



A NEW PLEISTOCENE *VALVATA* SPECIES FROM LAKE BEYŞEHİR AND TWO NEW *GYRAULUS* SPECIES FROM LAKE EĞİRDİR (MOLLUSCA: GASTROPODA: VALVATIDAE, PLANORBIDAE) IN TURKEY

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ABSTRACT: Recently collected samples from lakes Beyşehir and Eğirdir in Turkey contained one new Pleistocene *Valvata* which we describe here as †*Valvata beysehirensis* n. sp. In addition we found two new species of *Gyraulus*, named *G. egirdirensis* n. sp. and *G. taseviensis* n. sp. These species are compared with members of the genera *Valvata* and *Gyraulus* known so far from Turkey.

KEY WORDS: *Valvata*, *Gyraulus*, Turkey, Lake Eğirdir, Lake Beyşehir, new species

INTRODUCTION

Valvata piscinalis (O. F. Müller, 1774), *V. saulcyi* Bourguignat, 1853 and *V. cristata* O. F. Müller, 1774 are the recent *Valvata* species known from Turkey (YILDIRIM 1999). Another two members of the genus, †*V. costatus* Taner, 1973 and †*V. kavusani* Schütt, 1984, are known from Turkish Pleistocene deposits (YILDIRIM 1999).

In their check list of the basommatophoran pulmonates of Turkey, YILDIRIM et al. (2006) listed eight species of *Gyraulus*: *G. albus* (O. F. Müller, 1774), *G. ehrenbergi* (Beck, 1837), *G. piscinarum* (Bourguignat, 1852), *G. euphraticus* (Mousson, 1874), *G. laevis* (Alder, 1839), *G. parvus* (Say, 1817), *G. crista* (Linnaeus,

1758) and *G. hebraicus* (Bourguignat, 1852). Recently GLÖER & RÄHLE (2009) added *G. pamphylicus* to the list; the species was also mentioned by YILDIRIM & KEBAPÇI (2009), and KEBAPÇI & YILDIRIM (2010). *G. argaicus* (Sturany, 1904), described from Turkey (Soisaly), as well as *G. piscinarum acutissimus* Schütt, 1993, with its type locality in Lake Alzapli near Gölbaşı, were never mentioned, apart from the original descriptions. *G. argaicus* will be redescribed elsewhere (GLÖER & GEORGIEV 2012).

From Lake Eğirdir, YILDIRIM (2004) listed only *G. albus*, and BILGIN (1980: 50) mentioned also *G. ehrenbergi* (as *Biomphalaria ehrenbergi*).

MATERIAL AND METHODS

The snails were collected by hand. The shells were measured under a Zeiss stereomicroscope with a calibrated eyepiece; the photographs were taken with a Leica R8 camera system with a digital adapter. Dating of fossil samples was based on the isotope ¹⁴C analysis with the use of atomic mass spectrometer (¹⁴C AMS).

The type material is stored at the Zoological Museum Hamburg (ZMH), Museo Civico di Storia Naturale, Milano, Italy (MSNM), and the collection of ALBERTO GIROD (AGMal). In addition, paratypes have been sent to Prof. Dr. M. ZEKI YILDIRIM (University Burdur, Turkey).

SAMPLING SITES

Lake Beyşehir, 1,123 m a.s.l., 656 km², has a maximum depth of 10 m (IŞILDAR 2010). The lake (Fig. 1) occupies the northern basin of the Beyşehir depression, which extends southwards to Lake Suğla. The raised shorelines and Quaternary fossils indicate that during the Pleistocene pluvial periods the levels of the two lakes rose up to that of karstic outflows (EROL 1980). The beach ridges are between 10 and 25 m above the present water level (EROL 1978).

Beyond the existing shore, to the southeast of the lake, widespread outcrops of ancient lacustrine deposits are located, both north of Beyşehir towards Kireli and along the road which runs eastwards along the valley bottom in the direction of Konya, via Üçpinar. The strata from which the samples were obtained are exposed on a hillock to the west of the national road D695, at the latitude of Çiftlikköy, just south of the turning for this village.

The deposit crops out at 1,135 m a.s.l. and is cut by a disused quarry where the visible strata are about 5 metres thick, with alternating layers of carbonates and gyttja.

Lake Eğirdir (Fig. 1), 917 m a.s.l. and 482 km², is the fourth largest lake in Turkey after Van Gölü, Tuz Gölü ('Salt Lake') and Beyşehir Gölü. The average water depth is 7–8 m, with the maximum of 15 m. In summer stretches of shore emerge, with notable accumulations of mollusc shells. These are natural thanatocoenoses made evident by the seasonal drop in the water level, formed by wave action that pushes the mollusc shells up the beach, building up the accumulations. They rest on gravelly deposits from which the waves have removed the finer sediments. Samples were collected in the Hoyran lowlands, between the villages of Taşevi and Gençali, from a small lake or pond at the NW. margin of Lake Eğirdir and separated from it by a tree-covered beach ridge. It is fed by abundant spring water which supports plentiful submerged aquatic vegetation. Its water flows into Lake Eğirdir, with which it is occasionally connected only during water level highstands. The difference between high and low water levels can be as high as 5 m (GÜLLE et al. 2008).



Fig. 1. The sampling sites of †*Valvata beysehirensis* n. sp. (blue dot), *Gyraulus egirdirensis* n. sp. and *G. taseviensis* n. sp. (red dot)

RESULTS

The samples collected by A. GIROD in 2000 and 2002 contained one new Pleistocene *Valvata* species and two new *Gyraulus* species. Unfortunately we had only empty shells for identification, however, these are characteristic enough to describe the species as new.

Genus *Valvata* O. F. Müller, 1773

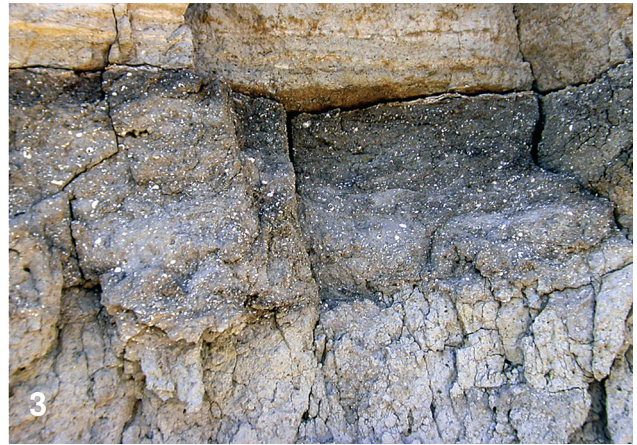
Type species: *Valvata cristata* O. F. Müller, 1774.

†*Valvata beysehirensis* n. sp.

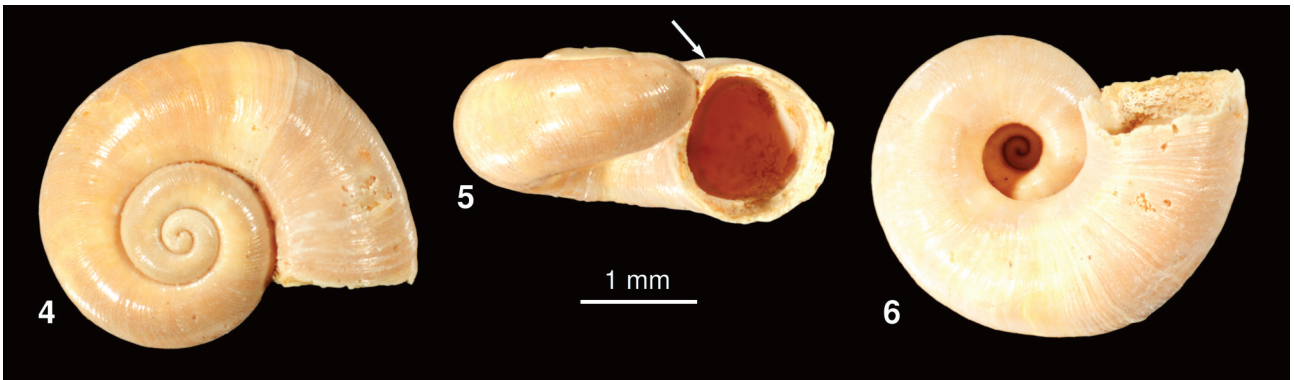
Holotype: Shell width 3.4 mm, shell height 1.6 mm, ZMH 79381.

Paratypes: 3 shells MSNM Mo-36591, numerous shells AGMal 3595, 3 shells coll. GLÖER.

Type locality: A hillock to the west of the national road D695, at the latitude of Çiftlikköy, just south of the turning for this village (37°43'58.38"N, 31°42'08.76"E) (Figs 2, 3). The deposit crops out at 1,135 m a.s.l. and is cut by a disused quarry where about 5 m thick strata are exposed, consisting of alternating layers of carbonates and gyttja.



Figs 2–3. The sampling site of †*Valvata beysehirensis* n. sp.



Figs 4–6. *Valvata beysehirensis* n. sp. (holotype): 4 – apical view, 5 – frontal view, 6 – umbilical view

Etymology: Named after the lake where the species was collected.

Description: The light brownish shell (Figs 4–6) is glossy with 3.5 whorls which are circular, but angled at the top near the suture (Fig. 5, arrow). The surface is finely striated (Fig. 4). The first whorls are flat and only the body whorl is descending. The suture is deep, especially at the body whorl (Fig. 5). The umbilicus is wide and the first whorls are clearly visible (Fig. 6). The shell is 3.0–3.4 mm in diameter and 1.4–1.6 mm in height.

Differentiating features: At first glance the shell is similar to that of *Valvata cristata* but in †*V. beysehirensis* n. sp. the whorls are distinctly angled. †*Valvata kavusani* Schütt et Kavuşan, 1984 as well as †*V. costatus* Taner, 1973 have a higher spire than †*V. beysehirensis* n. sp. (TANER 1973); the whorls of †*V. kavusani* bear one to three keels (SCHÜTT & KAVUŞAN 1984). No Pleistocene *Valvata* sp. which is similar to †*V. beysehirensis* n. sp. could be found in SANDBERGER (1870–1875).

Associated species: *Lymnaea stagnalis* (Linnaeus, 1758), *Anisus* sp., *Gyraulus convexiusculus* (Hutton, 1849), *Gyraulus crista* (Linnaeus, 1758), *Planorbarius corneus* (Linnaeus, 1758), *Acroloxus lacustris* (Linnaeus, 1758), *Viviparus* sp., *Bithynia*

pseudemmericia Schütt, 1964, *Islamia anatolica*¹ Radoman, 1973, *Borysthenia naticina* (Menke, 1845), *Unio* sp., *Pisidium* sp., *Pisidium amnicum* (O. F. Müller, 1774), *Pisidium personatum* Malm, 1855. Several other species are present sporadically, but their poor state of preservation did not permit reliable identification.

Remarks: Two samples of valvatid shells from gyttja layers yielded the following ¹⁴C AMS dates: sample Bey 3 – (GrA–53007) 46,000±850–600 years BP δ¹³C – 7.38‰; sample Bey 5 – (GrA–53009) 44,450±650–550 years BP δ¹³C – 6.66‰. Since these gyttja layers are overlain by thick carbonate sediments, contamination by young carbon from percolating meteoric water after the retreat of the lake must be taken into account (ROBERTS et al. 1999). The error in age determination could be between 4 and 6 ka. The two dates obtained are quite similar and correspond to the late Middle Pleistocene. The raised beaches of the Beyşehir-Suğla Basin at 1,130 and 1,135 m a.s.l. represent the contact between the Upper and Middle Pleistocene (EROL 1978); the dates from the new samples collected from between 1,130 and 1,133 m thus fit comfortably into this period, notwithstanding the error margin.

¹ Specimens of this species have been sent to M. Z. YILDIRIM for comparison with present-day individuals.

Genus *Gyraulus* Charpentier, 1837

Type species: *Planorbis albus* O. F. Müller, 1774.

Remark: *Gyraulus* species are sinistral, but the underside is the functional upper side of the snail. In the following description we always refer to the functional sides.

Gyraulus egirdirensis n. sp.

Holotype: Shell width 5.9 mm, shell height 1.4 mm, ZMH 79383.

Paratypes: 3 shells coll. MSNM Mo-36598, numerous shells AGMal 3217, 2 shells coll. GLÖER.

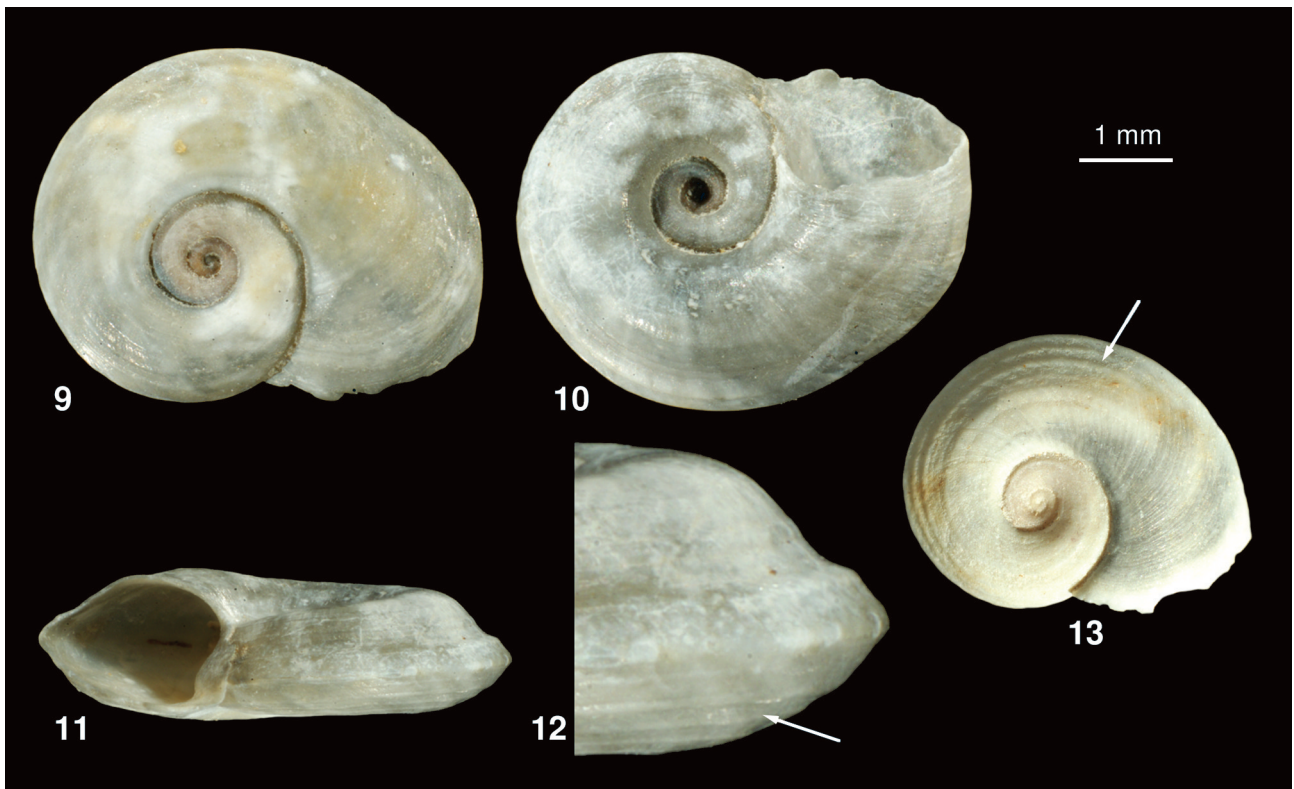
Type locality: Eğirdir lake, at village Taşevi, 38°16'N, 30°49'E (Figs 7, 8).

Etymology: Named after the lake where the species lives.

Description: The whitish shell is silky with fine growth lines (Fig. 9). The shell consists of 3.5–4 whorls, which are regularly and rapidly increasing with a deep suture on both sides (Figs 9, 10). The expanded body whorl is keeled and it is not deflected. The first whorls are immersed on both sides. On the surface of both sides 2–3 spiral ribs are visible (Figs 11–13). The shell is of medium size, 5.0–5.9 mm in diameter and 1.4 mm in height.



Figs 7–8. The sampling site at Lake Eğirdir



Figs 9–13. *Gyraulus egirdirensis* n. sp. (9–12: holotype). 9 – apical view, 10 – umbilical view, 11 – frontal view, 12 – border of the body whorl with keel and spiral ribs (arrow), 13 – paratype



Figs 14–16. *Gyraulus taseviensis* n. sp. (holotype): 14 – apical view, 15 – umbilical view, 16 – frontal view

Differentiating features: The species is characterised by its prominent keel (Fig. 12), and the spiral ribs on the shell, which are not found in any other *Gyraulus*.

***Gyraulus taseviensis* n. sp.**

Holotype: Shell width 5.5 mm, shell height 1.5 mm, ZMH 79382.

Paratypes: 33 shells MSNM Mo-36590, AGMal 3270, 3 shells coll. GLÖER.

Type locality: Eğirdir lake, at village Taşevi, 38°16'N 30°49'E (Figs 7, 8).

Etymology: Named after the village near which the species was found.

Description: The whitish to light-corneous shell is silky to glossy (Fig. 14), transparent, smooth with fine growth lines. The shell consists of 3.5–4 whorls, which are regularly and rapidly increasing with a deep suture. The first whorls are immersed slightly on the upper side and deep on the underside with a wide umbilicus (Fig. 15). The body whorl is angled and deflected (Fig. 16). The shell is of medium size, 5.0–6.0 mm in diameter and 1.4–1.6 mm in height.

Differentiating features: At first glance the shell looks like that of *Gyraulus bekaensis* Glöer et Bössneck,

2007, with its type locality far away in Lebanon (GLÖER & BÖSSNECK 2007). However, in the latter species the last whorl is not deflected. The deflected body whorl and the angled shell are reminiscent of *Gyraulus piscinarum acutissima* Schütt et Şeşen, 1993, described from Lake Gölbaşı (SCHÜTT & ŞEŞEN 1993), in which the upper side of the shell has a prominent reticulate sculpture, while the shell of *G. taseviensis* n. sp. is smooth.

Associated species: *Physa fontinalis* (Linnaeus, 1758), *Haitia acuta* (Draparnaud, 1805), *Lymnaea stagnalis* (Linnaeus, 1758), *Lymnaea truncatula* (O. F. Müller, 1774), *Lymnaea auricularia* (Linnaeus, 1758), *Gyraulus convexiusculus* (Hutton, 1849), *Gyraulus piscinarum* (Bourguignat, 1852), *Planorbarius corneus* (Linnaeus, 1758), *Theodoxus heldreichi* (Martens, 1878), *Bithynia pseudemmericia* (Schütt, 1964), *Graecoanatolica lacustriturca* (Radoman, 1973), *Falsipyrgula pfeifferi* (Weber, 1927), *Valvata cristata* O. F. Müller, 1774, *Valvata piscinalis* (O. F. Müller, 1774), *Borysthenia naticina* (Menke, 1845), *Dreissena polymorpha* (Pallas, 1771). *Pisidium* sp., *Pisidium henslowanum* (Sheppard, 1825), *Pisidium* cf. *nitidum* Jenyns, 1845.

DISCUSSION

All the associated species found together with †*Valvata beysehirensis* n. sp. in the same gytja layer showed that they occurred contemporarily. Because all the other species still occur in Turkey it is possible that also †*Valvata beysehirensis* n. sp. may be found alive.

In order to identify the species of *Gyraulus* collected by A. GIROD, we had to compare them with the members of *Gyraulus* previously known from Turkey. The differences between the new species described above and the *Gyraulus* spp. which live in Central Eu-

Table 1. Distinguishing characters of the members of *Gyraulus* from Turkey

Taxon (distribution)	max. diameter D [mm]	body whorl height [mm]	D/h ratio	keel	no. of whorls	body whorl	umbilicus	body whorl
<i>G. pamphylicus</i> (Turkey)	7.0	1.0–1.2	7.0–5.8	present	4	expanded	narrow	not deflected
<i>G. argaeicus</i> (Turkey)	7.0	1.5–1.8	3.2	slight	4	expanded	wide	not deflected
<i>G. piscinarum</i> (Lebanon)	4.4	1.1–1.2	4.0–3.7	no	3.5	expanded	wide	not deflected
<i>G. ehrenbergi</i> (Egypt)	4.5	1.0	4.5	no	3.5	expanded	narrow	not deflected
<i>G. euphraticus</i> (Iraq)	7.0	1.0	7.0	slight	4.5	not expanded	narrow	not deflected
<i>G. egirdirensis</i> n. sp. (Turkey)	5.9	1.4	4.2	yes	4	expanded	wide	not deflected
<i>G. taseviensis</i> n. sp. (Turkey)	6.0	1.6	3.8	yes	4	expanded	wide	deflected



Figs 17–22. Species of *Gyraulus* from Turkey: 17 – *G. pamphylicus* (holotype), 18 – *G. euphraticus* (syntype), 19 – *G. ehrenbergi* (topotype), 20 – *G. piscinarum* (topotype), 21 – *G. egirdirensis* n. sp. (holotype), 22 – *G. taseviensis* n. sp. (holotype)

rope and are mentioned in the literature: *G. albus* (O. F. Müller, 1774), *G. laevis* (Alder, 1838), *G. parvus* (Say, 1817), and *G. crista* (Linnaeus, 1758), are obvious, as these species are either smaller or not keeled.

Gyraulus taseviensis n. sp. is the only species from Turkey in which the last whorl is deflected. Of the keeled species the height of the body whorl of *G. taseviensis* n. sp. as well as *G. egirdirensis* n. sp. is higher than in the other species (see Table 1, Figs 17–22). In addition the keel in *G. egirdirensis* n. sp. is much pro-

nounced and the spiral ribs on the shell are not found in other species of *Gyraulus*.

All these species were formerly identified based exclusively on the shells (e.g. BOETTGER 1905), and the anatomical features which are suitable to distinguish among members of *Gyraulus* remained unknown before the publication of MEIER-BROOK's (1983) paper. It is possible that anatomical studies on Turkish *Gyraulus* may reveal more new species; a revision of *Gyraulus* of Turkey is necessary.

REFERENCES

- BILGIN F. 1980. Batı Anadolu'nun bazı önemli tath sularından toplanan Mollusca türlerinin sistematığı ve dağılışı. Systematics and distributions of Mollusca species collected from some fresh waters of West Anatolia. Diyarbakir Üniversitesi tip Fakültesi Dergisi 8, Supplement: 64 pp.
- BOETTGER O. 1905. Die Konchylien aus den Anspülungen des Sarus-Flusses bei Adana in Cilicien. Nachr. Dtsch. Malak. Ges. 37: 97–123.
- EROL O. 1978. The Quaternary history of the Lake Basin of Central and Southern Anatolia. In: BRICE W. C. (ed.) The environmental history of the Near and Middle East since the Last Ice Age. Academic Press, London, pp. 11–139.
- GLÖER P., BÖSSNECK U. 2007. Zur Identität von *Gyraulus piscinarum* Bourguignat 1852 mit der Beschreibung von *G. bekaensis* n. sp. (Gastropoda: Planorbidae). Mollusca 25: 139–146.



- GLÖER P., GEORGIEV D. 2012. Redescription of *Gyraulus argaicus* (Sturany 1904) with the description of two new gastropod species from Turkey (Mollusca: Gastropoda: Bithyniidae, Planorbidae). *J. Conch.* 41: 167–172.
- GLÖER P., RÄHLE W. 2009. *Gyraulus pamphylicus* n. sp. – a new species from Turkey (Mollusca: Gastropoda: Planorbidae). *Mollusca* 27: 57–60.
- GÜLLE I., YILDIRIM M. Z., KÜÇÜK F. 2008. Limnological history of Lake Eğirdir (Turkey): from 1950's to the present. *Natura Montenegrina* 7: 115–128.
- IŞILDAR G. Y. 2010. Anthropogenic impacts on Beyşehir Lake National Park: Infrastructure problems and management issues. *Gazi University Journal of Science* 23: 271–280.
- KEBAPÇI Ü., YILDIRIM M. Z. 2010. Freshwater snails fauna of Lakes Region (Göller Bölgesi), Turkey. *Muzeul Olteniei Craiova, Studii și comunicări, Științele Naturii* 26: 75–83.
- MEIER-BROOK C. 1983. Taxonomic studies on *Gyraulus* (Gastropoda: Planorbidae). *Malacologia* 24: 1–113.
- ROBERTS N., BLACK S., BOYE P., EASTWOOD W. J., GRIFFITHS H. I., LAMB H. F., LENG M. J., PARISH R., REED J. M., TWIGG D., YİĞİTBAŞIOĞLU H. 1999. Chronology and stratigraphy of Late Quaternary sediments in the Konya Basin, Turkey: results from the KOPAL project. *Quatern. Sci. Rev.* 18: 611–630. doi: 10.1016/S0277-3791(98)00100-0
- SANDBERGER F. 1870–1875. Die Land-und Süßwasser-Conchylien der Vorwelt (Atlas und Text). Kreidel, Wiesbaden.
- SCHÜTT H., KAVUŞAN G. 1984. Mollusken der miozänen Süßwasserablagerungen in der Umgebung von Harmançik bei Kütahya-Bursa in Nordwestanatolien. *Arch. Moll.* 114: 217–229.
- SCHÜTT H., ŞEŞEN R. 1993. *Pseudamnicola* species and other freshwater gastropods (Mollusca, Gastropoda) from East Anatolia (Turkey), the Ukraine and the Lebanon. *Basteria* 57: 161–171.
- TANER G. 1973. Denizli Bölgesi Neojenin Paleontolojik ve Stratigrafik Etüdü IV. Bilim Kong. Ankara.
- YILDIRIM M. Z. 1999. Türkiye Prosobranchia (Gastropoda: Mollusca) türleri ve zoocoğrafik yayılılıları. 1. Tatlı ve acı sular. *Turk. J. Zool.* 23: 877–900.
- YILDIRIM M. Z. 2004. The gastropods of Lake Eğirdir. *Turk. J. Zool.* 28: 97–102.
- YILDIRIM M. Z., GÜMÜŞ B. A., KEBAPÇI Ü., BAHADIR KOCA S. 2006. The basommatophoran pulmonate species (Mollusca: Gastropoda) of Turkey. *Turk. J. Zool.* 30: 445–458.
- YILDIRIM M. Z., KEBAPÇI Ü. 2009. Endemism of land and freshwater gastropods in the lakes region (Turkey). *Muzeul Olteniei Craiova, Studii și comunicări, Științele Naturii* 25: 55–59.

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