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SHORT PAPER

A New Species of *Bithynia* (Gastropoda: Bithyniidae) from an Eutrophic Lake Uluabat (South Marmara Region), Northwest of Turkey

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Abstract

Researches concerning freshwater gastropoda in Turkey have increased significantly in recent years. Among Prosobranchia, Bithyniidae are in an interesting position due to limited knowledge available about species diversity, distribution and ecology. Although most of species belong to Bithyniidae known from Balkans and Greece, only few species of Bithyniids have been known from Turkey so far, including *Bithynia tentaculata*, *B. leachii*, *B. pseudemmericia*, *B. phialensis*, *B. badiella*, *B. pesicii*, *B. yildirimi* and *Pseudobithynia pentheri*, *P. yildirimi*. In this study conducted on Lake Uluabat, a limnobenthos survey was carried out from 12 different sampling sites across the lake. This study aims to describe a new *Bithynia* from the eutrophic Lake Uluabat located in South Marmara Region of Turkey and provide data about the ecology of the new species that living in a restricted location in the lake.

Keywords: Gastropoda, Bithyniidae, *Bithynia* sp. nov., Lake Uluabat, Turkey.

Ötrofik Uluabat Gölü'nden (Marmara Bölgesi - Kuzeybatı Türkiye) Yeni Bir Bithynia (Gastropoda: Bithyniidae) Türü

Özet

Son yıllarda, Türkiye tatlısu Gastropodları üzerine yapılan araştırmalar önemli bir artış göstermiştir. Prosobranşlar içerisinde yer alan Bithyniidae familyasının tür çeşitliliği dağılım ve ekolojisi hakkında yeterli veri olmaması dikkat çekmektedir. Bithyniidae familyasına ait pek çok tür Balkanlarda ve Yunanistan anakarasında bilinirken, Türkiye'de bu familyaya ait az sayıda türün varlığı bilinmektedir, bunlar arasında; *Bithynia tentaculata*, *B. leachii*, *B. pseudemmericia*, *B. phialensis*, *B. badiella*, *B. pesicii*, *B. yildirimi* ve *Pseudobithynia pentheri*, *P. yildirimi* yeralır. Uluabat Gölünde gerçekleştirilen bu çalışmada göl boyunca belirlenen 12 farklı istasyondan limnobentik örneklemeleri yapılmıştır. Bu çalışmada, Türkiye'nin Güney Marmara bölgesinde yer alan ve ötrofik karakterdeki Uluabat Gölü'nde keşfedilen *Bithynia timmii* yeni türü tanımlanmıştır. Bununla birlikte, bu yeni türün bulunduğu ortamın özellikleriyle, türün ekolojisi hakkında bilgilerin de verilmesi amaçlanmıştır.

Anahtar Kelimeler: Gastropoda, Bithyniidae, *Bithynia* yeni türü, Uluabat Gölü, Türkiye.

Introduction

The unique geographic position and geological evolution of Anatolia, located between continents, gave rise to the region's diversity of flora and fauna. Studies on the freshwater gastropoda in the past decade revealed the splendid species diversity, especially for Hydrobiidae, in Turkey. Nevertheless, limited information is available regarding the speciation, species diversity, and distribution of freshwater gastropoda of Anatolia.

Recent studies focusing on the Bithyniidae revealed many new species in Europe, Asia Minor and the Middle East. In Europe, the Balkan Region, especially the mainland and some Islands of Greece, is regarded as a "Hot Spot of Biodiversity" in terms of diversity and distribution (Glöer *et al*., 2010). In Greece, neighboring Turkey, there are seven *Bithynia* spp. and 9 *Pseudobithynia* spp. (Glöer *et al*., 2010), while there are three records mentioned in Bulgaria (Glöer and Georgiev, 2012). Moreover, 7 *Bithynia* spp. and 2 *Pseudobithynia* spp. exist in surrounding areas of Iran (Glöer and Pesic, 2012).

Bithynia and *Pseudobithynia* are only two of the

genera in the Bithyniidae family found in Turkey so far. Seven species of *Bithynia* were cited so far: *B. tentaculata* (Linnaeus, 1758), *B. leachii* (Sheppard, 1824), *B. pseudemmericia* Schütt, 1964, *B. phialensis* (Conrad, 1852), *B. badiella* (Küster, 1852), *B. pesicii* Glöer and Yıldırım, 2006 and *B. yildirimi* Glöer and Georgiev, 2012. Two species of *Pseudobithynia*, *P. pentheri* (Sturany 1904) and *P. yildirimi* Odabaşı *et al.*, 2013 have also been described (Yıldırım, 1999, Glöer and Yıldırım, 2006; Odabaşı *et al*., 2013).

This study, conducted on the Lake Uluabat, aimed at describing a new species *Bithynia timmii* from the study area. Here also we partly revealed some ecological conditions of living habitat of the new *Bithynia* in the eutrophic lake.

Materials and Methods

The Lake Uluabat located in the western part of Turkey (40°10' N, 28°35' E) is shallow and eutrophic character with a surface area of 156 km^2 at an altitude of 9 m above sea level (Figure 1) (Magnin and Yarar, 1997; Arslan *et al*., 2010). Lake is fed principally by the Mustafa Kemal Paşa River from the southwest and has its only outlet in the northwest, where it drains into Kocaçay River. The lake has an inland delta formed through incoming silt deposits from the Mustafa Kemal Paşa Stream flowing over an area of 3,747.6 hectares that is under agricultural use (Salihoğlu and Karaer, 2004; Arslan *et al*., 2010).

Field study was carried out on the Lake Uluabat, benthic samples were collected from 12 sites in the Lake, and the sampling was performed by an Ekman-Birge Grab from the boat. Gastropod specimens were taken from the benthic samples after separation and sorting process of macro in vertebrates. Then, the material was placed into 75% ethanol. Shell measurements and dissections of soft body parts were performed under a stereo microscope (Olympus SZX7). The measurements of the digital images of the shell and soft body parts were performed by Q Capture Pro 7.

The type material is deposited at the Limnology Museum of Çanakkale Onsekiz Mart University (COMULM) and Osmangazi University, Faculty of Science and Letters, Hydrobiology Museum, Eskişehir (OGUHB), Turkey.

Results

FAMILY Bithyniidae Gray, 1857
Genus *Bithynia* Leach 1818
Type Species *Bithynia tentaculata* (Linnaeus 1758)
Bithynia timmii n. sp.

Material examined: 35 example from the Lake Uluabat; N 40°11'36″ E 28°38'12″, 10.11.2005, Naime Arslan leg.

Holotype: Shell height 5.12 mm, width 3.38 mm, COMULM–G 0030.

Paratypes: 3 ex. COMULM–G 0029, 5 ex OGUHB 0172, rest in coll. Odabaşı (Çanakkale Onsekiz Mart University, Faculty of Marine Science and Technology Turkey).

Locus Typicus: Lake Uluabat, Mustafa Kemal Paşa district, the south of Marmara Region, Bursa-Turkey.

Etymology: The species was named after Prof.

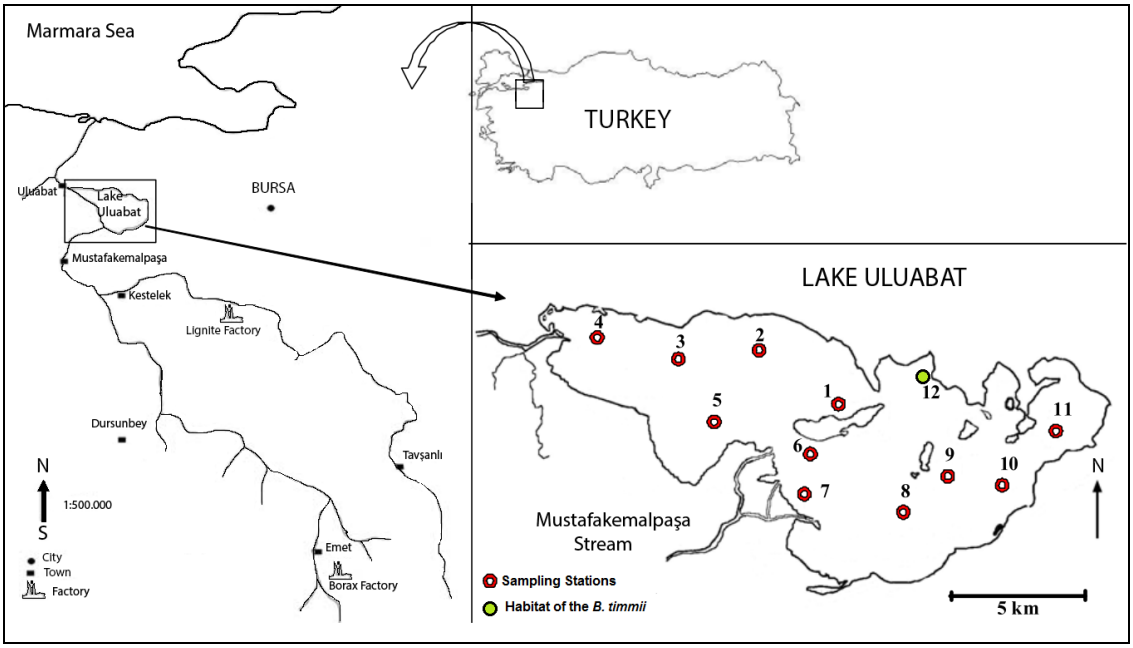

Figure 1. Geographic location of the Lake Uluabat with sampling stations.

Dr. Naime ARSLAN's supervisor Tarmo Timm, an outstanding expert on aquatic Oligochaeta in Estonia.

Diagnosis: Shell is conical and translucent. Shell has 4.5-5 stepped whorls with prominent body whorl, up to 5.64 mm height and 3.77 mm width. Shell width to height ranges between 0.56 and 0.71. Spirals are moderately swollen and the sutures are deep. Umbilicus is slit-like. Shell height to spire is 0.18-0.34. Body whorl is large approximately 2/3 of the shell height and not very broad. Body whorl to shell height is 0.69-0.82. Aperture is oval and slightly angulated at the top. Aperture height to shell height is 0.46 and the width to shell width ranges between 0.58 and 0.62. Sexual dimorphism is conspicuously visible ($P<0.05$ in Shell Height and Body Whorl Height, $P<0.001$ in Shell Width, Aperture Width and Aperture Height). Males are apparently slenderer than females (Figure 2A-B, Figure 3, Table 1).

Anatomy: The penis has an appendix and flagellum. The body of penis is broad and conical. The tip of the penis is small, pointed and curved toward to the end. The appendix is long almost as long as the penis itself, and has a sucker at the tip and emerging almost from the middle of the penis. The flagellum is very long (Figure 2D).

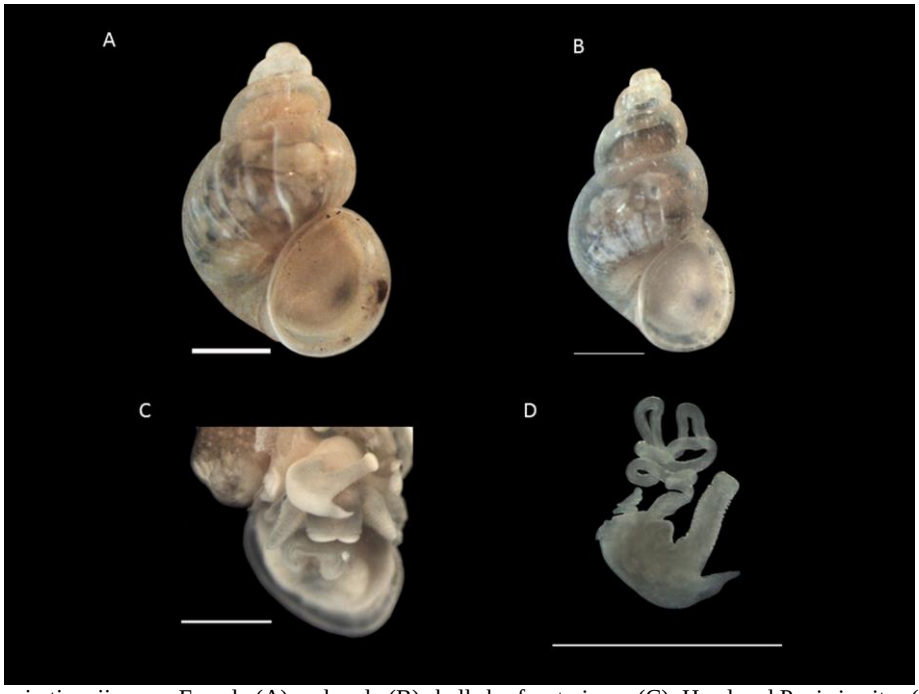

Figure 2. *Bithynia timmii* n. sp.. Female (A) and male (B) shells by front views. (C): Head and Penis in situ, (D): Penis with flagellum.

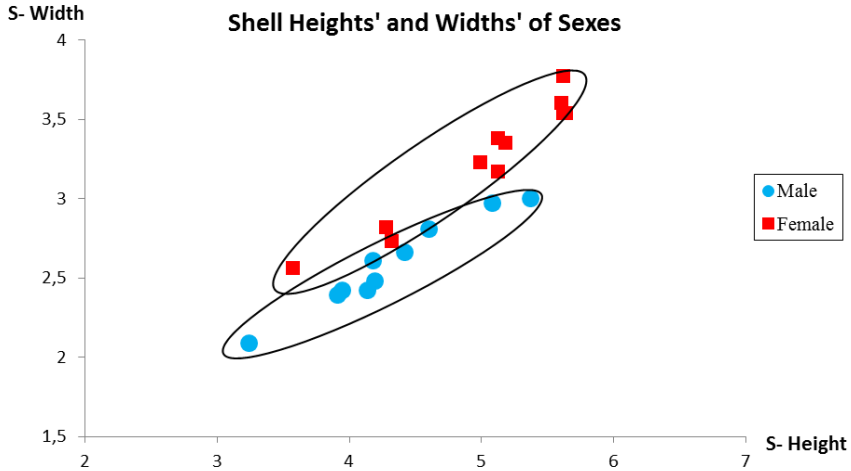

Figure 3. Plot of Shell Height (SH) and Shell Width (SW) of Both Sexes of *B. timmii*.

Table 1. Measurements of Some Shell Characters of *B. timmii* n. sp. with Morphometric Index Values

Features Min.─Max. (Average±SE)	Male (n=10)	Female (n=11)	Interval of Importance (P Values of Student-t test)
Shell Height (SH)	3.24-5.37 (4.31±0.21)	3.57-5.64 (5.01±0.21)	P<0.05
Shell Width (SW)	2.09-3.0 (2.59±0.09)	2.56-3.77 (3.24±0.12)	P<0.001
SW / SH	0.56-0.65 (0.60±0.01)	0.62-0.72(0.65±0.01)	P<0.001
AH / SH	0.40-0.51 (0.46±0.01)	0.46-0.54 (0.49±0.01)	P<0.05

n: Individual Numbers, SE: Standard Error, AH: Aperture Height

Differential diagnosis: According to earlier studies from Turkey, there have been seven *Bithynia* spp. recorded. *B. tentaculata* and *B. phialensis* have flattened sutures, while *B. timmii* has moderately deep suture. Conversely, suture in *B. pesicii* is very deep and whorls are apparently swollen while *B. timmii* has moderately swollen whorls and narrower shell width than *B. pesicii*. The *B. pseudemmericia* is broader in shell width than *B. timmii* and the preceding has a typical aperture edge unlike the latter. The *B. yildirimi* is somewhat similar to *B. timmii* in shell form, but they are anatomically distinct from each other. *B. timmii* has a distinctive penis from any other *Bithynia* spp. in Turkey. Although it is reported that the *B. leachi* exist in Turkey, distribution of this species is restricted with North and West Alps (Vavrova *et al*., 2010), for this reason, occurrence in Turkey is doubtful. Therefore, the *B. leachi* is not put into comparison.

Habitat: The Lake Uluabat has a eutrophic character formed after tectonic depression at the South Marmara Region. The lake receives freshwater mainly from Mustafa Kemal Paşa River in the Southwest and drains into Kocaçay River in the Northwest. Since 1998, the lake and its surrounding area have been considered under the Ramsar Convention of Wetlands in the world. The *B. timmii* was found only in one station (12^{th} station) located at north-east region of the lake (Figure 1). The station has a depth of 0.6 m with fine sand and muddy bottom. Dense vegetation of emerged and submerged macrophytes such as white water-lily was observed at the sampling time. In the sampling site, *B. timmii* was found together with *Viviparus viviparus* (Linnaeus, 1758), *Borystenia naticina* (Menke, 1845), *Pseudorientalia natolica* (Küster, 1852), *Planorbis intermixtus* Mousson, 1874, *Gyraulus albus* (O.F. Müller, 1774). Freshwater gastropods such as *B. tentaculata*, *Borysthenia naticina*, *Valvata* sp., *Valvata piscinalis* (O.F. Müller 1774), *Physa acuta* (Draparnaud 1805), *Lymnaea stagnalis* (Linnaeus 1758), *Radix labiata* (Rossmässler, 1835), *Gyraulus albus*, *Gyraulus piscinarum* (Bourguignat 1852) were recorded in small numbers as living specimens from the other locations of the lake. Besides, many empty shells of *Potamopyrgus antipodarum* (J.E. Gray, 1843) were observed.

Discussion

The family Bithyniidae is a well-studied group in Europe in terms of taxonomy and distribution (Glöer *et al*., 2007; Glöer and Maassen, 2009; Glöer *et al*., 2010). The most recent studies revealed that many species of two genera, *Bithynia* and *Pseudobithynia*, predominantly occur in the Balkans especially in mainland Greece (Glöer and Bössneck, 2007; Glöer *et al*., 2010). On the other hand, studies have been conducted in the Middle East such as in Iran (Glöer and Pesic, 2006; 2009; 2012), Lebanon (Glöer and Bössneck, 2007), Iraq (Glöer and Naser, 2008) and Asia Minor (Sturany, 1905; Schütt, 1965; Glöer and Yıldırım, 2006; Glöer and Georgiev, 2010) discovered new species for both genera.

In Turkey, seven representatives of *Bithynia* were reported so far from different locations. *B. pseudemmericia* has been regarded as endemic to Anatolia ranging from the south-west (Type locality: Antalya Pınarbaşı) to the middle Anatolia (Schütt, 1965; Yıldırım, 1999). *Bithynia pesicii* Glöer and Yıldırım 2006 is also endemic to Turkey and only known from two localities: the type locality of Akçapınar Stream (Glöer and Yıldırım 2006), and the Kadın Azmağı Stream in Muğla Province, the south-western Anatolia (Kebapçı and Seddon, 2014). There is scant information about the *B. yildirimi* Glöer and Georgiev, 2012 in distributional point of view and it is known only from the type locality (Kazanlı Village, Mersin) at the Mediterranean coast of Turkey (Glöer and Georgiev, 2012). *B. tentaculata* is widespread through Europe and it was also regarded as widespread in Turkey (Yıldırım, 1999). Despite *B. leachii* is cited in Turkey (Bilgin, 1980), the distribution range of this species is confined to North and West Alps (Vavrova *et al*., 2010) and *B. leachii* is also not reported from the Balkans and Greece. Therefore, the existence of this species in Turkey is not clear enough. Similarly, considering the type localities of *B. phialensis* and *B. badiella*, Palestine and Beirut respectively, which are reported from western and southern locations of Turkey (Yıldırım, 1999) are also doubtful as specified by Glöer and Georgiev (2012). According to studies conducted in the Balkans and Greece, almost all the Bithyniid species are endemic in a lake or a drainage system (Glöer *et al*., 2007). Hence, the distributional patterns and biogeography of the family should be taken into

account when making comparison in the taxonomic descriptions.

B. timmii described herein, was detected only in one sampling location across the Lake Uluabat. The accompanying species of *Pseudorientalia natolica* living in freshwater springs were found in the same sampling site. This species is originally a spring water inhabitant; however, some individuals of the species may accidentally appear in the other types of aquatic biotopes as seen in this study. The existence of this species most probably indicates a groundwater source containing the spring inhabitant taxa. As prosobranchia is intolerant to pollution, the groundwater-receiving-site in the eutrophic lake seems to pave a way for maintaining survival for the *B. timmii* population.

More comprehensive studies focusing on freshwater gastropods including systematics, ecology, and phylogenetics are needed. Hereby, the data could shed light on endemism, genetic lineages, and environmental risks which are threating biodiversity of Anatolian freshwater gastropod species.

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