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FRESHWATER MOLLUSCS OF KYRGYZSTAN WITH DESCRIPTION OF ONE NEW GENUS AND SPECIES (MOLLUSCA: GASTROPODA)

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ABSTRACT: Ten species of freshwater molluscs were collected in 2013 during an expedition to Kyrgyzstan. Five gastropod species, i.e. *Radix auricularia* (L.), *Radix* cf. *hookeri* (Reeve), *Lymnaea kashmirensis* Prashad, *Gyraulus chinensis* (Dunker), *Physella acuta* (Drap.), and two bivalve species, i.e., *Pisidium casertanum* (Poli) and *P. obtusale* (Lamarck) are reported as new for the fauna of Kyrgyzstan. A new hydrobiid genus and species, *Chirgisia alaarchaensis* n. gen. n. sp., is described from a rheocrenic spring in the National Park Ala Archa in northern Kyrgyzstan. Based on literature survey and our own studies, a checklist of freshwater molluscs of Kyrgyzstan is compiled. It includes a total of 27 gastropod species of 12 genera and six families, and two bivalve species of the genus *Pisidium*.

KEY WORDS: freshwater molluscs, Kyrgyzstan, *Chirgisia alaarchaensis* n. gen. n. sp.

INTRODUCTION

Kyrgyzstan is a landlocked country in Central Asia, bordering Kazakhstan, China, Tajikistan and Uzbekistan, with the mountainous region of the Tian Shan covering over 80% of the country. The climate of the northern foothills is temperate, while the climate of the Tian Shan varies from dry continental to polar, depending on the elevation. Most rivers and streams (most of them are small, rapid, runoff streams) are tributaries of the Syrdariya, which has its headwaters in the western Tian Shan. Another large runoff system forms the Chui River, which arises in northern Kyrgyzstan, then flows northwest and disappears into the deserts of southern Kazakhstan. Kyrgyzstan has a total of about 2,000 lakes, mostly located at altitudes of 3,000 to 4,000 metres; the largest three lakes, Issyk-Kul, Son Kul and Chatyr Kul, occupy more than 100 km^2 each.

The fauna of the freshwater molluscs of Kyrgyzstan is still poorly documented and only a few species, most of them pulmonate gastropods from Lake Issyk-Kul, have been known (MARTENS 1864, 1882, KOBELT 1872, CLESSIN 1894, 1907, MÖLLENDORFF 1901, YANKOVSKAYA 1972). In total 27 taxa have been listed so far, with some doubtful identifications which will be discussed below.

During a recent survey of the water mite fauna of Kyrgyzstan done by the third author one new hydrobiid species was discovered and it is described in the present paper. Therewith, we aim to provide a checklist of freshwater molluscs of Kyrgyzstan.

MATERIAL AND METHODS

In 2013 VLADIMIR PEŠIĆ collected 37 samples from northern Kyrgyzstan of which ten contained freshwater molluscs (Figs 1–9, Table 1). The snails were collected using a sieve and the samples were

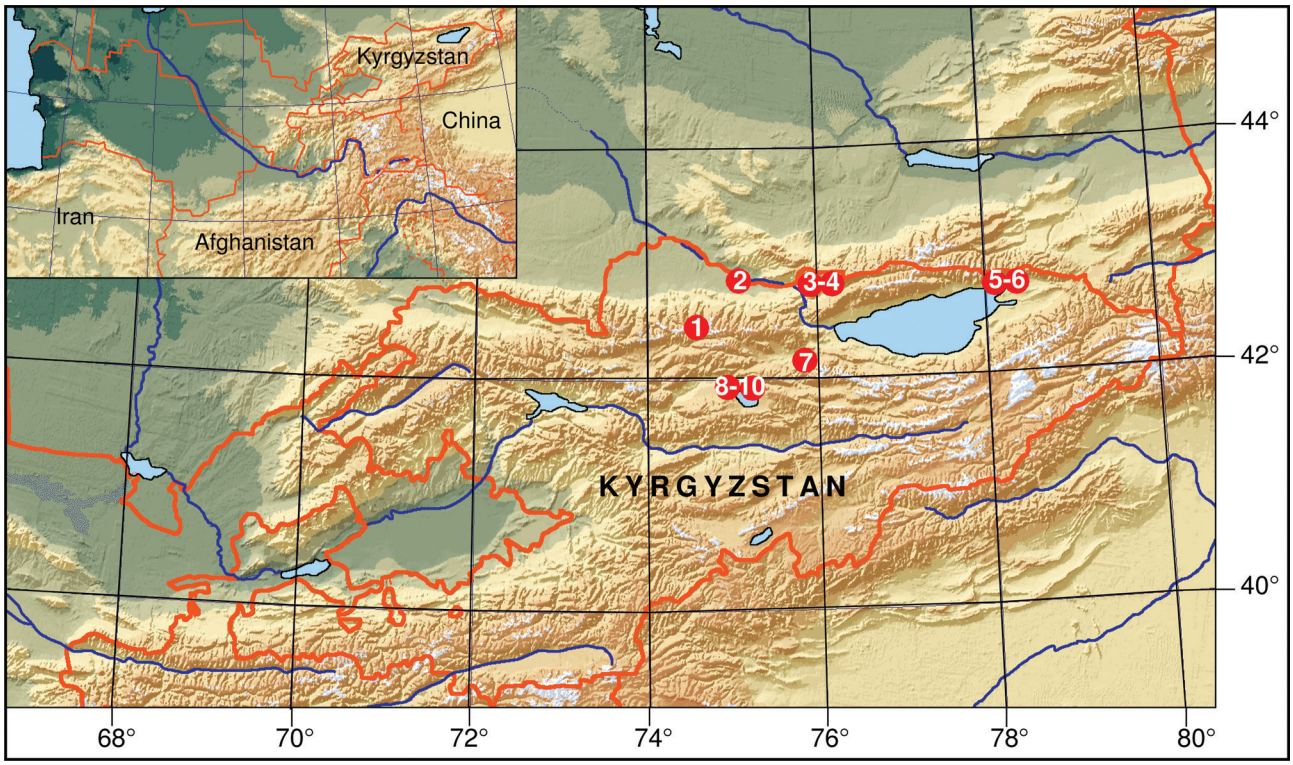


Fig. 1. The sampling sites: 1 – KR2, 2 – KR4, 3 – KR6, 4 – KR9, 5 – KR12, 6 – KR19, 7 – KR26, 8 – KR29, 9 – KR34, 10 – KR35 (for collecting site abbreviations see Table 1)

Table 1. Sampling sites of freshwater molluscs in our study in Kyrgyzstan. Photos of most sites are given in Figs 2–9

Coll. no.	Taxa	Sampling site	Alt. [m]	Coordinates	Date
KR2	*Chirgisia alaarchaensis* n. sp.	Ala Archa NP, rheocrenic spring	2,118	42°36.203' N, 74°28.959' E	9.07.2013
KR4	*Radix lagotis*, *Physella acuta*, *Gyraulus chinensis*	River Chu (Kyrgyzstan-Kazakhstan border),	703	42°56.169' N, 74°59.565' E	10.07.2013
KR6	*Galba truncatula*, *Pisidium casertanum*	Chon-Kemin NP, spring Omur Bulak (on road to Kalman Ashu village)	1,388	42°41.083' N, 75°56.956' E	10.07.2013
KR9	*Radix auricularia*, *Gyraulus chinensis*	River Chu	1,505	42°31.520' N, 75°49.235' E	11.07.2013
KR12	*Radix lagotis*, *Gyraulus chinensis*, *Pisidium obtusale*	Karakal region, road to May Saz pass, pond	2,729	42°27.499' N, 78°56.447' E	12.07.2013
KR19	*Radix auricularia*, *Gyraulus chinensis*	Karakal region, fish pond near Tup town	1,623	42°42.777' N, 78°22.506' E	13.07.2013
KR26	*Galba truncatula*, *Radix auricularia*, *Pisidium casertanum*	Kočkor region, stream	1,757	42°16.398' N, 75°51.204' E	15.07.2013
KR29	*Lymnaea kashmirensis*, *Radix* cf. *hookeri*	pond near Lake Son Kul	3,013	41°53.510' N, 75°12.090' E	16.07.2013
KR34	*Radix lagotis*	Lake Son Kul area, rheohelocrenic spring 1	3,093	41°56.236' N, 75°12.686' E	16.07.2013
KR35	*Radix lagotis*, *Pisidium obtusale*	Lake Son Kul area, limnocrenic spring	3,094	41°56.339' N, 75°12.904' E	16.07.2013

Figs 2–9. Photographs of selected sampling sites: 2 – KR2 (type locality of *Chirgisia alaarchaensis* n. gen. n. sp.); 3 – KR4 (sampling site of *Radix lagotis*, *Physella acuta*, *Gyraulus chinensis*); 4 – KR6 (sampling site of *Galba truncatula* and *Pisidium casertanum*); 5 – KR9 (sampling site of *Radix auricularia* and *Gyraulus chinensis*); 6 – KR12 (sampling site of *Radix lagotis*, *Gyraulus chinensis* and *Pisidium obtusale*); 7 – KR19 (sampling site of *Radix auricularia* and *Gyraulus chinensis*); 8 – KR26 (sampling site of *Galba truncatula*, *Radix auricularia* and *Pisidium casertanum*); 9 – KR29 (sampling site of *Lymnaea kashmirensis* and *Radix* cf. *hookeri*) (for collecting site abbreviations see Table 1)

preserved in 75% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (Zeiss); the photographs were taken with a digital camera system (Leica R8).

The collecting site abbreviations derive from the geographical database of VLADIMIR PEŠIĆ. All the material, including the holotype and paratypes of the new species, is stored in the Zoological Museum of Hamburg (ZMH).

RESULTS AND DISCUSSION

In ten sampling sites (Fig. 1) we found altogether ten species (Table 1), of which eight gastropod species represented Hydrobiidae (one new species assigned to a new genus), Lymnaeidae (5 species), Physidae (1 species), Planorbidae (1 species), and two bivalve species of the family Sphaeriidae.

NEW GENUS AND NEW SPECIES

Chirgisia n. gen.

Figs 10–18

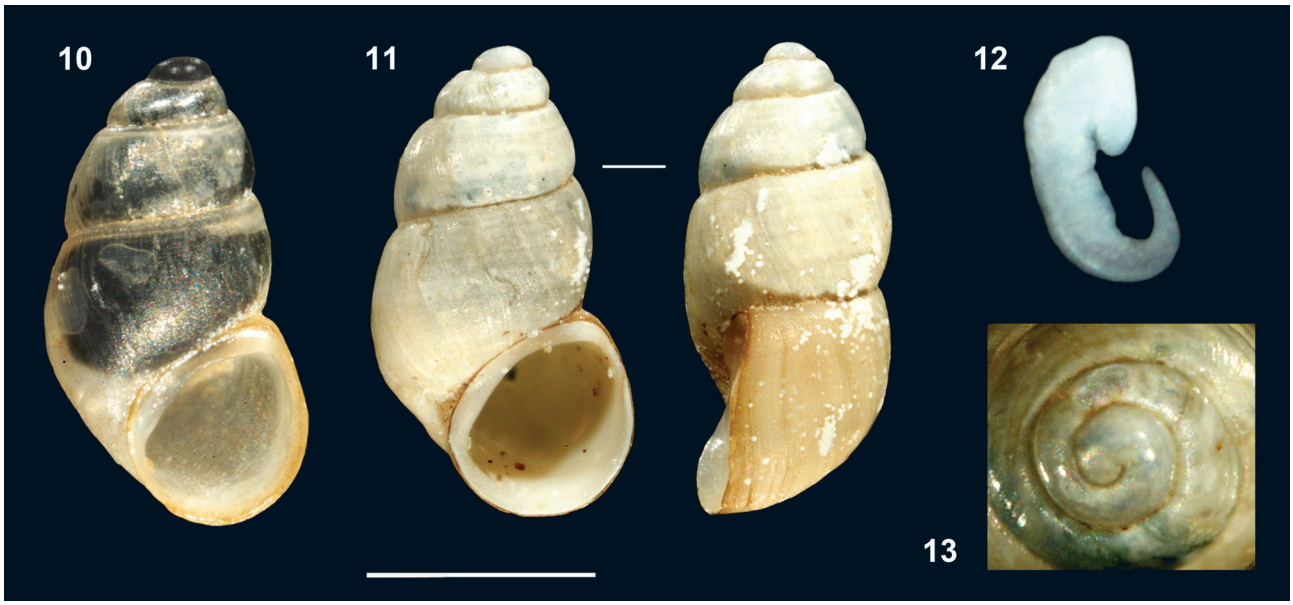
Diagnosis: Shell conically cylindrical with 4–4.5 slightly convex whorls. Umbilicus closed. Aperture oval and thickened at the columella. Penis simple, without any outgrowths, its core black pigmented. Renal oviduct without any receptacula, bursa copulatrix sac-like (Figs 15, 16).

Etymology: Named after its occurrence in Kyrgyzstan.

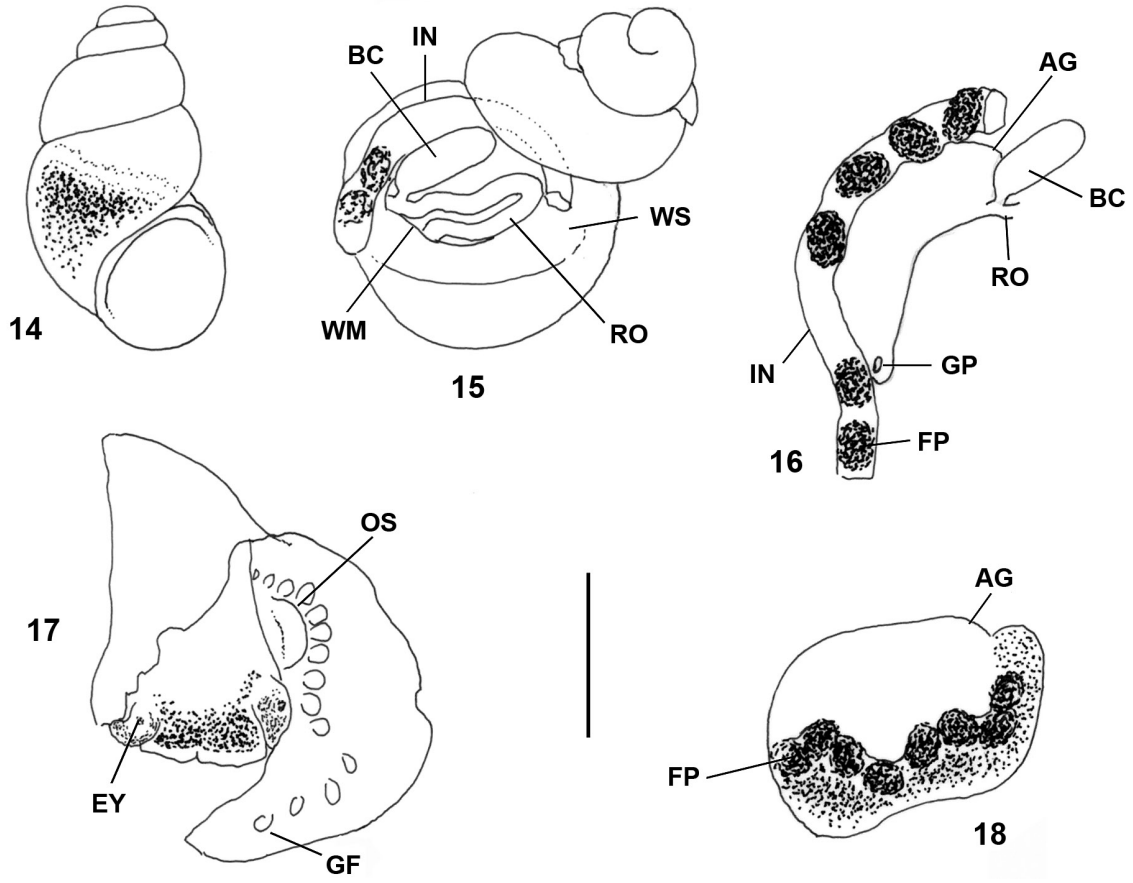
Differentiating features: In its shell shape the genus resembles *Belgrandiella* A. J. Wagner, 1928. However, these two genera can be clearly distinguished by the morphology of penis: while *Belgrandiella* has an outgrowth on the penis, there is no such outgrowth in *Chirgisia* n. gen. Furthermore, in females of *Chirgisia* n. gen. the renal oviduct is provided with a bursa only, and receptaculum (rs1), which is present in *Belgrandiella,* is missing.

The other hydrobioid genus known from Kyrgyzstan, *Pseudocaspia* Starobogatov, 1972, can be easily distinguished by the shell, which is elongated-conical.

In *Sibirobythinella kuznetzkiana* Johansen et Starobogatov, 1982 (type species of the genus) the aperture is shifted to the right by half its width. Furthermore, JOHANSEN & STAROBOGATOV (1982) assigned the genus to the Triculidae (superfamily Littoridinoidea) and stated that the superfamily was characterised by an own communication of the bursa with the mantle cavity, the communication being independent of the pallial oviduct (1982: 1147). Whether the assignment by JOHANSEN & STAROBOGATOV (1982) is correct and whether *Sibirobythinella almaatina* Izzatullaev, Sitnikova et Starobogatov, 1986 can be included in the same genus can be left an open question here, since the type species of *Chirgisia* n. gen. differs from both *S. kuznetzkiana* and *S. almaatina*. *S. almaatina* is a pomatiopsid species, known from the springs in the neighbouring Alma-Ata region, Zailiyskiy Alatau, spring Belbulak and environs of Talgar in Kazakhstan (IZZATULLAEV et al. 1986, KANTOR et al. 2010), its aperture is shifted to the left and thus lies direct-



Figs 10–13. *Chirgisia alaarchaensis* n. gen. n. sp.: 10 – shell (holotype), 11 – shell in frontal and lateral view (paratype), 12 – penis, 13 – apex. Scale bar equals 1 mm for Figs 10–11



Figs 14–18. *Chirgisia alaarchaensis* n. gen. n. sp.: 14 – shell (frontal view); 15 – body cavity between stomach and mantle cavity opened and spread to show renal oviduct with bursa copulatrix (shell except for protoconch and proximal section of intestine removed); 16 – complex of albumen and capsule gland with final section of renal oviduct entering the complex flanked by final section of intestine filled with faecal pellets; 17 – head; mantle cavity opened to show ctenidium with osphradium; 18 – lateral view of penultimate whorl (shell removed) with intestine filled with faecal pellets; constriction between bursa and albumen gland (drawing by H. BOETERS). Abbreviations: AG – albumen gland, BC – bursa copulatrix, EY – eye, FP – faecal pellet, GF – gill filaments, GP – gonoporus, IN – intestine, OS – osphradium, RO – renal oviduct, WM – wall of mantle cavity, WS – distal wall of stomach. Scale bar equals 1 mm for Fig. 14 only, for Figs 15–18 – 0.5 mm

ly beneath the body whorl, and the penis is small and triangular; in *Chirgisia* n. gen. it is long and slim. Moreover, in females of *S. almaatina* the distal loop of the renal oviduct adheres to the bursa on its whole length, whereas in *Chirgisia* n. gen. only the distal leg of the distal loop touches the bursa (cf. IZZATULLAEV et al. 1986: pl. 1, fig. 5 and our Fig. 15).

Some other hydrobiid species which differ from *Chirgisia* n. gen. in their penis morphology are known from Middle Asia: *Bucharamnicola* Izzatullaev, Sitnikova et Starobogatov, 1985 has one outgrowth; the same is true of *Sogdamnicola* Izzatullaev, Sitnikova et Starobogatov, 1985. Furthermore, besides the bursa, females of *Bucharamnicola* are provided with a distal plus proximal receptaculum (rs1 + rs2) and females of *Sogdamnicola* with at least a proximal receptaculum (rs2), which are missing in females of *Chirgisia* n. gen.

Martensamnicola Izzatullaev, Sitnikova et Starobogatov, 1985 has a globular shell and two receptacula (rs1 + rs2).

In females of *Turkmenamnicola* Izzatullaev, Sitnikova et Starobogatov, 1985 the genital orifice is slit-like and not a gonoporus as in *Chirgisia* n. gen.

In females of *Nurekia* Izzatullaev, Sitnikova et Starobogatov, 1985 the renal oviduct opens immediately into the mantle cavity and not close to the mantle edge as in *Chirgisia* n. gen.

The shell and penis of *Terranigra kosovica* Radoman, 1978 at first glance are slightly similar to those of *Chirgisia* n. gen. but females of *Terranigra* have receptacula which are absent in *Chirgisia* n. gen.

Type species: *Chirgisia alaarchaensis* n. sp.

Chirgisia alaarchaensis n. sp.

Type series: **Holotype** – ZMH 79677, shell height 1.9 mm, width 1.1 mm; **Paratypes** – 10 ex. ZMH 79678**,** 41 ex. GLÖER collection

Locus typicus: Kyrgyzstan**,** Ala Archa NP, rheocrenic spring, 42°36.203'N, 74°28.959'E, 2,118 m a.s.l. (Fig. 2).

Etymology: Named after the National Park Ala-Archa where it was collected.
Shell: The elongate conical shell (Figs 10, 11, 14) consists of 4–4.5 slightly convex whorls with a shallow suture and rounded apex (Fig. 13). The shell is light yellowish translucent. The umbilicus is closed. The surface is shiny and smooth. The aperture is oval and thickened at the columella, the margin is sinuate in lateral view (Fig. 11). Shell height: 1.9–2.2 mm, shell width: 1.1–1.2 mm.
Operculum: Flexible, transparent and horn-coloured.
Animal: The mantle is uniformly black, head between the eyes and body ventrally below the intestine intensively black pigmented.
Penis morphology: The penis is simple (Fig. 12) without any outgrowths. The core of penis black pigmented.
Female soft body: Ctenidium with 14 lamellae, drop-shaped (Fig. 17). Osphradium well-developed. Intestine with Z-like bend behind the stomach (seen through body wall) (Fig. 18); final section of intestine without second bend but slightly coiled. Length of the intestine corresponds to about 15 faecal pellets in alignment. Anus immediately in front of the mantle edge. Renal oviduct without any receptacula, i.e. rs_1 and rs_2 absent (Figs 15, 16). Bursa copulatrix like a long sac of nearly the same length as the final leg of the renal oviduct which runs from the distal wall of the stomach to the wall of the mantle cavity; bursa duct very short. Gonoporus 1–2 faecal pellets in front of anus (Fig. 16).
Distribution: The species is known only from the type locality.
***Chirgisia alaarchaensis* n. gen. n. sp. – concluding remarks**: Two characters of the genital apparatus of males and females are noteworthy. In males of the new species the core of the penis is black pigmented. Such a pigmentation is also known in other freshwater species of the Truncatelloidea, such as species of *Alzoniella* Giusti et Bodon, 1984, *Belgrandia* Bourguignat, 1869, *Islamia* Radoman, 1974, *Mercuria* Boeters, 1971, and *Pseudamnicola* Paulucci, 1878, and in *Bythinella austriaca* (Frauenfeld, 1857) and *B. conica* Clessin, 1910 (see Boeters 1988 and Boeters & Knebelsberger 2012).

In females of freshwater species of the Truncatelloidea, in general the renal oviduct is provided with a bursa copulatrix and, in addition, with at least one receptaculum. In *Chirgisia* n. gen. the renal oviduct lacks any receptaculum. However, considering *S. almaatina*, for example, such a poor equipment of the renal oviduct is not an exception.

FRESHWATER MOLLUSCS OF KYRGYZSTAN

The present list of freshwater molluscs (Table 2) of Kyrgyzstan includes a total of 27 gastropod species in 12 genera and six families. Clessin (1907) listed also *Radix rubella* from Kyrgyzstan. This species was described by the same author from Lake Chiemsee in Bavaria, Germany, and it possibly represents a form of *R. auricularia* (see Hubendick 1951). *R. auricularia* is common in northern Kyrgyzstan in shallow water bodies such as ponds and river floodplains, at the altitude of up to 2,000 m (Figs 5, 7, 8). The second species of the genus in our study, *Radix lagotis*, is a widely distributed Palaearctic freshwater snail. Its presence in our material was confirmed by molecular sequences (K. Schniebs personal communication). In our study this species was found to be common in ponds and springs of helocrenic and limnocrenic types within an altitudinal range of 2,700–3,100 m (Fig. 3). The third species of the genus in our study was tentatively identified as *Radix hookeri*, a species known from Sikkim and Tibet (Subba Rao 1989), and later reported from Nepal, from 2,700 to 3,900 m a.s.l. (Nesemann et al. 2007, Glöer & Bössneck 2013). Our record comes from Lake Son-Kul, at more than 3,000 m a.s.l. However, without comparison with additional material from the type locality (Sikkim Himalaya) our assignment to *R. hookeri* is still provisional, based mainly on the approved non-identity with some alternative species. However, it is likely that this species may turn out to be a Himalayan endemic.

Lymnaea kashmirensis can also be regarded as a Himalayan endemic. Recently Glöer & Bössneck (2013) reported *L. kashmirensis* from Nepal, from a marshy pond at the altitude of 2,700 m, a habitat similar to our locality in Kyrgyzstan (Fig. 9), at 3,000 m a.s.l.

The diversity of the two genera, *Gyraulus* and *Planorbis*, in Kyrgyzstan needs revision. The only species collected by us, *Gyraulus chinensis*, was anatomically identified and it is common in shallow water bodies such as ponds and river floodplains at altitudes up to 2,000 m (Figs 3, 5, 6). The species is native to south and southeast Asia (Meier-Brook 1983). However, it has been introduced in several European and West African countries (Brown et al. 1999, Beran & Glöer 2006), so its exact native and introduced ranges, including the origin of the populations from Kyrgyzstan, still require confirmation. It is worth to note that due to the shell variability, *G. chinensis* can be confused with *G. acronicus* or *G. laevis*.

As shown by Glöer & Pešić (2010) conchological differences between *Planorbis planorbis*, and *P. intermixtus* are slight and these species can be only reliably identified based on the shell size combined with the number of prostate diverticules. Recently, we reported *P. intermixtus* from Lake Issyk-Kul which represents the easternmost occurrence of the species known so far (Glöer & Pešić 2010). *Planorbis sieversi* Mousson, 1873, a species listed by Soldatenko & Starobogatov (2000) from Lake Issyk-Kul and

Table 2. List of freshwater molluscs from Kyrgysztan. Species in square brackets are of disputable taxonomical status and/or of doubtful identification

No.	Taxa	Reference	Distribution
		GASTROPODA	
Hydrobiidae Stimpson, 1865			
1.	*Pseudocaspia issykkulensis* (Clessin, 1894)	Clessin (1894), Yankovskaya (1972), Zhadin (1952)	Lake Issyk-Kul, endemic
2.	*Chirgisia alaarchaensis* n. gen. n. sp.	our study	Kyrgyzstan, endemic
Valvatidae J. E. Gray, 1840			
3.	*Valvata piscinalis* (O. F. Müller, 1774)	Martens (1882)	Palaearctic
4.	*Valvata macrostoma* Mörch, 1864	Martens (1882)	Palaearctic
Lymnaeidae Rafinesque, 1815			
5.	*Lymnaea stagnalis* (Linnaeus, 1758)	Martens (1882), Clessin (1907)	Palaearctic
6.	*Lymnaea kashmirensis* Prashad, 1925	our study	Himalayan
7.	*Radix auricularia* (Linnaeus, 1758)	our study	Holarctic
8.	*Radix ovata* (Draparnaud, 1805)	Clessin (1907)	Palaearctic
9.	*Radix* cf. *hookeri* (Reeve, 1850)	our study	Himalayan
10.	*Radix obliquata* (Martens, 1864)	Kobelt (1872), Martens (1882), Möllendorff (1901), Yankovskaya (1972)	Palaearctic
11.	*Radix lagotis* (Schrank, 1803)	Martens (1882), our study	Palaearctic
12.	*Radix balthica* (Linnaeus, 1758)	Martens (1882)	Palaearctic
13.	*Galba truncatula* (O. F. Müller, 1774)	Martens (1882), Clessin (1907), our study	Cosmopolitian
Planorbidae Rafinesque, 1815			
14.	[*Planorbis planorbis* (Linnaeus, 1758)]	Martens (1882)	Palaearctic
15.	*Planorbis carinatus* O. F. Müller, 1774	Martens (1882)	European
16.	*Planorbis intermixtus* Mousson, 1874	Glöer & Pešić (2010)	Palaearctic
17.	*Anisus issykulensis* (Clessin, 1907)	Clessin (1907)	Lake Issyk-Kul, endemic
18.	[*Gyraulus acutus* Clessin, 1907]	Clessin (1907)	Lake Issyk-Kul, endemic
19.	[*Gyraulus acronicus* (A. Férussac, 1807)]	Yankovskaya (1972)	Palaearctic
20.	[*Gyraulus laevis* (Alder, 1838)]	Martens (1882)	Palaearctic
21.	*Gyraulus chinensis* (Dunker, 1848)	our study	Oriental (native range)
22.	*Planorbarius corneus* (Linnaeus, 1758)	Martens (1882)	Palaearctic
Acroloxidae Thiele, 1931			
23.	[*Ancylastrum ovatum* Clessin, 1907]	Clessin (1907)	Lake Issyk-Kul, endemic
24.	[*Ancylastrum issykulense* Clessin, 1907]	Clessin (1907)	Lake Issyk-Kul, endemic
25.	[*Ancylastrum turkestanicum* Clessin, 1907]	Clessin (1907)	Lake Issyk-Kul, endemic
26.	[*Ancylastrum dextrorsum* Clessin, 1907]	Clessin (1907)	Lake Issyk-Kul, endemic
Physidae Fitzinger, 1833			
27.	*Physella acuta* (Draparnaud, 1805)	our study	Holarctic
		BIVALVIA	
28.	*Pisidium casertanum* (Poli, 1791)	our study	Holarctic
29.	*Pisidium obtusale* (Lamarck, 1818)	our study	Holarctic

Armenia, is probably a synonym of *P. intermixtus* (see GLÖER & PEŠIĆ 2010).

The systematic position of many endemic species of the genus *Ancylastrum* described by CLESSIN (1907) from Issyk-Kul is still enigmatic. The type material of these species no longer exists, as the Clessin collection in the Natural History Museum of Stuttgart has been destroyed in the Second World War (DANCE 1966). Further study on additional specimens from Lake Issyk-Kul is necessary to resolve the taxonomy of these species.

Most of the 27 gastropod species included in the list are widely distributed: two are cosmopolitan, four are Holarctic, ten are Palaearctic, one is Oriental in its native range and two species are Himalayan. Moreover, another eight species (30.1%, see Table 2) have been indicated as possibly endemic to Kyrgyzstan, seven of them known only from Lake Issyk-Kul. However, if we exclude the doubtful species (listed in square brackets in Table 2), the currently recognised degree of gastropod endemism for Kyrgyzstan is very low and is estimated to be only 16%. Additional field work is necessary for an appropriate evaluation of the extant biodiversity of the freshwater mollusc fauna of Kyrgyzstan.

We found two freshwater bivalve species in our study, i.e. cosmopolitan *Pisidium casertanum*, and *Pisidium obtusale*, a species which occurs in North America (including Alaska), throughout Europe, and in parts of Russia (including Siberia) (FROGLEY & PREECE 2007). In Kyrgyzstan the latter species was found in a shallow pond at ca. 2,700 m a.s.l. and a spring at more than 3,000 m a.s.l., while *P. casertanum* was found in a spring and a stream within an altitudinal range of ca. 1,300–1,800 m.

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