The freshwater snails (Gastropoda) of Iran, with descriptions of two new genera and eight new species

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Academic editor: Eike Neubert  |  Received 18 May 2012  |  Accepted 24 August 2012  |  Published 4 September 2012

urn:lsid:zoobank.org:pub:35A0EBEF-8157-40B5-BE49-9DBD7B273918

Citation: Glöer P, Pešić V (2012) The freshwater snails (Gastropoda) of Iran, with descriptions of two new genera and eight new species. ZooKeys 219: 11–61. doi: 10.3897/zookeys.219.3406

Abstract

Using published records and original data from recent field work and revision of Iranian material of certain species deposited in the collections of the Natural History Museum Basel, the Zoological Museum Berlin, and Natural History Museum Vienna, a checklist of the freshwater gastropod fauna of Iran was compiled. This checklist contains 73 species from 34 genera and 14 families of freshwater snails; 27 of these species (37%) are endemic to Iran. Two new genera, Kaskakia and Sarkhia, and eight species, i.e., Bithynia forcarti, B. starmuehlneri, B. mazandaranensis, Pseudamnicola georgievi, Kaskakia khorrasanensis, Sarkhia sarabensis, Valvata nowsharensis and Acroloxus pseudolacustris are described as new to science; Ecrobia grimmi (Clessin & Dybowski, 1888), Heleobia dalmatica (Radoman, 1974) and Hippeutis complanatus (Linnaeus, 1758) are reported for the first time from Iran. Additional field work is highly desirable for a more appropriate evaluation of the extant freshwater snail biodiversity in Iran.

Keywords

Freshwater snails, checklist, new species, Iran
Introduction

Considering the geographical position of Iran, a rich fauna of freshwater snails could be expected. A high level of endemism and a diverse mixture of Palaearctic and Paleotropical elements are characteristic of the Iranian freshwater fauna (Pešić and Saboori 2007).

Research of molluscs biodiversity in Iran has a relatively long tradition. In 1862, a group of Italian scientists undertook the first systematic expedition to Persia, which revealed a large number of molluscan samples. The results of this expedition have been published by Issel (1863). Two decades later, the mollusc fauna of the Caspian Sea was studied by Dybowski (1888). The first study on the molluscs diversity of inland water was done at the beginning of the XXth Century by the Indian malacologists Annandale and his coauthors (Annandale and Prashad 1919, Annandale 1921, Annandale and Rao 1925) who studied the molluscan fauna of Seistan and Baluchistan Province. Biggs (1936, 1937, 1971) studied the malacofauna of the Central Plateau of Iran. In 1936 he noted: “Little has been written on the Mollusca of the Iranian Plateau. This was perhaps due to the inaccessibility of the interior in the past when the only method of travelling was by caravan”. Forcart (1935) studied molluscs from the Mazandaran Province. Starmühlner and Edlauer (1957) published the results of the Austrian Iran expedition of 1949/50 and 1956. Later on, Starmühlner (1961, 1965) studied molluscs from Northern and Eastern Iran collected by the Austrian A. Ruttnner. More recently, Mansoorian (1986, 1994, 1998, 2000) published on the molluscan fauna of Iran.

However, our knowledge of freshwater snails of Iran remains scanty. Despite a growing number of data over the last years, resulting from the expeditions of the junior author in 2005, 2007, and 2011, literature records of freshwater snails in Iran have remained scattered and unreviewed, hampering ecological and biogeographical analysis. To what extent is the area of Iran unique and important for freshwater snail biodiversity? This paper attempts to answer such questions by compiling data on water molluscs and their current geographic distribution in Iran.

Material and methods

The checklist of the freshwater snail fauna of Iran was compiled using published records and original data. The data from all publications were brought to the presently accepted state of taxonomy following Subba Rao (1989) (for Asian Fauna), Brown (1994) (for African Fauna) and Glöer (2002) (for the European Fauna), and papers published thereafter. Species referred to in postgraduate theses and scientific meetings are no formal publications and are consequently not considered herein.

During the field work, freshwater snails were collected by hand netting, sorted on the spot and preserved in 75 % alcohol. The data and locations of the sampling sites, where the junior author collected in 2005, 2007 and 2011 are listed in Appendix 1. In the section ‘New records’ collecting site abbreviations derive from the geographical database Pešić. The type material will be deposited in the Zoological Museum Ham-
burg (ZMH), Germany. Further, we had the opportunity to revise material of some Iranian freshwater snails deposited in the collections of the Natural History Museum Basel (NMB – Forcart’s collection), Zoological Museum Berlin (ZMB) and Natural History Museum Vienna (NHMW – Edlauer’s collection).

Not all species could be identified due to the sparsity of specimens and the non-characteristic shells, especially of small hydrobioid snails. Furthermore, the Caspian Sea fauna is not considered in the present paper. The order of families follows Bouchet and Rocroi (2005).

Results

Systematics

Family Neritidae Rafinesque, 1815

http://species-id.net/wiki/Neritidae

Remarks. Theodoxus and Neritina are distinguished from each other by their ontogeny (Bandel 2001). While the Theodoxus species hatch from the spawn as miniature adult, Neritina species leave their spawn as planktotrophic larva that will float in the sea for a more or less extended period before its metamorphosis to a crawling young. However, at the adult stage the taxonomic separation of species of the genera Theodoxus and Neritina is not always easy. As most of the Neritina spp. are marine species and usually have a denticulate border of the columella and two apophyses of the operculum, most species of the genus Theodoxus are limnic and have a smooth border of the columella and one apophysis (the “rib”); some also have a small apophysis, the peg, on the operculum (Glöer 2002). Further, in Neritina the peg is thick and strong, while in Theodoxus it is, if exists at all, small and weak. A revision of this family, particularly its subdivision in clearly defined genera is needed.

Genus Neritina Rafinesque, 1815

Type species. Nerita pulligera Linnaeus, 1758

Neritina mesopotamica Martens, 1874

http://species-id.net/wiki/Neritina_mesopotamica

Figs 2a–c

Records from Iran. Khuzestan Province (Mansoorian 2001).

Material examined. Zoological Museum Berlin (ZMB), “Neritina (Neritaea) anatolica var. mesopotamica, Ras el Ain, Mesopot. Hausknecht”.

Remarks. The height of the largest shell of the examined syntypes from Zoological Museum Berlin was 7 mm. Mansoorian (1994) in his identification key described shell
of this species as being 14 mm high. Considering his photos (Mansoorian 1994), he probably confused it with *Neritina schlaeffii* Mousson, 1874 (Figs 2f–g).

**Distribution.** Iraq, Iran (Khuzestan).

*Neritina cinctellus* (Martens, 1874)  
http://species-id.net/wiki/Neritina_cinctellus

Syn.: *Theodoxus cinctellus* Martens, 1874

**Records from Iran.** Khuzestan Province (Chu et al. 1968, Massoud and Hedayeti-Far 1979).
Figure 2. a–c Neritina mesopotamica d–e N. euphratica f–g N. schlaeflii a shell (syntype) b lab e c operculum d shell (syntype, ZMZ 528916, Irak, Samava, photo: Eike Neubert) e operculum of N. euphratica from Euphrates f shell (syntype, ZMZ 529679, Persian Gulf, Island Ghaes, photo: Eike Neubert) g operculum of N. schlaeflii from Shatt Al-Arab-Fao region.
**Remark.** According to the original description (Martens 1874) this species is characterized by the presence of denticulated border of the columella, and should be ascertained to the genus *Neritina*.

**Distribution.** Iraq, Iran.

*Neritina euphratica* Mousson, 1874
http://species-id.net/wiki/Neritina_euphratica
Figs 2d–e

**Records from Iran.** Khuzestan Province (Massoud and Hedayeti-Far 1979, Mansoorian 2001).

**Remark.** This species is characterized by a small shell with 6 mm in height and a small spire. The border of the columella is straight and not denticulated. The operculum has a rib which is attenuated at its basis, the peg is thick and strong and split in two parts (fig. 2e).

**Distribution.** Iraq, Iran.

**Genus Theodoxus Montfort, 1810**

**Type species.** *Nerita fluviatilis* Linnaeus, 1758

*Theodoxus fluviatilis* (Linnaeus, 1758)
http://species-id.net/wiki/Theodoxus_fluviatilis
Figs 3c, 11a

*Theodoxus doriae* Issel, 1865 (synonymy)

**Records from Iran.** (all mentioned as *Th. doriae* Issel): Kerman (Issel 1863, Martens 1874, Biggs 1937); Gilan, Mazandaran and Lorestan Province (Mansoorian 2000).

**New records.** Fars Province: IR13-07 [3 ex.]; IR14-07 [2 ex.]; Khorrasan Province: IR76-05 [1 ex]; IR 64-05 [1 ex.]; IR78a-05 [2 ex.]; IR79-05 [1 ex.]; Hormozgan Province: IR 17-11 [5 ex.]

**Associated species.** *Melanopsis* sp., *Radix* sp., *Planorbis intermixtus*, *Farsithyra farsensis*, *Physella acuta*.

**Remarks.** Martens (1879) synonymised *Theodoxus doriae*, the species reported by Issel (1863) from S Iran, with *Th. fluviatilis*. Later on, Mansoorian (2000) described the operculum of *Th. doriae*, which has only a rib, no peg. However, the shell illustrated by Mansoorian (1994) agrees well with *Th. fluviatilis*. Thus we follow Martens’ (1879) synonymisation of *Theodoxus doriae* with *Th. fluviatilis*. Our samples revealed only the presence of *Th. fluviatilis*. 
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Distribution. W- to Central-Palaearctic. *Theodoxus fluviatilis* has been considered by many authors to be an exclusively European species (see e.g. Zhadin 1952, Glöer 2002). But Bourguignat (1864), Brown (1994) and van Damme (1984) mentioned it from NW Africa (Morocco, Algeria). Records of this species in Turkey (Yıldırım 1994), and in Iran, confirm its wide distribution. However, it does not occur in Siberia (Vinarski, pers. comm.).

*Theodoxus lituratus* Eichwald, 1838
http://species-id.net/wiki/Theodoxus_lituratus

Records from Iran. Kerman Province (Biggs 1971); Mazandaran Province (Eichwald 1838, Eliazian et al. 1979).

Remarks. This species has been described from the Caspian Sea. According to the original description (Eichwald 1838) this species is very distinct from the other *Theodoxus* spp. mentioned here.

Distribution. Iran.

*Theodoxus pallida* Dunker, 1861
http://species-id.net/wiki/Theodoxus_pallida
Figs 3a–b

Records from Iran. Isfahan and Fars Province (Starmühlner and Edlauer 1957).

Material examined. NHMW 75000/E/50824, “*Theodoxus pallidus* Dunker” Persien, Brackiger Quellsee, 500 m, nördl. vom Niris-see, leg. Starmühlner 1949.
Remarks. Starmühlner and Edlauer (1957) provide a detailed description of the anatomy of this species but did not consider the operculum, the most important diagnostic feature. On the other hand, as figured in Starmühlner and Edlauer (1957), the receptaculum seminis and the bursa copulatrix differ in length (while being of equal length in *Th. fluviatilis*).

The re-examination of the specimens of *Theodoxus pallida* (Dunker, 1862) from Edlauer’s collection in NHMW clearly shows that this species is distinct from *Theodoxus fluviatilis* due to the shape of shell and the operculum (Fig. 3). As already mentioned by Dunker (1862) the spire in *Th. pallida* is higher than in *Th. fluviatilis*, and furthermore the apophysis of the operculum is broader and not attenuated at its basis (Fig. 3c). In addition the callus at border of the operculum in *Th. pallida* is much stronger (Fig. 3c arrow).

**Distribution.** Iran.

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Family Viviparidae J.E. Gray, 1847

Genus *Bellamya* Jousseaume, 1886

**Type species.** *Paludina bellamya* Jousseaume, 1886

*Bellamya bengalensis* (Lamarck, 1822)
http://species-id.net/wiki/Bellamya_bengalensis

**Records from Iran.** Khuzestan Province (Chu et al. 1968, Massoud and Hedayeti-Far 1979, Mansoorian 1994, 2001), Mazandaran Province (Mansoorian 2000).

**Distribution.** According to Ramakrishna and Dey (2007) this species is widely distributed on the Indian subcontinent.

*Bellamya hilmandensis* (Kobelt, 1909)
http://species-id.net/wiki/Bellamya_hilmandensis

**Records from Iran.** Seistan and Baluchestan Province (Annandale et al. 1919).

**Distribution.** Iran.

Family Melanopsidae H. & A. Adams, 1854

Genus *Melanopsis* Férussac, 1807
http://species-id.net/wiki/Melanopsis

**Type species.** *Buccinum praemorsum* Linnaeus, 1758

**Remark.** *Melanopsis praerosa* L. is a misspelling of *M. praemorsa* L.
Melanopsis costata (Olivier, 1804)
http://species-id.net/wiki/Melanopsis_costata
Fig. 11e

Records from Iran. Kerman Province (Martens 1874); Khuzestan Province (Prashad 1921, Chu et al. 1968, as M. nodosa; Massoud and Hedayeti-Far 1979, Mansoorian 2001).

New records. Fars Province: IR13-07 [23 ad., 25 juv.].

Associated species. Farsithyra farsensis.

Distribution. Asia Minor, Syria, Palestine, Iraq, Iran.

Melanopsis doriae Issel, 1865
http://species-id.net/wiki/Melanopsis_doriae
Fig. 4

Records from Iran. Kerman Province (Issel 1863, Martens 1874, Biggs 1936, 1937, Starmühlner and Edlauer 1957, 1961, 1965); Fars Province (Starmühlner and Edlauer 1957); Yazd Province (Starmühlner and Edlauer 1957); Khuzestan Province (Mansoorian 1994, 2001); Mazandaran Province (Starmühlner and Edlauer 1957, Mansoorian 2000); Gilan Province (Starmühlner and Edlauer 1957); Bushehr Province (Starmühlner and Edlauer 1957).

New records. Hormozgan Province: IR17-11 [2 ex.]; IR19-11 [1 ex.].

Material examined. NHMW “Melanopsis doriae Issel” Persien, Kerman, aus teilweise eingestürztem Kanal, leg. Starmühlner 1949/50.

Associated species. Melanoides tuberculatus, Thiara scabra, Farsithyra farsensis.

Figure 4. Melanopsis doriae (from Edlauer’s collection, NHMW 750000/E/50801a): shell.
Remarks. Starmühlner and Edlauer (1957) studied the anatomy of *Melanopsis doriae* and *M. kotschyi* showing differences in the nervous system. Furthermore they found differences in some features of the opercula between these species, and showed a strong morphological plasticity of the shells (see: Starmühlner and Edlauer 1957, plate 1: Figs g’, g””, g’”’ and h’, h”). Re-examination of *Melanopsis doriae* from Edlauer’s collection in NHMW shows that the shell (Fig. 4) is slimmer than the shell of *Melanopsis* sp.

**Distribution.** Iran.

*Melanopsis kotschyi* Philippi, 1847
http://species-id.net/wiki/Melanopsis_kotschyi

**Records from Iran.** Fars Province (Starmühlner and Edlauer 1957).

**Remarks.** See remarks under previous species.

**Distribution.** Iran.

*Melanopsis* sp.

**Fig. 11d**

**Records from Iran.** Kerman Province (as *Melanopsis variabilis*: Martens 1874); Seistan and Baluchistan Province (as *M. deserticola*: Annandale and Prashad 1919); Isfahan and Yazd provinces (Biggs 1937); Fars province (as *M. buccinoidea variabilis*: Starmühlner and Edlauer 1957, as *M. praerosa*: Starmühlner 1961); Khuzestan Province (Chu et al. 1968, as *M. praerosa*: Massoud and Hedayeti-Far 1979, Mansssorian 2001).

**New records.** Mazandaran Province: IR02-05 [11 ad., 48 juv.]; Khorrasan Province: IR64-05 [12 ad., 39 juv.]; IR79-05 [3 ad., 4 juv.]; IR78a-05 [8 ad., 15 juv.]; IR78c-05 [2 ex.]; Fars Province: IR17-07 [2 ex]; Hormozgan Province: IR19-11 [21 ex.].

**Associated species.** *Galba truncatula, Theodoxus fluviatilis, Planorbis intermixtus, Grossuana sp., Farsithyra farsensis*.

**Remark.** The species of this genus have a high morphological plasticity and many species have been described. Glaubrecht (1993) tried to solve the complicated taxonomy by proposing to consider all circum-Mediterranean *Melanopsis* spp. as being part of one ‘superspecies’, *M. praemorsa*. However, we follow Neu- bert (1998) who believes that this approach does not solve the problem. In recent literature the ‘superspecies’ notion tends to be abandoned and the former species names are being reinstituted (see: Heller et al. 2005; van Damme et al. 2010. This means that the smooth unsculptured species *M. praemorsa* sensu stricto (terra typica: Spain) is actually a western Mediterranean species and that unsculptured morphs from the Levant belong to other species, such as *M. buccinoidea, ammonis,*
dircaena, khabourensis and meiostoma (Heller et al. 2005). Those from Mesopotamia have been described under M. variabilis, deserticola, buccinoidea and praemorsa. Further study is necessary to establish under which name or names the Iranian populations should be placed.

Family Potamididae H. & A. Adams, 1854

Genus Cerithidea Swainson, 1840

Type species. Cerithium obtusum Lamarck, 1822

Cerithidea cingulata (Gmelin, 1790)
http://species-id.net/wiki/Cerithidea_cingulata
Fig. 8c

Records from Iran. Hormozgan Province (Ghasemi et al. 2011).
  New records. Hormozgan Province: IR14-11 [21 ad., 6 juv.]; IR-20-11 [10 ex.].
  Associated species. Ecrobia grimmi, Pseudamnicola sp.
  Distribution. Indo-Pacific coast.

Family Thiaridae Gill, 1871

Genus Thiara Roeding, 1798

Type species. Helix amarula Linnaeus, 1758

Thiara scabra (O.F. Müller, 1774)
http://species-id.net/wiki/Thiara_scabra
Fig. 12c

Records from Iran. Seistan and Baluchestan Province (as Melanoides scabra var. elegans: Annandale and Prashad 1919); Isfahan Province (as M. scabra: Biggs (1937); Hormozgan Province (Starmühlner and Edlauer 1957).
  New records. Hormozgan Province: IR08-11 [13 ex.]; IR17-11 [2 ex.].
  Associated species. Farsithyra farsensis, Melanoides tuberculatus, Physella acuta, Melanopsis doriae.
  Distribution. Indo-Pacific coasts.
Genus *Melanoides* Olivier, 1804

**Type species.** *Melanoides fasciolata* Olivier, 1804 = *Nerita tuberculata* O.F. Müller, 1774.

*Melanoides tuberculatus* (O.F. Müller, 1774)
http://species-id.net/wiki/Melanoides_tuberculatus
Fig. 12b

**New records.** Seistan and Baluchestan Province: IR8a-11 [5 juv.], IR8-11 [18 ex.]. Hormozgan Province: IR10-11 [3 ex.], IR17-11 [10 ad., 9 juv.], IR18-11 [1 ad., 8 juv.], IR19-11 [2 ex.].

**Associated species.** *Melanopsis doriae*, *Thiara scabra*, *Farsithyra farsensis*.

**Records from Iran.** Kerman Province (as *Melania tuberculata*: Issel 1863), Martens 1874, Biggs 1936, 1937, Starmühlner and Edlauer 1957); Seistan and Baluchestan Province (as *M. pyramis*, *M. tigrina*: Annandale and Prashad 1919, Biggs 1937); Hormozgan Province (Biggs 1937, Starmühlner and Edlauer 1957), (as *Melania tuberculata*: Starmühlner (1961); Isfahan Province (Biggs 1937); Yazd Province (Starmühlner and Edlauer 1957, as *Melania tuberculata*: Starmühlner 1965); Khuzestan Province (Chu et al. 1968, Mansoorian 2001); South Iran (Mansoorian 1994); Fars Province (Starmühlner and Edlauer 1957): Mazandran Province (Starmühlner and Edlauer 1957, Mansoorian 2001).

**Remarks.** The species *Melanoides pyramis* and *M. tigrina*, which have been mentioned by Annandale and Prashad (1911) from Seistan and Baluchistan, have been listed by Westerlund (1886) as subspecies. However, due to the high morphological plasticity of *M. tuberculatus* and in absence of any geographical separation of these taxa, we list all *Melanoides* taxa under *M. tuberculatus*.

**Distribution.** S Asia, Arabia, Near East, Africa.

Family Bithyniidae J.E. Gray, 1847

Genus *Bithynia* Leach, 1818

**Type species.** *Helix tentaculata* Linnaeus, 1758

*Bithynia (Bithynia) tentaculata* (Linnaeus, 1758)
http://species-id.net/wiki/Bithynia_tentaculata

**Records from Iran.** Mazandaran Province (Mansoorian 2000); Gilan and Lorestan Province (Mansoorian 2000).

**Rejected records.** Mazandaran Province (Forcart 1935).
Remarks. The Euro-Siberian species *Bithynia tentaculata* (Linnaeus 1758) has often been mentioned from Iran, Turkey and Greece. However, this species could not be found in Greece (Glöer et al. 2010) and probably does not occur in Turkey. The southern distribution border of this species lies possibly in N Bulgaria (Georgiev pers. comm.). An analysis of the specimens from NMB published by Forcart (1935) as *Bithynia tentaculata* shows that these specimens represent *B. forcarti* sp. n. (see below). Thus, *B. tentaculata* most probably does not occur in Iran and has been confused with *B. forcarti* sp. n. or possibly with *Bithynia mazandaranensis* sp. n. (see below).

Distribution. Euro-Siberian.

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*Bithynia* (**Bithynia**) *forcarti* sp. n.
urn:lsid:zoobank.org:act:8A83711B-797D-4D86-99D5-72F217B14A89
http://species-id.net/wiki/Bithynia_forcarti

Figs 5a–b

Type locality. Mazandaran Province, Tschalekuti.

Holotype (NMB 11517a): shell height 7.5 mm, width 5.6 mm.

Paratypes. Mazandaran Province, Tschalekuti (NMB 11517a, 26 ex.), Geniste d. Babul (NMB 11517b, 1 ex., NMB 11571c, 10 ex.)

Etymology. Named after Lothar Forcart in appreciation on his studies of Iranian freshwater snails.

Description. The whitish shell is conical with 5.5 whorls, which are convex with a deep suture and a small and acute apex. The convex whorls are flattened at the suture. The umbilicus is open. The aperture is ovate, angled at the top. The margin of the aperture is, from lateral view, slightly sinuated. The surface is smooth with fine growth lines. Shell height 5.5 – 7.5 mm, width 5.0 – 5.6 mm.

Differentiating features. Due to the shape of the aperture (angled at the top), *Bithynia forcarti* sp. n. resembles *B. mazandaranensis* sp. n. (see below). However, from the latter species it can be easily distinguished by the stepped whorls.

Remarks. Formerly (Forcart 1935) this species has been confused with *B. tentaculata*.

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*Bithynia* (**Bithynia**) *starmuehlneri* sp. n.
urn:lsid:zoobank.org:act:5A63D216-B630-4808-8B2D-0F77E3EAE287
http://species-id.net/wiki/Bithynia_starmuehlneri

Figs 6a–c

*Bulimus* (**Bithynia**) *leachi troschelii*: Starmühlner and Edlauer 1957, non *troschelii* Paasch, 1842 (synonymy)

Type locality. Border of Lake Urmia, W Azarbayian, 1949 leg. Starmühlner.

Holotype. NHMW (50940): shell height 10.3 mm, width 5.6 mm.
Paratypes. 9 ex. from the type locality.

Etymology. Named after Ferdinand Starmühlner, who collected this species in 1949.

Description. The whitish shell is elongated conical with 6.5 whorls, which are convex with a deep suture and a small and acute apex. The umbilicus is open. The aperture is ovate. The margin of the aperture is, from lateral view, straight. The surface is smooth with fine growth lines. Shell height 8.2 – 10.3 mm, width 4.6 – 6.4 mm.

Differentiating features. This slim species is the largest Bithynia sp. known in Iran. It can be easily distinguished from the other Bithynia spp. by the larger dimensions of elongated shell with the stepped whorls and the not angled aperture.

Remarks. This species has been misidentified by Starmühlner and Edlauer (1957) with B. troschelii.

Bithynia (Bithynia) mazandaranensis sp. n.
urn:lsid:zoobank.org:act:22D0892E-8670-4131-9149-0F77C007BB94
http://species-id.net/wiki/Bithynia_mazandaranensis
Figs 7a–d

Type locality. Mazandaran Province, Nowshahr city, pond near Caspian Sea, 51°31’E, 36°38’N, 18 June 2005.

Holotype (ZMH 79369): Shell height 8.0 mm, width 5.0 mm.

Etymology. Named after the region where the species was collected.

Description. The horn-coloured shell is conical with 5.5 whorls, which are slightly convex with a clear suture and an acute apex. The umbilicus is closed. The aperture is ovate, angled at the top. The margin of the aperture is, from lateral view, sinuated. The surface bears a lattice structure. Shell height 8.0 mm, width 5.0 mm, aperture height 3.6 mm.
**Differentiating features.** The new species resembles *B. tentaculata* but differs from it by the following features: (i) the operculum is more angled (Fig. 7c), (ii) the whorls are more convex (Fig. 7a–b), and (iii) the surface has longitudinal and transverse striae (Fig. 7d).

**Associated species.** *Planorbis carinatus, Anisus* sp., *Valvata cristata, Valvata nowshahrensis* sp. n., *Hippeutis complanatus*.

**Remarks.** Probably this species formerly (e.g., Mansoorian 2000) was confused with *B. tentaculata*. Because we had only an empty shell of this species, we do not know if it belongs to the genus *Bithynia* or *Pseudobithynia*, so our generic assignment is tentative. To address this question, anatomical studies of more specimens are necessary.

**Bithynia (Bithynia) cf. ejecta Mousson, 1874**

**Records from Iran.** Isfahan Province – (as *Amnicola ejecta*: Biggs 1937).

**Remarks.** Probably due to the small size of this species, Biggs (1937) assigned this species belongs to the genus *Amnicola*, although Mousson (1874) described it as a *Bythynia*, and pointed out that the operculum is characteristic for *Bythinia* and different from *Amnicola* (syn. to *Pseudamnicola*). Furthermore, Biggs (1937) found his species in the mountains, while the original description of *Bithynia ejecta* comes from the lowland, indicating the Biggs’s species is not conspecific with *Bithynia ejecta* and probably represents an undescribed species.
**Bithynia (Bithynia) rubens** (Menke, 1830)

http://species-id.net/wiki/Bithynia_rubens

**Records from Iran.** North Iran (Caspian Sea) – Eliazian et al. (1979).

**Remarks.** This species could not be found in any of the neighbouring countries of Iran. Eliazian et al. (1979) don’t mention the source that led to their identification. The record and taxonomic status of this species is questionable and needs new confirmation.

**Subgenus Gabbia** Tryon, 1865

Type species. *Gabbia australis* Tryon, 1865
**Remarks.** Some authors (e.g. Subba Rao 1989, Nesemann et al. 2007) mention *Gabbia* as a genus. However, it seems not possible to distinguish the genera of the Bithyniidae by the shape of opercula (Mandahl-Barth 1968) and/or by shell forms, because these characters are found to be variable. On the other hand, the examined material of the family of Bithyniidae can be easily separated by the characteristics of penis morphology (having a penial appendix: *Bithynia* Leach 1818; or lacking a penial appendix: *Pseudobithynia* Glöer & Pešić 2006). In our study, we tentatively use the name *Gabbia* as a subgenus for small *Bithynia* species with a globular shell, originating from India.

*Bithynia (Gabbia) sistanica* (Annandale & Prashad, 1919)
http://species-id.net/wiki/Bithynia_sistanica

**Records from Iran.** Seistan and Baluchestan Province (as *Amnicola sistanica*: Annandale and Prashad 1919).

**Remark.** Annadale and Prashad (1919) described this species as *Amnicola (Alocinma) sistanica* and depicted the penis morphology. Due to the presence of a penial appendix this species is ascertained to the genus *Bithynia*. The members of the genus *Pseudamnicola* (formerly *Amnicola*) have no penial appendix.

**Distribution.** Iran; only known from N Seistan.

**Genus Pseudobithynia** Glöer & Pešić, 2006

**Type species.** *Pseudobithynia irana* Glöer & Pešić, 2006

*Pseudobithynia irana* Glöer & Pešić, 2006
http://species-id.net/wiki/Pseudobithynia_irana
Fig. 12k

**Records from Iran.** Markazi and Lorestan Provinces (Glöer and Pešić 2006).

**New records.** Lorestan Province: IR26-07 [10 ex.].

**Associated species.** *Planorbis intermixtus*, *Radix* sp.

**Distribution.** Iran; Markazi and Lorestan Provinces.

*Pseudobithynia zagrosia* Glöer & Pešić, 2009
http://species-id.net/wiki/Pseudobithynia_zagrosia
Fig. 12l

**Records from Iran.** Fars Province (Glöer and Pešić 2009).
**Distribution.** Iran; known only from the locus typicus (Dasht Arzhan village, Shiraz to Kazerum road).

**Family Cochliopidae Tryon, 1866**

**Genus Heleobia Stimpson, 1865**

**Type species.** *Heleobia stagnorum* (Gmelin, 1791)

*Heleobia dalmatica* (Radoman, 1974)

http://species-id.net/wiki/Heleobia_dalmatica

Fig. 8b

**New records.** Hormozgan Province: IR14-11 [12 ad., 20 juv.].

**Associated species.** *Cerithidea cingulata, Ecrobia grimmi, Pseudamnicola sp.*

**Remarks.** New for Iran.

**Distribution.** Previously only known from the brackish part of rivers along the coast of Croatia (Radoman 1983).

**Family Hydrobiidae Stimpson, 1865**

**Genus Hydrobia Hartmann, 1821**

**Type species.** *Cyclostoma acutum* Draparnaud, 1805

*Hydrobia acuta* (Draparnaud, 1805)

http://species-id.net/wiki/Hydrobia_acuta

**Records from Iran.** Isfahan Province (Biggs 1971).

**Rejected records.** Fars Province (Starmühlner and Edlauer 1957).

**Remark.** Probably this species has been confused with one of the following species (*Ecrobia grimmi, Heleobia dalmatica*), so all former records of this species in Iran are questionable. The record for this species is kept until the original material of Biggs could be studied.

**Genus Ecrobia Stimpson, 1865**

**Type species.** *Turbo ventrosus* Montagu, 1803
Ecrobia grimmi (Clessin & Dybowski, 1888)
http://species-id.net/wiki/Ecrobia_grimmi
Figs 8a, c

New records. Hormozgan Province: IR14-11 [12 ad., 20 juv.].
Associated species. Cerithidea cingulata, Heleobia dalmatica, Pseudamnicola sp.
Remarks. On the base of molecular results, Haase et al. (2010) concluded that Ecrobia grimmi from the mixomesohaline Lake Sawa (Iraq) was possibly transported by migrating birds from the Caspian Sea. The identification of our material of Ecrobia grimmi as well of Heleobia dalmatica was confirmed by using molecular techniques (Martin Haase pers. communication). An analysis of the specimens from NHMW published by Starmühlner and Edlauer (1957) as Hydrobia acuta shows that these specimens probably belong to Ecrobia grimmi (see Fig. 8c).
Distribution. Caspian Sea; Iraq, Iran.

Genus Pseudamnicola Paulucci, 1878
Type species. Bithynia lucensis Issel, 1866

Pseudamnicola kotschyi v. Frauenfeld, 1863
http://species-id.net/wiki/Pseudamnicola_kotschyi

Records from Iran. Isfahan Province (Starmühlner 1961, 1965).
Distribution. Iran: Isfahan Province; endemic.

Pseudamnicola saboori Glöer & Pešić, 2009
http://species-id.net/wiki/Pseudamnicola_saboori
Fig. 12h

Records from Iran. Khorasan and Markazi Provinces (Glöer and Pešić 2009).
Distribution. Iran: Khorasan and Markazi Provinces.

Pseudamnicola zagrosensis Glöer & Pešić, 2009
http://species-id.net/wiki/Pseudamnicola_zagrosensis
Fig. 12i
Records from Iran. Kermanshah Province – Glöer and Pešić (2009).
Distribution. Iran: Kermanshah Province.

_Pseudamnicola raddei_ Boettger, 1889
http://species-id.net/wiki/Pseudamnicola_raddei

Records from Iran. Mazandaran Province – Forcart (1935).
Distribution. Transcaspian region (Zhadin 1952).
Remarks. In Russia it is listed as _Turkmenamnicola raddei_ (Kantor et al. 2009).

_Pseudamnicola georgievi_ sp. n.
urn:lsid:zoobank.org:act:D2E680D0-AAC4-45DF-954A-28D553EC957F
http://species-id.net/wiki/Pseudamnicola_georgievi
Fig. 9

Type locality. Markazi Province, Ashtian to Arak road (ca. 5 km after Ashtian city, Ashtian county), 50°01’E, 34°34’N, ca. 1800 m asl., 21 June 2005.

Holotype (ZMH 79370): Shell height 2.6 mm, width 1.9 mm.
Paratypes (ZMH 79371): 6 ex. from type locality.
Etymology. Named after Dr. Dilian Georgiev in appreciation of his studies on Bulgarian hydrobiids.
Description. The whitish shell is conical with 4.5 whorls, which are separated by a clear suture. The surface is glossy and finely striated. The apex is blunt, the umbilicus is closed, the aperture is ovate and pointed at the top. Shell height 2.4–2.6 mm, width 1.9 mm.
Differentiating features. The conical shell with its pointed aperture (Fig. 9) clearly distinguished the new species from other Iranian members of the genus _Pseudamnicola_.
Remark. We had only shells with dried tissue at our disposal. Since the penis morphology could not be examined, the assignment to the genus _Pseudamnicola_ is provisional.
Distribution. Iran; only known from the type locality.

Genus _Kaskakia_ gen. n.
urn:lsid:zoobank.org:act:31BFCB62-BE86-43CE-A888-B0562CC2740E
http://species-id.net/wiki/Kaskakia

Diagnosis. Shell conical. Penis broad at the basis, distal part with a bulbous and acute penis tip.

Type species. _Kaskakia khorrasanensis_ sp. n.
Etymology. Named after the region where the species was collected.
Differential diagnosis. The new genus appears to be close to *Pseudamnicola*, but can easily be distinguished by the unique morphology of the penis with bulbous and acute apex (vs. a broad elongated triangular penis in *Pseudamnicola*).

*Kaskakia khorrasanensis* sp. n.
urn:lsid:zoobank.org:act:8EDD45AD-46F2-4BC8-A7BE-73B44BBCDF6D
http://species-id.net/wiki/Kaskakia_khorrasanensis
Figs 10a–d

**Type locality.** Khorrasan Province, Kaskak stream in Kaskak village, 59°10’E, 35°25’N, ca. 1800 m asl., 11 June 2005.

- **Holotype** (ZMH 79372): Shell height 2.5 mm, width 1.9 mm.
- **Paratypes** (ZMH 79373): 21 ex. from type locality.

**Etymology.** Named for its occurrence in Khorrasan Province.

**Description.** The yellowish shell is conical to globular with 5.5 whorls, which are slightly convex and separated by a clear suture (Fig. 10a). The whorls increase rapidly with a prominent body whorl. The surface is glossy and finely striated. The apex is acute, the aperture is ovate and angled at the top, the umbilicus is closed. Shell height 2.3–2.5 mm, width 1.8–1.9 mm.

- **Animal.** The mantle and head are black. The penis is broad at the basis and tapered at the distal end (Figs 10b–d).

- **Differentiating features.** As for the genus.
- **Distribution.** Iran: Khorrasan Province; known only from type locality.
Genus *Sarkhia* gen. n.
urn:lsid:zoobank.org:act:4AC287DC-4E88-4043-BA17-880E84883276
http://species-id.net/wiki/Sarkhia

**Diagnosis.** Shell elongated conical. Penis simple, broad at the basis and tapered at the distal end, with a black pigmentation mark. The tentacles are cylindrical.

**Type species.** *Sarkia sarabensis* sp. n.

**Etymology.** Named after the region where the species was collected.

**Differential diagnosis.** The genus seems to be closely related to *Pseudamniciola* (in the following, in parentheses), but the unique morphology of the penis, broad at the basis and tapered at the distal end (Figs 10b–c), with a black pigmentation mark (vs. broad and elongated triangular penis), and the presence of broad cylindrical tentacles (slim cylindrical tentacles) will separate the new genus from *Pseudamniciola*.

*Sarkhia sarabensis* sp. n.
urn:lsid:zoobank.org:act:F7FBD536-0970-4B9B-A0AC-EAF9E7C91C72
http://species-id.net/wiki/Sarkhia_sarabensis
Fig. 11a–c

**Type locality.** Kermanshah Province, Sarabe–Sahne (= Sarabe – bede – Sarkh) city, stream, 27 June 2005.

**Holotype** (ZMH 79374): Shell height 5.9 mm, width 2.3 mm.

**Paratypes** (ZMH 79375): 1 specimen dissected.
**Etymology.** Named after the region where the species was collected.

**Description.** The yellowish shell is elongated conical with 6.5 whorls, which are slightly convex and separated by a deep suture. The aperture is oval with a sharp peristome, the umbilicus is closed. The surface is dull. Shell height 5.9 mm, width 2.3 mm.

**Differentiating features.** The slim elongated conical shell with more than 5 whorls (Fig. 11a) is characteristic and separates this species from *Sarkhia kermanshahensis* (see below).

**Distribution.** Iran, Kermanshah Province; only known from type locality.

*Sarkhia kermanshahensis* (Glöer & Pešić, 2009), comb. n.

http://species-id.net/wiki/Sarkhia_kermanshahensis

Fig. 12g

*Pseudamnicola kermanshahensis* Glöer & Pešić, 2009 (synonymy)

**New records.** Markazi Province: IR51 [2 ex.].

**Records from Iran.** Kermanshah Province (as *Pseudamnicola kermanshahensis* Glöer and Pešić 2009).

**Remarks.** This species has originally been placed in the genus *Pseudamnicola*. However, due to the characteristic shape of the penis and the tentacles it is transferred to *Sarkhia* gen. n.

**Distribution.** Iran; Kermanshah and Markazi Provinces.
Figure 12. The prosobranch molluscs of Iran. a *Theodoxus fluviatilis* (operculum see Fig. 3d) b *Bithynia* (*Bithynia*) *ejecta* (syntype ZMZ 524006, Iraq, Samava, ex coll. Mousson, photo: E. Neubert) c *Melanoides tuberculatus* d *Thiara scabra* e *Melanopsis* sp. f *Melanopsis costata* g *Farsithyra farsensis* h *Sarkhia kerman-shahensis*, i: *Pseudamnicola saboori* k *P. zagrosensis* l *Pseudobithynia irana* m *P. zagrosia* n *Valvata cristata*. 
Genus *Belgrandiella* Wagner, 1927

**Type species.** *Belgrandia kusceri* Wagner, 1914

*Belgrandiella elburensis* (Starmühlner & Edlauer, 1957), comb. n.
http://species-id.net/wiki/Belgrandiella_elburensis

**Records from Iran.** Tehran Province – “Frauenfeldia elburensis” Starmühlner and Edlauer (1957).

**Remarks.** Starmühlner and Edlauer (1957) originally described this species as *Frauenfeldia elburensis*. However, the genus name *Frauenfeldia* is preoccupied, and thus, the species of this genus have been re-assigned to *Belgrandiella, Boleana, Graziana* and *Sarajana* (Radoman 1983). Due to the shape of the aperture in original description (see Starmühlner and Edlauer 1957) we affiliate this species to the genus *Belgrandiella*.

**Distribution.** Iran, only known from the locus typicus (Gelandoah, 60 km NE of Tehran).

Genus *Hauffenia* (Pollonera, 1898)

**Type species.** *Valvata erythropomatia* Hauffen, 1856

*Hauffenia erythropomatia* (Hauffen, 1856)
http://species-id.net/wiki/Hauffenia_erythropomatia

**Records from Iran.** Sistan and Baluchestan Province (Source lake Gomun) – “Erythropomatiana erythropomatia” Starmühlner and Edlauer (1957).

**Remarks.** Most probably, Starmühlner and Edlauer (1957) misidentified this subterranean species, known only from its type locality in Slovenia, far away from Iran. The comparison with the description of *H. erythropomatia* by Radoman (1983) shows that these species are not conspecific as the umbilicus seems to be broader in later species compared with the species depicted by Starmühlner and Edlauer (1957). Unfortunately this species could not be found in Edlauer’s collection in NHMW (Anita Eschner, pers. comm.). The record for this species is kept until specimens from the original locality could be studied.

Family Stenothyridae Tryon, 1866

Genus *Stenothyra* Benson, 1854

**Type species.** *Nematura deltae* Benson, 1836
*Stenothyra arabica* Neubert, 1998
http://species-id.net/wiki/Stenothyra_arabica

**Records from Iran.** Hormozgan Province (Ghasemi et al. 2011).

**Distribution.** Saudi-Arabia, Iran.

Genus *Gangetia* Ancey, 1890

**Type species.** *Hydrobia* (*Belgrandia*) *miliacea* Nevill, 1880

*Gangetia* (*Iranothyra*) *uzzielliana* (Issel, 1866)
http://species-id.net/wiki/Gangetia_uzzielliana

**Records from Iran.** Kerman province (as *Bythinia uzielliana*: Issel 1866, Martens 1874), as *Hydrobia uzielliana*: Biggs (1936, 1937), (as *Pseudamnicola uzielliana*: Starmühlner and Edlauer 1957), (as *Pseudamnicola uzielliana*: Starmühlner (1961, 1965); Fars province (as *Pseudamnicola uzielliana*: Starmühlner and Edlauer 1957), (as *Pseudamnicola uzielliana*: Starmühlner and Edlauer (1961, 1965).

**Rejected records.** Yazd Province (as *Pseudamnicola uzielliana*: Starmühlner and Edlauer 1957).

**Remarks.** Schütt (1973) classified this species in the genus *Gangetia* and introduced the new subgenus *Iranothyra* Schütt, 1973. Mansoorian (1994) reported *Gangetia uzielliana* with some doubts. However, his species clearly differs from the topotype of *Gangetia uzielliana* illustrated by Schütt (1973). Most probably, the species recorded by Mansoorian (1994) under this name represents an undescribed new species (Glöer and Pešić 2009).

**Distribution.** Iran.

Genus *Farsithyra* Glöer & Pešić, 2009

**Type species.** *Farsithyra farsensis* Glöer & Pešić, 2009

*Farsithyra farsensis* Glöer & Pešić, 2009
http://species-id.net/wiki/Farsithyra_farsensis
Fig. 12f, 13a–b

*Bulimus badiella*: Starmühlner and Edlauer 1957, non *badiella* Küster, 1852 (synonymy)

**Records from Iran.** Fars Province (Glöer and Pešić 2009).
New records. Hormozgan Province: IR17-11 [1 ex.].

Material examined. NHMW “Pseudamnicola uzielliana” Issel”, Persien, stark salziger Tümpel, südl.von Yest (=Yesd), leg. Starmühlner. NHMW 60.459 “Bulimus badiella”, Lake Taschk, 07.07.1956 leg. Löffler.

Associated species. Melanoides tuberculatus, Melanopsis sp., Melanopsis doriae, Thiara scabra.

Remarks. Starmühlner and Edlauer (1957) mentioned Gangetia uzielliana from many sampling sites in Yazd Province. An analysis of one lot from the Edlauer collection (NHMW) with the specimens from Yazd Province shows that these specimens (Fig. 13a–b) belong to Farsithyra farsensis. Further, re-examination of the specimens from Lake Taschk in Fars Province identified by Starmühlner and Edlauer (1957) as Bulimus badiella (syn. to Bithynia badiella) shows that it is also conspecific with Farsithyra farsensis.

Distribution. Iran: Fars, Yazd and Hormozgan Provinces.

Family Valvatidae J.E. Gray, 1840

Genus Valvata O.F. Müller, 1773

Type species. Valvata cristata O.F. Müller, 1774
Valvata cristata O.F. Müller, 1774
http://species-id.net/wiki/Valvata_cristata
Fig. 12m

New records. Mazandaran Province: IR01-05 [6 ex.]. Tehran Province: IR48-05 [2 ex.].
Associated species. Bithynia mazandaranensis sp. n., Planorbis carinatus, Anisus sp., Valvata nowshahrensis sp. n., Hippeutis complanatus.
Records from Iran. Mansoorian (1994).
Remarks. Considering the photo provided by Mansoorian (1994), he probably confused this species with Valvata nowshahrensis sp. n. (see below).
Distribution. Palaearctic.

Valvata piscinalis O.F. Müller, 1774
http://species-id.net/wiki/Valvata_piscinalis

Records from Iran. Gilan, Mazandaran and Lorestan Province – Mansoorian (2000).
Distribution. Palaearctic.

Valvata nowshahrensis sp. n.
urn:lsid:zoobank.org:act:944E6EE3-B23C-43FB-A305-882A4D4CF3D9
http://species-id.net/wiki/Valvata_nowshahrensis
Fig. 14a–c

Type locality. Mazandaran Province, Nowshahr city, pond near the Caspian See, 51°31’E, 36°38’N, 18 June 2005.
Holotype (ZMH 79376): Shell diameter 3.3 mm, height 2.3 mm.
Paratypes (ZMH 79377): 2 specimens from type locality; [2 ex.], Kermanshah Province: IR105-05.
Etymology. Named after the region, where the species was collected.
Description. The yellowish shell is translucent with 3 circular whorls. The umbilicus is wide, and the first whorl is visible through the umbilicus. The surface is glossy with very fine ribs. Shell diameter 3.2–3.3 mm, height 2.3 mm.
Differentiating features. The new species can be distinguished from Valvata piscinalis by its larger umbilicus and from V. cristata by its higher spire.
Remarks. This species has possibly been depicted by Mansoorian (1994) and confused with Valvata cristata.
Associated species. Pseudobithynia mazandaranensis sp. n., Planorbis carinatus, Anisus sp., Valvata cristata, Hippeutis complanatus
Distribution. Iran: Mazandaran and Kermanshah Provinces.
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Pulmonata

Family Acroloidae Thiele, 1931

Genus Acroloxus H. Beck, 1838

Type species. *Patella lacustris* Linnaeus, 1758

*Acroloxus lacustris* (Linnaeus, 1758)

http://species-id.net/wiki/Acroloxus_lacustris

Rejected Records from Iran. Mazandaran Province – Forcart (1935).

Remarks. See remarks under *Acroloxus pseudolacustris* sp. n.

*Acroloxus pseudolacustris* sp. n.

urn:lsid:zoobank.org:act:83575F59-E417-44D3-8F6D-A5DB45EA2B21

http://species-id.net/wiki/Acroloxus_pseudolacustris

Fig. 15a–b

Type locality. Gilan Province, IR82-05, Bandar Anzali Lagoon, 49°27’E, 37°26’N, 16 June 2008.

Holotype (ZMH 79378): Shell length 4.0 mm, width 2.0 mm, height 0.9 mm.

Paratypes. 2 ex., NMB 11516a “*Acroloxus lacustris*” zwischen Nika und Aschref, 10 m ü. M., Drs. A. Erni & R. Buxtorf leg. 22.X.1931.

Figure 14. *Valvata nowshahrensis* sp. n. a shell b ventral view on the umbilicus c head with penis in situ.
**Etymology.** Named for its resemblance with *Acroloxus lacustris*.

**Description.** The oval limpet shell is transparent. The apex is blunt and bent to the left side (Figs 15a–b).

**Differentiating features.** The new species resembles *A. lacustris*, which can be easily distinguished by the shape of apex, which is always acute and not blunt (Figs 15c–d) like in the new species. From Russia, no *Acroloxus* sp. with a blunt apex is known (Vinarski, pers. comm.).

**Remark.** An analysis of the two specimens from Forcart’s collection (NMB 11516a) identified as *Acroloxus lacustris* from Mazandaran Province shows that these specimens belong to *A. pseudolacustris* sp. n.

**Associated species.** *Haitia acuta*.

**Distribution.** Iran: Gilan and Mazandaran Provinces.

**Family Lymnaeidae Rafinesque, 1815**

**Genus *Radix* Montfort, 1810**
http://species-id.net/wiki/Radix

**Type species.** *Helix auricularia* Linnaeus, 1758

**Remarks.** Hubendick (1951) grouped most *Radix* spp. from the Near East (i.e. *R. tenera*, *R. euphratica* – «Mesopotamia», *R. bactriana* - Afghanistan, *R. gedrosiana* - Iran, *R. rectilabrum* - Seistan and Baluchistan, *R. persica* - Iran and *R. acuminata* - (Bengal, India) under the palaearctic *R. auricularia*, but from Europe he lumped all *Radix* spp.
together in three species. Today, five *Radix* species are known from Europe, confirmed by molecular (Pfenninger et al. 2006, Schniebs et al. 2011) and anatomical studies (Glöer 2002). Only a few species can be distinguished by the shells alone (e.g. *Radix ampla*, *R. auricularia*). Most species show a large morphological plasticity in the shape of the shell, so this character cannot be used for distinguishing species. Ananndale and Prashad (1919) and Annandale and Rao (1923) provided anatomical data of *Radix* spp., but these drawings are not suitable enough to identify the *Radix* spp. found by us in Iran. The diagnostic features and taxonomic relationship of the Iranian *Radix* species require further revision and particularly the application of molecular techniques with topotypes of the species. The following list of *Radix* species contains the hitherto recorded nominal species, their taxonomic status remains to be explored.

**Radix persica** (Issel, 1865)
http://species-id.net/wiki/Radix_persica
Fig. 16a

**Records from Iran.** Kerman Province – “*Limnaea auricularia var. persica*” Issel (1865), “*Limnaea auricularia var. persica*” Martens (1874); Seistan and Baluchestan Province (as *Limnaea auricularia var. persica*: Annandale and Prashad 1919); Isfahan Province (as *Lymnaea persica*: Biggs 1937).

**New records.** Markazi Province: IR27-07 [7 ex.]

**Distribution.** South Iran.

**Radix auricularia** (Linnaeus, 1758)
http://species-id.net/wiki/Radix_auricularia

**Records from Iran.** Khuzestan Province (Mansoorian 2001); Mazandaran, Gilan and Lorestan Provinces (Starmühlner and Edlauer 1957), Isfahan Province (Starmühlner 1965).

**Distribution.** Palaearctic.

**Radix bactriana** (Annandale & Prashad, 1919)
http://species-id.net/wiki/Radix_bactriana
Figs 16b–d

**Records from Iran.** Seistan and Baluchestan Province (Annandale and Prashad 1919); Kerman Province (Starmühlner and Edlauer 1957).

**New records.** Markazi Province: IR03-05 [1 ex], IR87-05 [9 ex.], IR88-05 [3 ex.], IR89-05 [2 ex], IR91-05 [3 ex.]; Khorasan Province: IR67-05 [1 ex.], IR79-05 [1 ex.]

**Distribution.** Iran: Seistan and Baluchestan and Kerman Provinces.
Radix iranica (Annandale & Prashad, 1919)
http://species-id.net/wiki/Radix_iranica
Fig. 16g

Records from Iran. Seistan and Baluchestan Province (Annandale and Prashad 1919).
   New records. Markazi Province: IR89-05 [5 ex].
   Distribution. Iran: Seistan and Baluchestan Province.

Radix gedrosiana gedrosiana (Annandale & Prashad, 1919)
http://species-id.net/wiki/Radix_gedrosiana_gedrosiana

Records from Iran. Seistan and Baluchestan Province (Annandale and Prashad 1919),
   Azarbayjan Province (Starmühlner and Edlauer 1957), Khuzestan Province (Chu et al.
   1968, Massoud and Hedayeti-Far 1979, as Lymnaea auricularia gedrosiana: Mansoori
   2001), N Iran (Annandale 2000).
   Distribution. Iran, Pakistan.

Radix gedrosiana rectilabrum (Annandale & Prashad, 1919)
http://species-id.net/wiki/Radix_gedrosiana_rectilabrum

Records from Iran. Seistan and Baluchestan Province (Annandale and Prashad 1919);
   Isfahan Province (Starmühlner and Edlauer 1957).
   Distribution. Iran; endemic.

Radix hordeum (Mousson, 1874)
http://species-id.net/wiki/Radix_hordeum

Records from Iran. Seistan and Baluchestan Province (Annandale and Prashad 1919)
   Distribution. Iraq (Euphrates, as Lymnaea hordea: Mousson 1874); Iran: Seistan
   and Baluchestan Province.

Radix lagotis (Schrank, 1803)
http://species-id.net/wiki/Radix_lagotis

Records from Iran. Qom, Tehran and Gilan Provinces (Martens 1874); Kerman
   Province (Biggs 1937).
   Remarks. This species has been described from the Danube (Germany) and most
   probably does not occur in Iran. According to Subba Rao (1989) R. lagotis is a syno-
   nym of R. peregra (syn. to R. labiata). However, recently Schniebs et al. (2011) clearly
   showed that R. lagotis and R. labiata are distinct species.
   Distribution. Europe.
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Figure 16. The Lymnaeidae of Iran. 

a) Radix persica (IR27-07)  b–d) Radix bactriana (b) IR03-05, c) IR87-05, d) IR88-05

e) IR91-05 

f) Radix persica (IR107-05)  
g) Radix iranica (IR89-05)  
h) Radix sp.  
i) Radix sp.  
j) Galba truncatula (IR62-05)  
k) Galba schirasensis.
Radix labiata (Rossmaessler, 1835)
http://species-id.net/wiki/Radix_labiata

Records from Iran. (mentioned as R. peregra f. canalifera): N Iran (Caspian Sea) (Eliazian et al. 1979); Kerman Province (Starmühlner and Edlauer 1957); Fars Province (Starmühlner and Edlauer 1957); Yazd Province (Starmühlner and Edlauer 1957); Kermanshah Province (Starmühlner and Edlauer 1957), Starmühlner (1965).

Remarks. R. labiata is a species which prefers springs and is distributed in M – and S Europe and the Balkans (Glöer 2002).

Distribution. Europe.

Genus Galba Schrank, 1803

Type species. Galba truncatula O.F. Müller, 1774

Galba truncatula (O.F. Müller, 1774)
http://species-id.net/wiki/Galba_truncatula
Fig. 16k

Records from Iran. Seistan and Baluchestan Province (as Limnaea truncatula: Annandale and Prashad 1919); North Iran (Caspian Sea) (as Lymnaea truncatula: Eliazian et al. 1979); Manzandaran Province (Forcart 1935); Gilan, Mazandaran and Lorestan Province (Mansoorian 2000); Kerman Province (Starmühlner and Edlauer 1957, Biggs 1937); Tehran Province (Starmühlner and Edlauer 1957); Khuzestan Province (Mansoorian 2001, Chu et al. 1968, Massoud and Hedayeti-Far 1979); Isfahan Province (Biggs 1937); Semnan Province (Starmühlner 1961); Hormozgan Province (Starmühlner 1965).

New records. Khorasan Province: IR63-05 [22 ex.]; IR66a-05 [1 ex.]; IR77-05 [1 ex.].

Associated species. Radix sp., Planorbis intermixtus, Physella acuta.

Distribution. Worldwide.

Galba schirazensis Küster, 1862
http://species-id.net/wiki/Galba_schirazensis
Fig. 16l

Records from Iran. Fars Province (Küster 1862); Gilan Province (Bargues et al. 2010).

Distribution. Iran, Mediterranean, Central America (Bargues et al. 2011).
Genus *Stagnicola* Jeffreys, 1830

**Type species.** *Buccinum palustre* O.F. Müller, 1774

*Stagnicola palustris* (O.F. Müller, 1774)

http://species-id.net/wiki/Stagnicola_palustris

**Records from Iran.** Kerman Province (Martens 1874); Isfahan Province (Martens 1874); Qazvin and E Azarbayjan Provinces (Starmühlner and Edlauer 1957); Gilan, Mazandaran and Lorestan Provinces (Eliazian et al. 1979); N Iran (Mansoorian 2000).

**Rejected Records from Iran.** Mazandaran Province (Forcart 1935).

**Remark.** The recent insights on the distribution of *Stagnicola palustris* show that it is a Northern European/Siberian species. Most probably, the species reported from Iran as *S. palustris* represents an undescribed species (see below).

*Stagnicola* sp.

Fig. 17

**Records from Iran.** Mazandaran Province (Forcart 1935).

**Material examined:** 35 ex., NMB 11518b “*Stagnicola palustris*” Zw. Nika und Aschref, Dr. Erni & Buxtorf 1934; 3 ex., NMB 11518a “Iran, Prov. Mazandaran. Meschhediser, Geniste am rechten Ufer des Babul ca. 300 m S der Mündung, -26 m Meereshöhe. Leg. 23.8.1931 & don. 1935 Drs. A. Erni & R. Buxtorf”.

**Remark.** An examination of the specimens from NMB identified by Forcart (1935) as *Stagnicola palustris* shows that these specimens are not conspecific with *S. palustris*. Namely, Forcart’s specimens clearly differ in the aperture, which is broader at the basis (Fig. 17) than in *S. palustris*. However, due to the fact that the shells of *Stagnicola* spp. are very variable, it is not possible to identify or eventually describe this species as new to science without anatomical studies.

Genus *Lymnaea* Lamarck, 1799

**Type species.** *Lymnaea stagnalis* (Linnaeus, 1758)

*Lymnaea stagnalis* (Linnaeus, 1758)

http://species-id.net/wiki/Lymnaea_stagnalis

**Records from Iran.** Khuzestan Province (Mansoorian 1998, 2001).

**Distribution.** Palaearctic.
Family Planorbidae Rafinesque, 1815

Genus Bulinus O.F. Müller, 1781

Type species. Physa truncata Audouin, 1827

Bulinus truncatus (Audouin, 1827)
http://species-id.net/wiki/Bulinus_truncatus

Records from Iran. Khuzestan Province (Chu et al. 1968, Massoud and Hedayeti-Far 1979, Mansoorian 1994, 2001); Gilan Province (Mansoorian 2000).

Distribution. Tropical Africa, Arabian Peninsula, Iran.

Genus Planorbis O.F. Müller, 1774

Type species. Helix planorbis Linnaeus, 1758

Planorbis intermixtus Mousson, 1874
http://species-id.net/wiki/Planorbis_intermixtus
Fig. 18b

Planorbis subangulatus Philippi, 1844; Planorbis persicus Ancey, 1900 (synonymy)

Records from Iran. Northern Iran (as P. planorbis: Mansoorian 2000); Mazandaran Province (as P. planorbis: Eliazian et al. 1979, Mansoorian 2000); Fars Province (as...
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_P. planorbis:_ Forcart 1935, Starmühlner and Edlauer 1957; Isfahan Province (Glöer and Pešić 2010); Yazd Province (as _P. persicus, P. subangulatus:_ Biggs 1937, 1971, Starmühlner and Edlauer 1957); Gilan Province (as _Anisus (Gyraulus) intermixtus:_ Starmühlner and Edlauer 1957); Khuzestan Province (as _P. planorbis, P. planorbis submarginatus:_ Starmühlner and Edlauer 1957, as _P. planorbis:_ Biggs 1971); Markazi Province (Chu et al. 1968, Massoud and Hedayeti-Far 1979, Mansoorian 2001, Glöer and Pešić 2010).

**New records.** Mazandaran Province: IR01-05 [11 ex.]; Markazi Province: IR51-05 [11 ex.]; IR87-05 [3 ex.]; IR88-05 [7 ex.]; IR91-05 [5 ex.]; IR93-05 [1 ex.]; Khorasan Province: IR66-05 [10 ex.]; IR67-05 [2 ex.]; IR68-05 [5 ex.]; IR78a-05 [2 ex.]; IR78b-05 [7 ex.]; Fars Province: IR02-07 [2 ex.]; IR07-07 [2 ex.]; IR26-07 [9 ex.]; IR27-07 [3 ex.].

**Associated species.** _Physella acuta, Pseudobithynia zagrosia, Radix sp._

**Remarks.** The species _Planorbis planorbis_ and _P. intermixtus_ can only be distinguished by the number of prostate diverticula (Glöer and Pešić 2010). All _Planorbis_ spp. collected in Iran have been anatomically studied and no _P. planorbis_ could be found. Thus we list the old records from Iran under _P. intermixtus_.

In addition, _Planorbis subangulatus_ Philippi, 1844 and _Planorbis persicus_ Ancey, 1900 have been mentioned from Iran (Ancey 1900, Biggs 1937). Both species have been described on the basis of the shells, the morphology of which falls within variability of _P. intermixtus_. Thus we list these species under _P. intermixtus_.

**Distribution.** Turkey, Iran, N India.

*Planorbis carinatus* O.F. Müller, 1774

http://species-id.net/wiki/Planorbis_carinatus

Fig. 18a

**Records from Iran.** Northern Iran (Mansoorian 1994).

**New records.** Mazandaran Province: IR01-05 [5 ex., anat. det. ].

**Associated species.** _Valvata cristata, Anisus sp., Valvata nowshabrensis_ sp. n., _Pseudobithynia mazandaranensis_ sp. n., _Hippeutis complanatus._

**Distribution.** Palaearctic.

**Genus Anisus S. Studer, 1820**

http://species-id.net/wiki/Anisus

**Type species.** _Helix spirorbis_ Linnaeus, 1758

**Remarks.** The identification of the species of this genus is based on the anatomical features (Glöer and Meier-Brook 2008), so all former records of this genus are questionable and need new confirmation.
Figure 18. The Planorbis spp. of Iran. a Planorbis carinatus b Planorbis intermixtus c Indoplanorbis exustus.
*Anisus leucostoma* (Millet, 1813)
http://species-id.net/wiki/Anisus_leucostoma

**Records from Iran.** Gilan Province – Mansoorian (1994, 2000).
**Distribution.** Palaearctic.

*Anisus spirorbis* (Linnaeus, 1758)
http://species-id.net/wiki/Anisus_spirorbis

**Records from Iran.** Azarbayjan Province (Starmühlner and Edlauer 1957)
**Distribution.** Palaearctic.

*Anisus sp.*

Fig. 19

**New records.** Mazandaran Province: IR01-05 [1 empty shell].

**Associated species.** *Planorbis carinatus, Anisus* sp., *Valvata nowshahrensis* sp. n., *Pseudobithynia mazandaranensis* sp. n., *Hippeutis complanatus*.

**Remarks.** The shells (Fig. 19) of this species are similar to the rare species *Anisus vorticulus*, which is distributed in Central and E Europe. Additional material is necessary to resolve the taxonomy of this taxon.

*Anisus vortex* (Linnaeus, 1758)
http://species-id.net/wiki/Anisus_vortex

**Records from Iran.** Fars Province – Mansoorian (1994).
**Distribution.** Euro-Siberian.

Figure 19. *Anisus sp.:* shell.
Genus *Gyraulus* Charpentier, 1837

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

*Gyraulus piscinarum* (Bourguignat, 1852)
http://species-id.net/wiki/Gyraulus_piscinarum
Fig. 20b

**Records from Iran.** Tehran Province (as *Anisus* (*Gyraulus*) *piscinarum*: Starmühlner and Edlauer 1957).

**New records.** Mazandaran Province: IR02-05 [6 ex.]; Fars Province: IR07-07 [13 ex.]; Seistan and Baluchestan Province: IR08-11 [10 ex.], IR09-11 [14 ex.].

**Distribution.** Lebanon, Syria, Turkey (Black Sea coast), Iran.

**Remark.** The examined specimens have been identified by its anatomy and are in a good agreement with Glöer and Bößneck (2007) as well as the anatomical studies carried out by Meier-Brook (1983).

*Gyraulus euphraticus* (Mousson, 1874)
http://species-id.net/wiki/Gyraulus_euphraticus

**Records from Iran.** Seistan and Baluchestan Province (Annandale and Prashad 1919); Fars Province (Starmühlner and Edlauer 1957); Khuzestan Province (Massoud and Hedayeti-Far 1979, Mansoorian 2001).

**Remarks.** *Gyraulus euphraticus* can be confused with *Anisus* spp. (Glöer and Bößneck 2007).

**Distribution.** Irak, Iran.

*Gyraulus convexiusculus* (Hutton, 1849)
http://species-id.net/wiki/Gyraulus_convexiusculus
Fig. 20a

**New records.** Seistan and Baluchestan Province: IR08-05 [2 ex.]; IR09-11 [4 ex.].

**Records from Iran.** Seistan and Baluchestan Province (Annandale and Prashad 1919); Yazd Province (Starmühlner and Edlauer 1957).

**Distribution.** Afghanistan to Thailand, Iran.

*Gyraulus laevis* (Alder, 1838)
http://species-id.net/wiki/Gyraulus_laevis

**Records from Iran.** Mazandaran Province (Forcart 1935, Starmühlner and Edlauer 1957).

**Distribution.** Central Europe.
Figure 20. a Gyraulus convexusculus b G. piscinarum c Hippeutis complanatus.
Genus *Indoplanorbis* Annandale and Prashad, 1920

Type species. *Planorbis exustus* Deshayes, 1834

*Indoplanorbis exustus* (Deshayes, 1834)
http://species-id.net/wiki/Indoplanorbis_exustus
Fig. 18c

Records from Iran. Seistan and Baluchestan Province (Mansoorian 1994).
New records. Hormozgan Province: IR15-11 [5 ex.].
Distribution. Iran, Oman, Yemen, India, Nepal, SE Asia.

Genus *Hippeutis* Charpentier, 1837

Type species. *Helix complanata* Linnaeus, 1758

*Hippeutis complanatus* (Linnaeus, 1758)
http://species-id.net/wiki/Hippeutis_complanatus
Fig. 20c

New records. Mazandaran Province: IR01-05 [3 ex., anat. det.].
Remarks. New for Iran.
Distribution. Europe to W Asia.

Genus *Segmentina* Fleming, 1818

Type species. *Planorbis nitidus* O.F. Müller, 1774

*Segmentina calatha* (Benson, 1850)
http://species-id.net/wiki/Segmentina_calatha

Records from Iran. Seistan and Baluchestan Province (Annandale and Prashad 1919).
Distribution. India, Iran.

Genus *Ferrissia* Walker, 1903

Type species. *Ferrissia rivularis* (Say, 1817)
**Ferrissia isseli** (Bourguignat, 1866)
http://species-id.net/wiki/Ferrissia_isseli

**Records from Iran.** Gilan Province (as Protanclus (Ferrissia) isseli: Starmühlner and Edlauer 1957).

**Distribution.** Africa, Iran.

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**Family Physidae** Fitzinger, 1833

**Genus Haitia** Clench & Aguayo, 1932

**Type species.** Physa globosa Haldeman, 1841

**Haitia acuta** (Draparnaud, 1805)
http://species-id.net/wiki/Haitia_acuta

**Records from Iran.** all mentioned as Physa acuta: Gilan, Mazandaran and Lorestan Provinces (Mansoorian 2000); Khuzestan Province (Mansoorian 2001, Massoud and Hedayeti-Far 1979, Elazian et al. 1979).

**New records.** Mazandaran Province: IR02-05 [2 ex.]; IR03-05 [3 ex.]; IR04-05 [3 ex.]; IR05-05 [3 ex.]; Markazi Province: IR51-05 [2 ex.], IR91-05 [6 ex.]; IR93-05 [1 ex.]; Khorasan Province: IR70-05 [1 ex.]; IR77-05 [1 ex.]; Gilan Province: IR82-05 [1 ex.]; Lorestan Province; IR95-05 [39 ex.]; Fars Province: IR07-07 [22 ex.]; IR14-07 [13 ex.]; IR26-07 [3 ex]; Seistan and Baluchestan Province: IR08-11 [12 ex.]; Hormozgan Province. IR17-11 [1 ex.].

**Associated species.** Melanoides tuberculatus, Thiara scabra, Grossuana sp., Galba truncatula, Acroloxus pseudolacustris, Planorbis intermixtus, Pseudobithynia zagrosia.

**Distribution.** Europe, Mediterranean, Iraq, Iran.

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**Discussion**

The checklist of Iranian freshwater snails presented here shows a total of 73 species in 34 genera and 14 families. The records and taxonomic status of six species i.e. Neritina mesopotamica Martens, 1874, Bithynia cf. ejecta Mousson, 1874, B. rubens (Menke, 1830), Hydrobia acuta (Draparnaud, 1805), Hauffenia erythropomatia (Hauffen, 1856) and Stagnicola palustris (O.F. Müller, 1774) are questionable and needs new confirmation. Further, the genus Melanopsis needs revision as several species have been reported from Iran (i.e., Melanopsis variabilis, deserticola, buccinoides and praemorsa), but without further study and additional materials it is not possible to establish under which name or names the Iranian populations should
be placed. The genus *Radix* is richest in the number of the species. However, our list of *Radix* species from Iran contains the hitherto recorded nominal species, their taxonomic status remains to be explored. For the two species i.e. *Stagnicola* sp. and *Anisus* sp. further study and additional specimens are necessary to resolve the taxonomy of these taxa. The identification of the species of the genus *Anisus* is based on the anatomical features (Glöer and Meier-Brook 2008), so all former records of this genus are questionable and need new confirmation. Three species, *Bithynia badiella* (Küster, 1852), *B. troschelii* (Pasch, 1842) and *Acroloxus lacustris* (Linnaeus, 1758), are excluded from the list of Iranian freshwater snails, while *Bithynia tentaculata* most probably does not occur in Iran.

Of the 73 species reported in this paper, 12 species have a wide distribution (known from two or more biogeographical regions), 9 species are Palaeartic, 4 species are W-Palaearctic and 8 species are “Middle East” (Iran, Iraq, Tadjikistan, Uzbekistan, Turkey, Syria, Israel) in their distribution. Insufficient knowledge hampers the determination of the biogeographic status of the rest of the species. Moreover, another 27 (37%) of these species have been indicated as being endemic to Iran.

If we take generic diversity into consideration, we can see that only three genera i.e. *Farsityra* Glöer & Pešić 2009, *Kaskakia* gen. n. and *Sarkhia* gen. n. are endemic to Iran.

The species-richness of freshwater gastropods in our study was rather low one with an average of 2.12 species and a maximum of 6 spp. per sampling site. Only some common species occur in high abundances [> 20 ind./sampling site], abundances of most species being < 10 ind./sampling site. Most sampling sites in our study were intermittent streams, with perennial surface water only present in the head water section near their source in the mountains. Further downstream, riverbeds are usually seasonally dry with occasionally some standing pools in their middle course (Pešić et al. 2012).

As expected, our current knowledge of the diversity of the freshwater snail fauna is far from being complete. For most Iranian provinces, all available data come from a few surveys with as objective the study of snails as vectors of digenetic trematodes of medical or veterinary importance (e.g., Mansoorian 1994, 1998, 2001). However, large portions of Iran remain unexplored and many important hydrological basins have never been sampled. The number of known species may hence only represent but a part of the total freshwater snail species number in Iran. For example, for Central Europe, an estimated total species number of about 150 appears appropriate (Glöer 2002).

However, the present study is exhaustive and constitutes the most complete list of freshwater snails in Iran, including a complete bibliography of research on the subject. Further studies should focus at a serious improvement of our knowledge on Iranian freshwater snails by intensive collecting activities in little known areas in order to close the large gaps in our knowledge on their diversity. Particularly some specific habitats such as springs and underground habitats are more or less unexplored but may prove to be a major source for freshwater biodiversity.
Acknowledgements

We would like to thank Dr Martin Haase for identifying the hydrobioid snails *Ecrobia grimmi* and *Helobia dalmatica*. Further we are thankful to Anita Eschner for the loan of material from Edlauer’s collection (Natural History Museum Vienna), to Edi Stöckli and Urs Wüest for the loan of material from Forcart’s collection (Natural History Museum Basel), to Murtada Naser for *Nerita* spp. from Iraq, and to Dr David Walker who reviewed the English. This study was partly supported by the research project CBFEcoMTG from the Ministry of Science, Montenegro. Furthermore, we are grateful to Dr Eike Neubert (Switzerland), Dr Dirk van Damme (The Netherlands) and Dr Uli Bößneck (Germany) for their careful work and valuable comments.

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# Appendix

List of sampling sites.

| code  | sampling site                                                                                     | GPS-coordinates [m asl.] | habitat                  | date       |
|-------|--------------------------------------------------------------------------------------------------|---------------------------|--------------------------|------------|
| 1     | Mazandaran province, Nowshahr city (near Caspian Sea)                                             | 51°31'E, 36°38'N [-28]    | pond                     | 18.06.2005 |
| 2     | Mazandaran province, road to Kandelous                                                            | no coordinates           | spring                   | 18.06.2005 |
| 3     | Markazi province, road to Khomeyn                                                               | no coordinates           | stream                   | 27.06.2005 |
| 4     | Lorestan province, Khorramabad area.                                                             | no coordinates           | stream                   | 24.06.2005 |
| 5     | Khorasan province, 25 km to Bojnurd River                                                        | no coordinates           | stream                   | 07.07.2005 |
| 6     | Markazi Province, Bolagh stream 10 km after Shahzand city (in Shahzand to Pole Doab Road).       | no coordinates           | stream                   | 04.06.2005 |
| 7     | Khorasan Province, Akhlamad                                                                      | 58°57'E, 36°40'N [ca. 2000] | waterfall                | 04.06.2005 |
| 8     | Khorasan Province, Golmakan, Cheshmeh Sebz                                                       | 59°15'E, 36°15'N [ca. 2000] | spring                   | 04.06.2005 |
| 9     | Khorasan Province, Gojki road to Kalat (ca. 94 km to Kalat)                                      | 59°45'E, 36°35'N [ca. 1400] | rheohelocrenic spring    | 05.06.2005 |
| 10    | Khorasan Province, Gojki road to Kalat (ca. 94 km to Kalat)                                      | 59°45'E, 36°35'N [ca. 1400] | stream                   | 05.06.2005 |
| 11    | Khorasan Province, spring at Mashhad-Kalat road (35 km to Kalat)                                 | no coordinates           | spring                   | 05.06.2005 |
| 12    | Khorasan Province, river near Kalat city                                                          | 59°45'E, 36°58'N [ca. 1900] | river                    | 05.06.2005 |
| 13    | Khorasan Province, Mach stream (in Moghan road), 16 km to Moghan                                 | 59°31'E, 35°10'N [ca. 2000] | stream                   | 06.06.2005 |
| 14    | Khorasan Province, Kaskak stream in Kaskak village                                               | 59°10'E, 35°25'N [ca. 1800] | stream                   | 07.06.2005 |
| 15    | Khorasan Province, Khav stream in Khav city (25 km to Neishabour)                                | 59°5'E, 36°12'N [ca. 2200] | stream                   | 10.06.2005 |
| 16    | Khorasan Province, Koh Sorkh stream (in Koh Sorkh city, ca. 35 km to Kashmar city)               | 59°25'E, 36°25'N [ca. 2200] | stream                   | 10.06.2005 |
| 17    | Khorasan Province, Zou Eram spring in Zou Eram village (near Shirvan city)                        | 58°40'E, 37°20'N [ca. 1600] | spring                   | 11.06.2005 |
| 18    | Khorasan Province, spring 1 near Zou Eram spring in Zou Eram village (near Shirvan city)          | no coordinates           | spring                   | 11.06.2005 |
| 19    | Khorasan Province, spring 2 near to Zou Eram spring in Zou Eram village (near Shirvan city)       | no coordinates           | spring                   | 11.06.2005 |
| code   | sampling site                                                                 | GPS-coordinates [m asl.]                  | habitat | date       |
|--------|-------------------------------------------------------------------------------|------------------------------------------|---------|------------|
| 20     | Khorrasan Province, Baba Aman Park spring (ca. 5 km to Bojnurd city)          | 57°24'E, 37°25'N [ca. 1300]              | spring  | 11.06.2005 |
| 21     | Gilan Province, Bandar Anzali Lagoon                                          | 49°27'E, 37°26'N                         | wetland | 16.06.2005 |
| 22     | Markazi Province, Ashtian to Arak road (ca. 5 km after Ashtian)               | 50°01'E, 34°34'N [ca. 1800]             | pool    | 21.06.2005 |
| 23     | Markazi Province Aman Abad spring in Anjedan road before Aman Abad village    | 49°48'E, 33°55'N [ca. 1700]             | spring  | 22.06.2005 |
| 24     | Markazi Province, Cheshmeh Shater in Arak to Khomein road (8 km after Arak)  | 49°45'E, 34°08'N [ca. 1700]             | pool    | 22.06.2005 |
| 25     | Markazi Province, stream 2 km after Hassan Abad (in Arak to Khomein road)     | 49°52'E, 33°50'N [ca. 1700]             | stream  | 22.06.2005 |
| 26     | Markazi Province, Varcheh spring in Emamzadeh Varcheh village (in Arak to Khomein road, ca. 20 km to Khomein) | 49°55'E, 33°49'N [ca. 1700]             | spring  | 22.06.2005 |
| 27     | Markazi Province, stream near Astaneh city (Azna Aligudarz cross way)         | 49°24'E, 33°55'N [ca. 2400]             | stream  | 23.06.2005 |
| 28     | Lorestan Province, Darband stream in Darband village (Azna to Dorood road, ca. 16 km to Azna) | 49°17'E, 33°25'N [ca. 1800]             | stream  | 23.06.2005 |
| 29     | Lorestan Province, Dareh Takht stream in Dareh Takht village (13 km to Azna city) | 33°22'N, 49°22'E [ca. 2800]             | stream  | 23.06.2005 |
| 30     | Kermanshah Province, Firoozan stream in Firoozan village                      | 34°25'N, 48°11'E                        | stream  | 27.06.2005 |
| 31     | Kermanshah Province, Sar Pol Kangar stream in Sar Pol Kangarar village        | 34°30'N, 47°55'E                        | stream  | 27.06.2005 |
| 32     | Kermanshah Province, spring near Sarbe – Sarkh city                           | no coordinates                          | spring  | 27.06.2005 |
| 33     | Kermanshah Province, stream Gamasiab in village Gamasiab                      | 34°27'N 47°45'E                        | stream  | 27.06.2005 |
| 34     | Fars Province, Dasht Arzhan village (in Shiraz to Kazerum road)               | 29°39'N, 51°59'E [ca. 2300]             | stream  | 04.08.2007 |
| 35     | Fars Province, AtashKadeh spring, Ardeshir palace in Firooz Abad              | 28°54'N, 52°32'E [1683]                 | limnocrenic | 05.08.2007 |
| 36     | Fars Province, Firooz Abad city, Kay Zarrin village                           | 28°53'N, 52°32'E [1711]                 | stream  | 05.08.2007 |
| 37     | Fars Province, Shiraz to Firooz Abad road, Ebrahim Abad village, Ebrahim Abad stream | 29°00'N, 52°34'E                      | stream  | 06.08.2007 |
| code | sampling site | GPS-coordinates [m asl.] | habitat | date |
|------|---------------|--------------------------|---------|------|
| 38   | Lorestan Province, Mode Abad village | 33°35'N, 48°37'E [1723] | stream | 10.08.2007 |
| 39   | Lorestan Province, road from Boroujerd to Khorram Abad city | 33°30'N, 48°44'E [1660] | limnocrenic | 10.08.2007 |
| 40   | Markazi Province, Aman Abad (near Arak city) | 33°59'N, 49°52'E [1775] | pool | 11.08.2007 |
| 41   | Seistan Province, Chahabar, Sharak village, Qanat 1 | 26°02’N, 61°04’E [264] | qanat (spring) | 13.07.2011 |
| 42   | Seistan va Baluchestan Province, Chahabar, Sharak village, Qanat 2 (ca. 100 m from Qanat 1) | no coordinates | qanat (spring) | 13.07.2011 |
| 43   | Seistan va Baluchestan Province, Chahabar, Shirgovaz – Machkor stream, 45 m asl. | 25°47’N, 61°28’E | stream | 14.07.2011 |
| 44   | Seistan va Baluchestan Province, Chahabar, Hootgat Bala river | 25°48’N, 61°31’E [57] | river | 14.07.2011 |
| 45   | Hormozgan Province, Bandar Abass, Khorgoo village before hot water spring | 27°29’N, 56°28’E [125] | saline stream | 14.07.2011 |
| 46   | Hormozgan Province, Bandar Abass, Khorgoo village before hot water spring, small pool near 14-11 | 27°29’N, 56°28’E [113] | pool (saline water) | 16.07.2011 |
| 47   | Hormozgan Province, Bandar Abass, Siahoo Qanat in Siahoo village | 27°46’N, 56°20’E [630] | qanat (spring) | 18.07.2011 |
| 48   | Hormozgan Province, Bandar Abass, Taleguerdoo village, Poshtekeno spring, upper part of stream | 27°49’N, 56°24’E [836] | stream | 18.07.2011 |
| 49   | Hormozgan Province, Bandar Abass, Banglayan village | 27°46’N, 56°32’E [577] | stream | 18.07.2011 |
| 50   | Hormozgan Province, Bandar Abass, Bandar Kamir to Bandar Lenhuhue road, ca 80 km to Bandar Abass, saline stream near Dezhgan | 26°53’N, 55°16’E [20] | saline stream | 20.07.2011 |
| 51   | Tehran Province, Elbrus Mt., Shahrestanak River | | river | 18.08.2003 |
