream, microhabitat: filamentous algae, N: 39^{O} 50' 095'' E: 026^{O} 36' 336'', altitude: 75 m., 03.VIII.2006, 3 ♂♂, 6 ♀♀; ÇANAKKALE: Ezine, habitat: small stream, microhabitat: filamentous algae, N: 39^{O} 46' 378'' E: 026^{O} 25' 604'', altitude: 50 m., 04.VIII.2006, 1 ♂, 2 ♀♀; BURSA: İnegöl, habitat: small stream, microhabitat: filamentous algae, N: 39^{O} 56' 599'' E: 029^{O} 36' 416'', altitude: 361 m., 15.VIII.2006, 3 ♀♀; MANİSA: Gediz-I, habitat: small stream, microhabitat: filamentous algae, N: 38^{O} 36' 060'' E: 28^{O} 48' 490'', altitude: 413 m., 16.VIII.2011, 2 ♂♂; MANİSA: Yeniköy, habitat: small stream, microhabitat: filamentous algae, N: 38^{O} 48' 380'' E: 28^{O} 30' 470'', altitude: 275 m., 16.VIII.2011, 1 ♂, 1 ♀.

Distribution in the world: Azerbaijan (Löbl, 2003), France, Greece, Iran, Serbia, Turkey (Löbl, 1994), Bulgaria, Italy, Russia, Spain (Hinton, 1969b; Richoux & Doledec, 1987).

Distribution in Turkey: Balıkesir, Çanakkale, İzmir (Löbl, 1994).

Descriptions of the Collected Specimens

Measurements: Total body length (the distance between the anterior margin of the head and the posterior margin of the abdomen) between 1.10–1.62 mm, fore body (the distance between the anterior margin of the head and the posterior margin of the elytra) between 0.76–0.94 mm, maximum width of elytra between 0.46–0.50 mm.

Coloration: Body tawny to dark brown, head, anterior and posterior margins of pronotum and elytral suture slightly darker.

Antenna: Antennomere II approximately 1.29 times longer than wide; antennomere VIII slightly asymmetrical, and 2.10 times longer than wide. There is one long trichoid sensilla on antennomere VIII and I. These sensillas are easily broken and they are usually omitted from the drawings (Figure. 1a, 2a).

Male: Sternite V straight and not denticulate on posterior margin (Figure. 1b, 2b). Sternite VI without setae on anterior margin, with disorganized setae on surface, deeply collapsed on posterior margin and right of the median portion denticulate. Others except first two of these denticles are pointed among all examined specimens (Figure. 1c, 2c). Of the examined two male specimens, sternite VII is without postero-median projection (Figure. 1d, 2d) or slightly convex in three specimens (Figure. 1e, 2e), with long and irregularly arranged in tufts along postero-lateral margins.

Aedeagus: The length of the median lobe of the aedeagus was measured from the apex of the ventral process to the base of the capsule. 0.26–0.29 mm long, slightly sinuate in lateral view, continually narrowing apicad, apex slightly bent ventrad (Figure. 1f, 2f) or straight (Figure. 1g, 2g), surface with micro denticulate. Basal portion of aedeagus thicken and bent ventrad. Because of the internal sac of the aedeagus is slightly everted, we observed that the bumpy projection on the dorsal surface of the aedeagus in Figures 1g and 2g.

Female: Sternite VI getting broad anterior to posterior, apex slightly pointed, disorganized setae on surface (Figure. 1h, 2h). Lateral margins of tergit VI have micro denticulate area (Figure. 1i, 2i). Median lobe of sternit VII narrowed toward apex, inner portion of lateral lobes with pointed spines and posterior margins with long setae (Figure. 1j, 2j)

Habitat: All examined *Hydroscapha granulum* specimens were found in filamentous algae growing on rocks (Figure. 3).

Examined specimens in this study were identified as *H. granulum*. But when these specimens analyzed carefully and compared with Löbl (1994) and Fikacek and Sipkova (2009), several differentiations observed on some important taxonomical characters.

According to Löbl (1994) and Fikacek and Sipkova (2009) dedicated as total body length has 0.95–1.20 mm, fore body length has 0.77–0.98 mm, maximum width of elytra has 0.48–0.60 mm, antennomere II has 2 times longer than wide, antennomere VIII has 3 times longer than wide.

Some of the examined specimens determined as total body length has 1.48 and 1.62 mm (Figure 1b, c). With reference to these measurements, some *H. granulum* specimens are bigger than those in literatures. When antennomere measurements compared with the literatures, measured antennomere II of examined specimens was 1.29 times longer than its wide and antennomere VIII was 2.10 times longer than its wide. These measurements are different from the literatures. Moreover, antennomere I and VIII have long and thin trichoid sensilla which were not mentioned at the other papers. Trichoid sensillas are easily broken and not easy-to-examine in the slides, which is the reason why they are usually omitted from the drawings.

When identification keys which in Fikacek and Sipkova (2009) are analyzed, postero-median portion of sternit VII in males nearly straight between lateral

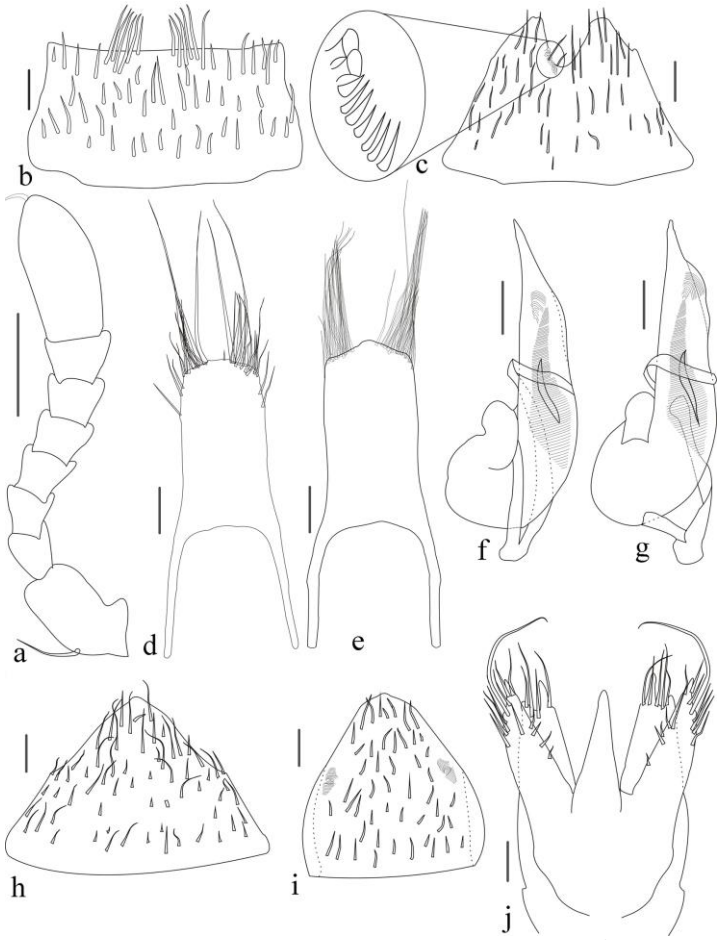

Figure 1. *H. granulum*: a, antenna; b, sternite V male; c, sternite VI male; d-e, sternite VII male; f, aedeagus (lateral); g, aedeagus (dorso-lateral); h, sternite VI female; i, tergit VI female; j, sternite VII female. Scale bars: 0.05 mm.

tufts of setae. But the same area in some of the examined specimens has slightly convex (Figure. 1e, 2e).

Although the morphology of sternite VI in males are the same, the first denticles of side of the median portion have not pointed but short and thick (Figure. 1c). Also arrangements of the setae on the surface of sternite VI are different from Löbl (1994).

Moreover, characteristics of sternite V in males and tergit VI and sternit VI in females for *H. granulum*, which is not mentioned in prior researchers and declared as important taxonomic characters for Hydroscaphidae species by Fikacek and Sipkova (2009), were firstly reported in present paper.

H. granulum is a rare species because of its small size and captures are rather aleatory (Richoux & Doledec, 1987). 78 different freshwater localities studied from all of the South Marmara Region (Turkey) during 2004–2006 and 41 different freshwater localities studied from Gediz River Basin (Kütahya, Manisa, Uşak and İzmir) during 2011–2013, only 19 specimens have been captured at 5 different localities. Because of these results, it is concluded that *H. granulum* is rare and endangered species for Turkey.

In prior studies, description of *H. granulum* was given but when these descriptions compared with the examined specimens determined some remarkable differentiations. In this paper, redescription of *H. granulum* was introduced by taking different characters into account.

H. granulum belongs to Hydroscaphidae which is only species known from Turkey. When the zoogeographical and climate characteristics of Turkey were considered, it is obvious that the species number of Hydroscaphidae will probably increase by doing detailed studies in Turkey. Therefore, it is thought that this study will be useful for the researchers to describe the species easily.

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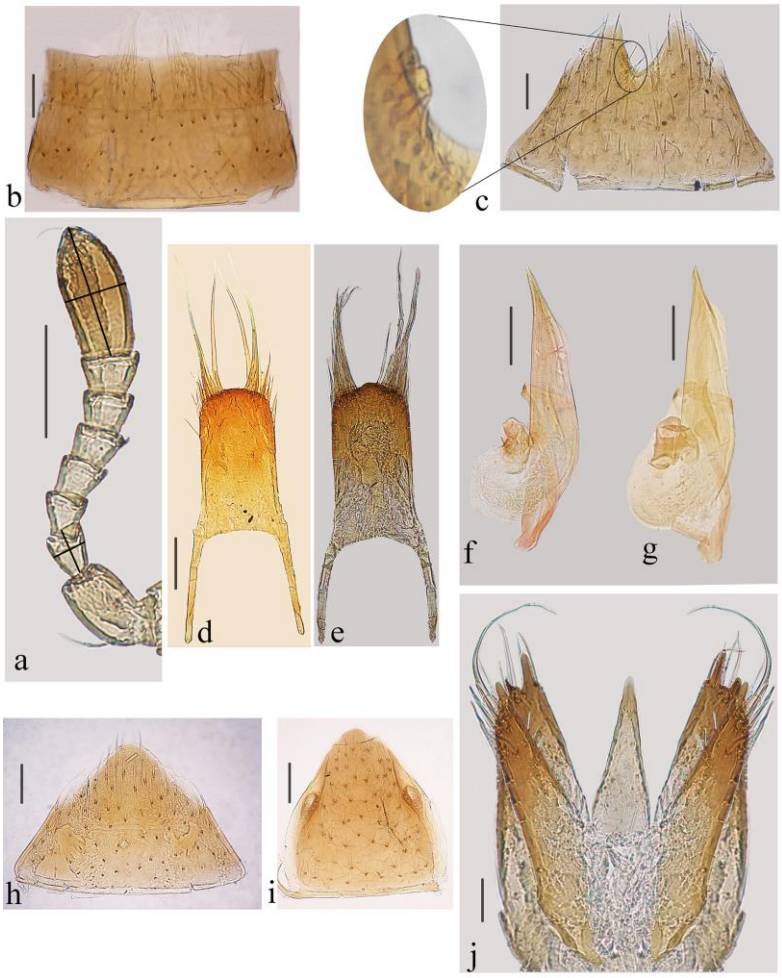

Figure 2. *H. granulum*: a, antenna; b, sternite V male; c, sternite VI male; d-e, Sternite VII male; f, aedeagus (lateral); g, aedeagus (dorso-lateral); h, sternite VI female; i, tergit VI female; j, sternite VII female. Scale bars: 0.05 mm.

Figure 3. Habitats of the collected *Hydroscapha granulum* specimens A: Çanakkale (Ezine), B: Bursa (İnegöl), C: Manisa (Gediz I), D: Manisa (Yeniköy). Photograph by C. Aydınlı.

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