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On the taxonomic state of *Bithynia troschelii* var. *sibirica* Westerlund, 1886, a Siberian endemic bithyniid snail (Gastropoda: Bithyniidae)

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> Abstract

The taxonomic identity of the snail *Bithynia troschelii* var. *sibirica* Westerlund, 1886 is studied by means of examining the syntypes as well as materials from Western Siberia collected by the authors. In the Russian literature (Starobogatov & Streletzkaja 1967; Starobogatov et al. 2004), this variety is considered as a distinct species, *Boreoelona sibirica* (Westerlund). Our data has shown that *B. sibirica* is a species closely related to Euro-Siberian *Bithynia troschelii* (Paasch, 1842) and can be distinguished from the latter by some conchological features and by differences in the structure of the copulative apparatus. Possibly, this species should not be placed in the genus *Boreoelona* Starobogatov et Streletzkaja, 1967 since its traits do not correspond with the diagnosis of their genus. However, this suggestion has to be corroborated by examination of another species of *Boreoelona*. The range of *B. sibirica* covers almost all Asian part of Russia as well as Middle Urals.

> Резюме

Таксономическое положение *Bithynia troschelii* var. *sibirica* Westerlund, 1886, эндемичного вида битиниид Сибири (Gastropoda: Bithyniidae). – Обсуждается таксономический статус моллюска *Bithynia troschelii* var. *sibirica* Westerlund, 1886 с привлечением синтипов данного таксона и собственных сборов авторов из водоемов Западной Сибири. В российской научной литературе (Старобогатов & Стрелецкая 1967; Старобогатов и др. 2004) этот вариетет рассматривается как самостоятельный вид *Boreoelona sibirica* (Westerlund). Полученные нами данные также указывают на самостоятельность этого вида, близкого к палеарктическому виду *Bithynia troschelii* (Paasch, 1842). Различия между этими видами проявляются в строении как раковины, так и совокупительного аппарата. Возможно, что вид *B. sibirica* не следует относить к роду *Boreoelona* Starobogatov et Streletzkaja, 1967, так как его признаки не вполне соответствуют диагнозу этого рода. Однако это предположение должно быть подтверждено путем изучения других представителей рода *Boreoelona*. Ареал *B. sibirica* охватывает практически всю Азиатскую Россию, а также Средний Урал.

> Kurzfassung

Der taxonomische Status von *Bithynia troschelii* var. *sibirica* Westerlund, 1886, eine für Sibirien endemische Bithynia (Gastropoda: Bithyniidae). – Die taxonomische Identität der Schnecke *Bithynia troschelii* var. *sibirica* Westerlund, 1886 wurde untersucht durch Überprüfung der Syntypen, wie auch von Material aus West-Sibirien, das von den Autoren gesammelt wurde. In der russischen Literatur (Starobogatov & Streletzkaja 1967; Starobogatov et al. 2004) wird diese Varietät als eigenständige Art geführt: *Boreoelona sibirica* (Westerlund). Unsere Ergebnisse haben gezeigt, dass *B. sibirica* eng verwandt ist mit der Euro-sibirischen *Bithynia troschelii* (Paasch, 1842), und kann von letzterer durch einige konchologische Merkmale, wie auch Unterschiede in der Struktur des Kopulationsorgans, unterschieden werden. Möglicherweise sollte diese Art der Gattung *Boreoelona* Starobogatov et Streletzkaja, 1967 zugerechnet werden, obwohl einige Merkmale nicht mit ihrer Gattungsdiagnose übereinstimmen. Wie dem auch sei, diese Vermutung sollte erhärtet werden durch die Untersuchung einer anderen *Boreoelona*-Art. Das Verbreitungsgebiet erstreckt sich über den gesamten asiatischen Teil Russlands sowie des Mittleren Urals.

> Key words

Gastropoda, Bithyniidae, *Bithynia troschelii* var. *sibirica*, *Boreoelona sibirica*, taxonomy, Western Siberia.

Introduction

Bithyniid snails are among the most extensively studied taxa of freshwater gastropods, and the main cause of this is that bithyniids in many countries serve as vectors of different natural helminthiases, including opisthorchiasis, clonorchiasis, and methorchosis (KAEWKES 2003; BE'ER 2005). It may seem surprising, however, that malacologists are still not able to develop an unified system to apply to this practically important family and to determine the number of valid species it comprises and what the exact names are that these species should bear. In some countries, including South Europe and Asia Minor, bithyniid diversity has not been studied completely and several new species and even one new genus have been described recently (GLÖER & PEŠIĆ 2006, 2007; GLÖER & NASER 2008). However, even in Northern Europe, where the freshwater malacofauna has been studied very thoroughly, there are serious controversies between taxonomists interested in bithyniid systematics (compare, for instance, GLÖER 2002a; FALKNER 2003; GLÖER 2004). A quite peculiar approach to the taxonomy of this family was developed by Russian authors (BERIOZKINA et al. 1995) and none of Western European malacologists did accept it completely.

Obviously, these taxonomic discrepancies may cause difficulties for those researchers, who are studying the geographic distribution, ecology and epidemiological role of bithyniids. For example, no one of today's experts knows exactly how many species of the family live in Western Siberia, where the world's largest natural focus of opisthorchiasis is situated (BE'ER 2005). None of experts can say exactly which species is (are) the vector(s) of the liver fluke *Opisthorchis felineus* (Rivolta, 1884), the agent of opisthorchiasis (ABAKUMOVA 2002). The nomenclatorial chaos that originated from the decades of non-coordinated use of taxonomic names led to the situation that in the parasitological literature the same species of snails has occasionally been mentioned under different names, and, on the other hand, a single Latin binomen would have been used in different senses.

There are not too many practical ways of accomplishing this taxonomic task, and the study of the type materials of species and varieties described by the older authors is, possibly, the better one. It allows us to attach a certain scientific Latin name to a particular species and, thus, we can put a check to taxonomic debates dealing with the true application. Here, we discuss the taxonomic identity of a rather poorly studied bithyniid taxon, *Bithynia troschelii* var. *sibirica* Westerlund, 1886 with using of the type materials and all available malacological collections. In the recent Russian nomenclature, it is referred to as *Boreoelona sibirica* (STAROBOGATOV et al. 2004; KANTOR & SYSOEV 2005; KANTOR et al. 2009). New records of this species from the Western Siberian waterbodies allow us to describe its range in more detail than given in the previous malacological literature.

Material and methods

The type series of *Bithynia troschelii* var. *sibirica* Westerlund, 1886 that is housed in the Swedish Museum of Natural History (accession number SMNH No. 6150) has been examined. It comprises two empty shells of syntypes. The place of syntypes sampling is "Kungur, Siberia".

In addition, samples of *B. troschelii* var. *sibirica* kept in the Russian large malacological collections were studied. We used samples from the Zoological Institute of the Russian Academy of Sciences, Sankt-Petersburg (ZIN, hereafter) and the Museum of Siberian Aquatic Molluscs, Omsk State Pedagogical University (MSAM, hereafter). The latter collection contains own samples of the authors made in different parts of Western Siberia. In total, 179 specimens of this taxon were examined (Table 1), 77 of these were dissected, including snails collected in the waterbodies of Tomsk, Tyumen and Novosibirsk regions of Russia. 23 shells were measured within the standard measurements scheme (STAROBOGATOV et al. 2004) with a precision to the nearest 0.1 mm for the purpose to study the shell sexual dimorphism of the shells.

For comparative purposes, specimens of representatives of the bithyniid genera *Opisthorchophorus* Beriozkina, Levina et Starobogatov, 1995 and *Parafossarulus* Annandale, 1924 (Collections of the Göteborgs Naturhistoriska Museum and MSAM) from Europe, Siberia and Korea were used.

Taxonomic history of *Bithynia troschelii* var. *sibirica*

The first record of this taxon has been mentioned by WESTERLUND (1876: 63), who listed it from Eastern Siberia under the name *Bithynia inflata* (Hansen). WESTERLUND (1876) reported the only known locality of this snail, namely Vorogovo village situated at Yenissei River (60° 50' N). Ten years later, the same author concluded that the Siberian snails have nothing in common with the species *B. inflata* (with locus typicus situated in Sweden) and separated them as a special variety *B. troschelii* var. *sibirica* West. (WESTERLUND 1886: 18). However, in the Russian faunistic

Tab. 1. Samples of *Bithynia troschelii* var. *sibirica* (= *Boreoelona sibirica*) examined.

Sampling locality, date of collection, collector's name	n	Museum location
"Kungur, Siberia" [syntypes]	2	SMNH No. 6150
Kamchatka Peninsula, Mednoye Lake near Kljuchevskoye settlement. 16.06.1909. F. P. Rjabushinsky's expedition.	23	ZIN
Krasnoyarsk Region, Seinga Lake near Nizhnyaya Tunguska River. 30.06.1873. A. L. Czekanowski.	32	ZIN
Magadan Region. Chukcha Lake near Magadan City. 28.08.1973. I. A. Chereshnev.	43	ZIN
Novosibirsk Region. Icha River near Pokrovka village. 13.08.2005. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	1	MSAM
Sverdlovsk Region, Krasnoufimsk Town, an oxbow above Sobolij Kamen' Mt. 12.08.1887. S. I. Korzhinsky.	2	ZIN
Sverdlovsk Region. Krasnoufimsk Town, an unnamed water reservoir behind the Ufa River. 12.08.1887. S. I. Korzhinsky.	6	ZIN
Chelyabinsk Region. Sungul' Lake. 01.08.1929. N. N. Lipina.	1	ZIN
Tomsk Region, a channel of the Tom' River near Kolarovo settlement. 08.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	5	MSAM
Tomsk Region, Zyryanovskaya oxbow near Tegul'det settlement. 12.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	2	MSAM
Tomsk Region, a floodplain of the Chulym River near Tegul'det settlement. 11.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	5	MSAM
Tomsk Region, a bay of the Chulym River near Teguldet settlement. 11.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	4	MSAM
Tomsk Region, Yaya River. 10.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	2	MSAM
Tomsk Region, a lake near Novoshumilovo village. 13.08.2006. N. I. Andreyev, M. V. Vinarski & A. V. Karimov.	39	MSAM
Tyumen Region, Vylposl Channel in vicinity of Labytnangi Town. 19.07.2007. M. V. Vinarski, A. V. Karimov, E. V. Golovanova & A. V. Sverlova.	23	MSAM

literature of the first half of the XX century this variety name was not used, and numerous authors (Vnukovsky 1929; Lindholm 1932; Zhadin 1933, 1935; Johansen 1934; Mozley 1936) referred snails under discussion to *B. leachii* (Sheppard, 1823) or to *B. leachi* var. *inflata* (Hansen).

In 1967, Starobogatov & Streletzkaja (1967) published a revision of the species *B. leachii* s. lato. They found that it comprises as many as 4 distinct species that may be distinguished on the base of conchological features: *B. leachi* s. str., *B. inflata, B. troschelii* (Paasch, 1842) and *B. sibirica* (Westerlund, 1886). Thus, these authors for the first time raised the taxonomic rank of *B. troschelii* var. *sibirica* up to the species level. Besides, Starobogatov & Streletzkaja (1967) placed this taxon in the new subgenus *Bithynia* (*Boreoelona* Starobogatov et Streletzkaja, 1967), which is characterised by thin spiral lines on the shell surface and an angle in the upper part of the aperture. The authors believe that the range of *B. sibirica* covers Eastern Siberia and the Russian Far East eastward to Kamchatka Peninsula. This opinion is repeated in the most recent Russian faunistic literature (Bogatov & Zatravkin 1990; Dolgin 2001; Starobogatov et al. 2004; Kantor & Sysoev 2005). The only known record of *B. sibirica* from Western Siberia (Starobogatov & Zatravkin 1987) has not been confirmed by indication of the sampling location and, perhaps, is based on a mistake.

Later, Izzatullaev (1982) proposed to consider *Boreoelona* as a separate genus in the family Bithyniidae since it is not closely related to European bithyniid genera and demonstrates an affinity with the East Asiatic genus *Parafossarulus*. Izzatullaev (1982) notes that representatives of *Boreoelona* are dioecious and display a sexual dimorphism in their conchological features. This opinion has been shared by Starobogatov & Zatravkin (1987) and Beriozkina et al. (1995). In the recent Russian literature, the species under discussion is placed in the subfamily Mysorellinae Annandale, 1920 (Starobogatov et al. 2004; Kantor & Sysoev 2005). The main diagnostic trait of Mysorellinae is the sexual dimorphism in the shell structure, which is thought to be absent in species of Bithyniinae (Beriozkina et al. 1995). However, Glöer & Yildirim (2006) have reported "a poorly developed" sexual dimorphism in the species *Bithynia pesicii* Glöer et Yıldırım, 2006, and a clear sexual dimorphism can be found in some species of the genus *Bithynia* (e.g. *B. kastorias* Glöer, Wilke & Albrecht, 2007) as well as in the genus *Pseudobithynia* (e.g. *P. panetolis* Glöer, Wilke & Albrecht, 2007).

The anatomical structure of the genitals in *B. sibirica* is still unknown though internal traits serve as a good diagnostic feature in delimitation species and genera in the family Bithyniidae (Beriozkina et al. 1995; Glöer & Pešić 2006).

Fig. 1. Shells of syntypes of *Bithynia troschelii* var. *sibirica* Westerlund. Scale bar 1 mm.

Results and discussion

The comparison between specimens from our samples from Western Siberia determined as *B. sibirica* (Fig. 2) with the syntypes of *B. troschelii* var. *sibirica* (see fig. 1) has shown a near resemblance of their conchological traits. Snails from the Western Siberian waterbodies correspond to the original description of *B. troschelii* var. *sibirica* (Fig. 3) as well. Having dissected several decades of specimens, we are able now to present the redescription of *Bithynia sibirica* that is based on examination of 179 specimens from Siberia and Russian Far East (see Table 1). Because both species, *Bithynia troschelii* and *Bithynia sibirica*, occur in Siberia sympatrically, there is no reason to believe that *B. sibirica* is a subspecies (or variety) of *B. troschelii*.

Redescription of *Bithynia sibirica*

- *inflata* Westerlund 1876: 63 (*Bithynia*) non Hansen, 1845 nec Villa et Villa, 1841.
- *troschelii* var. *sibirica* Westerlund 1886: 18 (*Bithynia*).
- *leachi* var. *inflata* Zhadin 1933: 156 (*Bithynia*), partim.
- *sibirica* Starobogatov & Streletzkaja 1967: 227, fig. 8 (*Bithynia*).
- *sibirica* Bogatov & Zatravkin 1990: 54, fig. 14, d (*Boreoelona*).
- *sibirica* Starobogatov et al. 2004: 290, pl. 112, figs. 3–4 (*Boreoelona*).

Shell of yellow-brownish colour, medium-sized (shell height up to 10.5 mm), turriculate, its apex is usually strongly corroded. Up to 5.0 convex (almost stepped) whorls with a deep suture; umbilicus opened. Shell width is variable and comprises 0.67–0.77 of shell height. Spire high, its height reaches up to 0.87 of the shell height. The body whorl is massive but not very wide; it takes 0.68–0.78 of the shell height. The body whorl surface sometimes bears weak vestiges of spiral lines. Aperture ovate with an obtuse angle in its upper part. Aperture height takes 0.43–0.51 of shell height; aperture width reaches to 0.76–0.89 of its height.

The operculum is oval (Fig. 2, E) with numerous closely located concentric lines and crest-like prominent riblets. The nucleus is absent.

The penis is rather long, prolonged, with a sharp distal end (see Fig. 2, D). The penial appendix is somewhat short, as compared with the full length of the penis. Flagellum is of medium size.

Differential diagnosis. By its shell shape and convex whorls, *Boreoelona sibirica* is closer to the species of the *Bithynia leachii–troschelii* group[1] than to *B. tentaculata* (L.) and related species with flattened whorls. It can be distinguished from *B. leachii* (Sheppard, 1823) by larger size and greater whorls number (up to 5.0 in *B. sibirica* vs. 4.0–4.5 in *B. leachii*). Conchological and anatomical differences between *B. sibirica* and *B. troschelii* are summarised below (see also Table 3).

The shell of *B. sibirica* is turriculate; if upper whorls are corroded, its shape becomes close to conical. It is wider and more massive as compared with *B. troschelii* shell; comprises 4.5–5.0 whorls. The shell of *B. troschelii* is of highly-turriculate shape, has up to 5.5 whorls (see GLÖER 2002b). The shells surface in *B. sibirica* bears low densely situated longitudinal riblets, which are very fragile and can easily be erased when one tries to clean the surface of shell. Shell surface of *B. troschelii* is free of riblets of this kind.

[1] In the Russian literature, this group is split into in several species separated in the three genera, *Codiella* Monterosato in Locard, 1894, *Opisthorchophorus* Beriozkina, Levina et Starobogatov, 1995, and *Paraelona* Beriozkina et Starobogatov in Anistratenko et Stadnichenko, 1995 (see BERIOZKINA et al 1995).

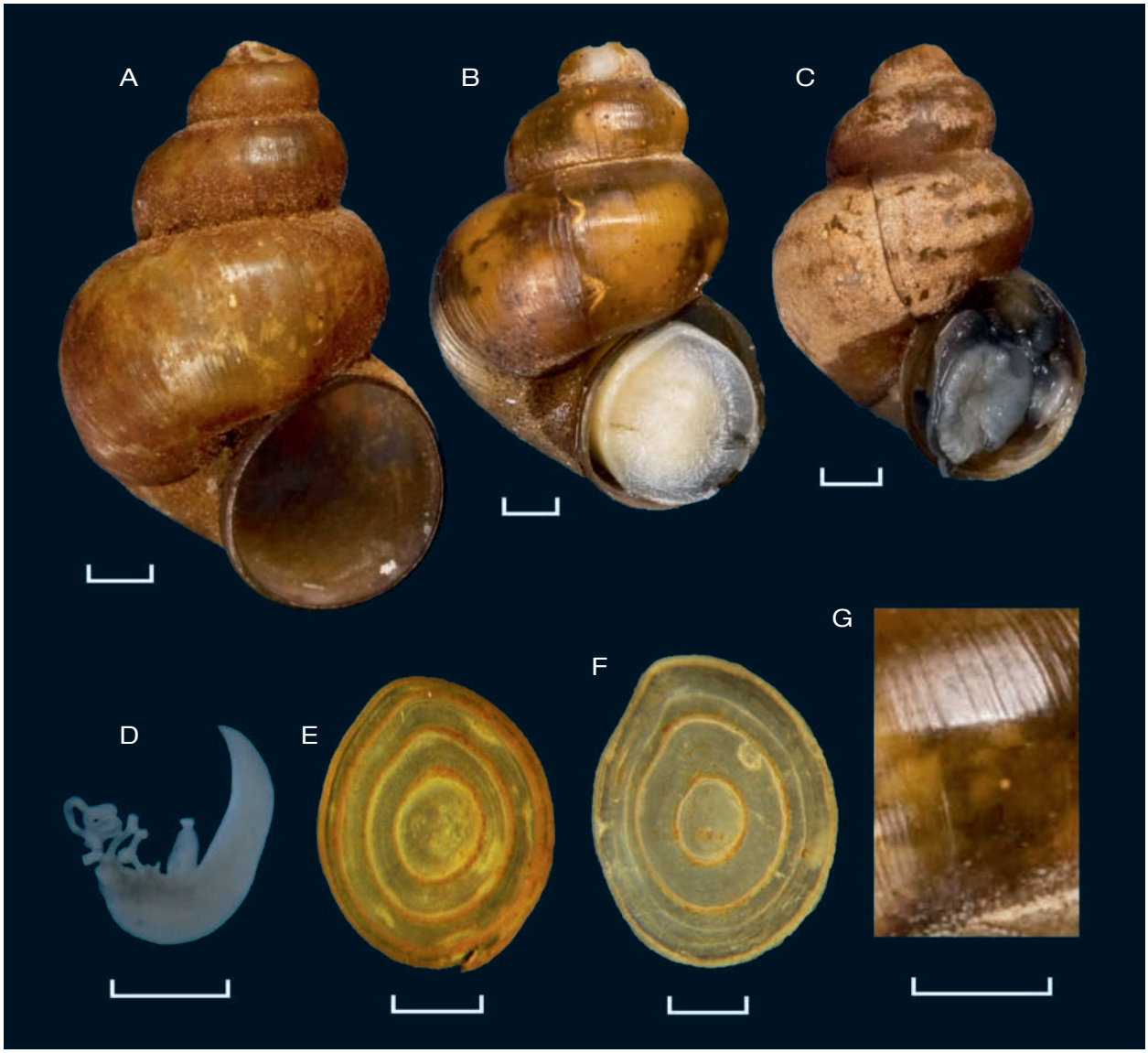

Fig. 2. *Boreoelona sibirica* from Western Siberia: **1**. Tomsk Region, a lake near Novoshumilovo (A, D, E, G); **2**. Tyumen Region, Vylposl channel (B, C, F). **A–C**: Shells (A, C – male; B – female). **D**: Penis. **E–F**: Operculums. **G**: Shell surface. Scale bars: 1 mm.

* **B. troscheli** *Paasch.* Geh. gross, fast durchbohrt, eifg.-gethürmt; Gew. 1 $^1/_2$—2 mal so hoch wie die Münd.; Umg. 5—6, stark gewölbt, treppenartig abgesetzt, der letzte aufgetrieben, etwa $^1/_3$ der Gesammthöhe; Naht tief; Münd. u. Deckel länglich-rund, oben leicht stumpfeckig. G. 9—13 : 5—7 mm. *(Norddeutschland, Siebenbürgen, Russland.)* Wiegm. Arch. 1842 t. 6 f. a—d, Kstr. Mon. t. 8 f. 9—11. — **Syn.** *B. similis* Stein 1850, *Pal. transsilvanica* Bz. olim.

Var. **sibirica** *West.*: durchbohrt, eifg.-konisch, etwas gethürmt, hornfarben, Umg. 5, aufgeblasen-stielrund, von einer s. tiefen rinnenartigen Naht getrennt, der letzte mitunter eine ziemliche Strecke ganz getrennt, stark in die Quere verbreitert. Münd. schief oval, oben kaum merkbar winklig, Munds. zus.-hängend (mitunter gelöst), gerade, scharf, Deckel mit schiefartig gelösten Anwachsringen: G. 10—12 : 7—7 $^1/_2$. M. 4—5 : 3 $^1/_2$—4 mm. (Sibirien.) *B. inflata* W. in Sibir. Moll. 1877 p. 63.

Fig. 3. The original description of *Bithynia troschelii* var. *sibirica* (Westerlund 1886: 18).

Fig. 4. Penis of *Bithynia troschelii* (Paasch) from a wetland in the floodplain of the Irtysh River (Omsk, Russia). Scale bar: 1 mm.

Tab. 2. The morphometric characteristics of shells of *B. sibirica* males and females from the Vylposl Channel (Tyumen Region). Significant values of t are marked by bold.

Trait	Males (n = 10)	Females (n = 13)	Results of the Student's t-test
Shell height (SH)	6.5–9.2 7.9±0.7	7.3–10.1 8.5±0.5	1.67 (p = 0.11)
Shell width (SW)	5.0–6.5 5.8±0.3	5.2–7.5 6.2±0.4	1.77 (p = 0.09)
Spire height (SpH)	3.3–5.2 4.3±0.5	3.8–6.5 4.7±0.4	1.49 (p = 0.15)
Body whorl height (BWH)	5.0–6.5 5.9±0.3	5.4–7.5 6.3±0.4	2.13 (p = 0.05)
Body whorl height above aperture (BWHa)	1.8–2.5 2.2±0.2	1.9–3.0 2.4±0.2	**2.25 (p = 0.04)***
Aperture height (AH)	3.4–4.5 3.9±0.2	3.2–4.0 3.7±0.2	2.12 (p = 0.05)
Aperture width (AW)	2.7–3.8 3.2±0.2	2.5–3.4 3.1±0.2	1.00 (p = 0.33)
SW/SH	0.68–0.77 0.73±0.02	0.67–0.77 0.73±0.02	-0.20 (p = 0.84)
SpH/SH	0.66–0.83 0.74±0.04	0.68–0.87 0.74±0.03	0.39 (p = 0.70)
BWH/SH	0.68–0.78 0.74±0.02	0.71–0.77 0.75±0.01	0.57 (p = 0.57)
AH/SH	0.43–0.51 0.47 ± 0.02	0.44–0.48 0.46±0.01	-0.74 (p = 0.46)
AW/AH	0.78 – 0.89 0.84±0.02	0.76–0.85 0.81±0.02	-1.91 (p = 0.07)
BWHa /AH	0.25–0.29 0.27±0.01	0.26–0.30 0.28±0.01	2.01 (p = 0.06)
BWHa/BWH	0.36–0.38 0.37±0.01	0.35–0.42 0.38±0.01	-1.96 (p = 0.06)

Tab. 3. Values of standard conchological indices in *B. sibirica* and *B. troschelii*. *Males and females are taken together. **Above the lines – limits of indices variation; below lines – mean values of indices ± standard deviations.

Locality	n*	Index**				
		SW/SH	SpH/SH	BWH/SH	AH/SH	AW/AH
B. sibirica						
Vylposl channel	23	0,67–0,77 0,73±0,01	0,66–0,87 0,74±0,02	0,68–0,78 0,74±0,01	0,43–0,51 0,47±0,01	0,76–0,89 0,82±0,01
B. troschelii						
Krivoye Lake, Omsk Region, Russia	12	0,50–0,55 0,53±0,01	0,57–0,64 0,61±0,01	0,67–0,73 0,70±0,01	0,39–0,44 0,42±0,01	0,74–0,92 0,80±0,03
Tenis Lake, Kustanay Region, Kazakhstan	10	0,57–0,65 0,61±0,01	0,55–0,66 0,59±0,02	0,67–0,76 0,72±0,01	0,41–0,48 0,45±0,01	0,74–0,89 0,83±0,02
Floodplain of the Irtysh River near Kachesovo village, Omsk Region	10	0,54–0,66 0,61±0,02	0,57–0,66 0,60±0,02	0,68–0,74 0,71±0,01	0,41–0,49 0,45±0,01	0,70–0,87 0,79±0,03

Body whorl in *B. sibirica* is larger than in *B. troschelii*, therefore it seems that body whorl includes 2/3 of the shell in *B. sibirica*. In *B. troschelii*, the body whorl forms less than 2/3 of the shell. The aperture in *B. sibirica* is wider and larger than in *B. troschelii*. The operculum of *B. sibirica* bears fine conchioline riblets, which are very fragile. Therefore, these riblets are clearly visible in juvenile specimens only.

Anatomically, *Bithynia sibirica* can be distinguished from all another Euro-Siberian species of the family Bithyniidae by a long penis with a pointed distal end in conjunction with a relatively short penial appendix. The differences in the penis structure between *B. sibirica* and *B. troschelii* are somewhat slight (compare Fig. 2, D and Fig. 4). Penis of *B. troschelii* is always longer and narrower than that of *B. sibirica*;

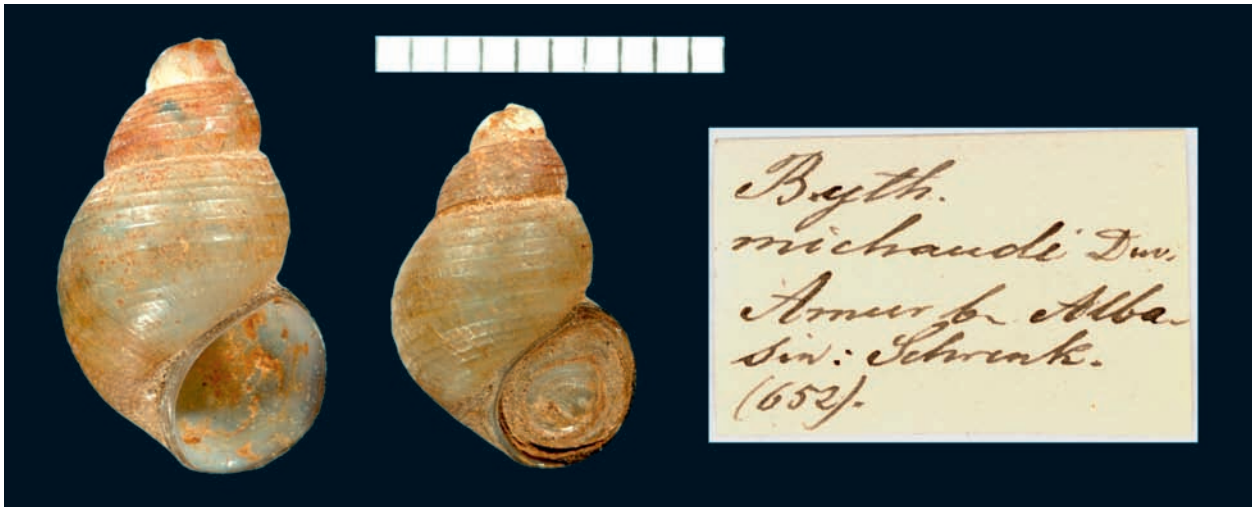

Fig. 5. Shells of "*Bithynia michaudi* Duv." (most probably *Parafossarulus manchouricus*, subfamily Mysorellinae) from the Amur River drainage (collection of the Göteborgs Naturhistoriska Museum, Sweden). Distinct spiral striae characteristic for the genus *Parafossarulus* are evident on the shell surface. Scale bar: 1 mm.

it is ribbon-like and pointed at its edge. Penial appendix in *B. troschelii* is long and narrow; it is situated relatively far from the base of penis. Penis of *B. sibirica* is widened in its distal part. The penial appendix is somewhat shorter and wider than in *B. troschelii*; it is situated near the base of penis.

Thus, we agree with STAROBOGATOV'S & STRELETZKAJA'S (1967) opinion that the variety *Bithynia troschelii* var. *sibirica* is a good species, however, there are some questions concerning its true generic position. Firstly, the statistical analysis performed by us failed to reveal any clear sexual dimorphism in the shell structure of *B. sibirica* (Table 2). The only significant distinction between males and females is a difference in the body whorl height above the aperture. Slight differences in the sizes of females and males (female shells are somewhat larger) are not statistically significant. From our point of view, there are no serious reasons to recognise sexual dimorphism in shells of the species under discussion. It should be repeated here, the existence of the shell dimorphism is thought to be an important diagnostic feature of the genus *Boreoelona* as well as of the subfamily Mysorellinae (BERIOZKINA et al. 1995).

Secondly, we were not able to find any distinct spiral lines on the shell surface of *B. sibirica* studied by us (see Fig. 2, F) though this trait is included in the diagnosis of the genus *Boreoelona*. In some shells, only weak vestiges of such lines can be observed. Similarly, the shell surface of the *B. troschelii* var. *sibirica* syntypes is devoid of spiral lines. By contrast with *B. sibirica*, Far East representatives of Bythiniidae (Mysorellinae) such as *Parafossarulus manchouricus* (Gerstfeldt in Bourguignat, 1860) studied by us exhibit well developed spiral striae on the body whorl surface (Fig. 5).

Thirdly, the shell habitus and the penial structure of *B. sibirica* is much more similar to some European species of bythiniid snails (*B. troschelii*) than to East Asian ones.

Hence, it might be possible that *B. sibirica* should not be classified within the genus *Boreoelona* since it is allied to the Palaearctic group of bithyniid species including *B. troschelii*, *B. leachii* and related taxa. Due to the scarcity of materials on another species of *Boreoelona* we are at the moment not able to verify this hypothesis.

Geographic distribution and bionomics of *Boreoelona sibirica*

There are no specimens of *B. sibirica* from its type locality (Yenissei, Vorogovo village) neither in Sweden nor in Russian malacological collections. The locality of syntypes sampling is Kungur, a town situated in Perm' Region of Russia at the western (European) side of the Ural Mountains (57° 26' N; 56° 56' E). No information on the syntypes' habitat is given on the label. It is known, however, that between 1896 and 1898 some parts of malacological collections of the former Imperial Zoological Museum (now – ZIN) were sent to Westerlund for the purpose of taxonomic identification (ANONYMOUS 1897, 1898; see also GLÖER & VINARSKI 2009). According to the ZIN archive documents [1], the fourth parcel sent to Westerlund contained molluscs collected by Czekanowski from "Fl. Babka,

[1] This information has been provided by Maxim Grebennikov (Yekaterinburg, Institute of Plant and Animal Ecology, Uralian branch of the Russian Academy of Sciences).

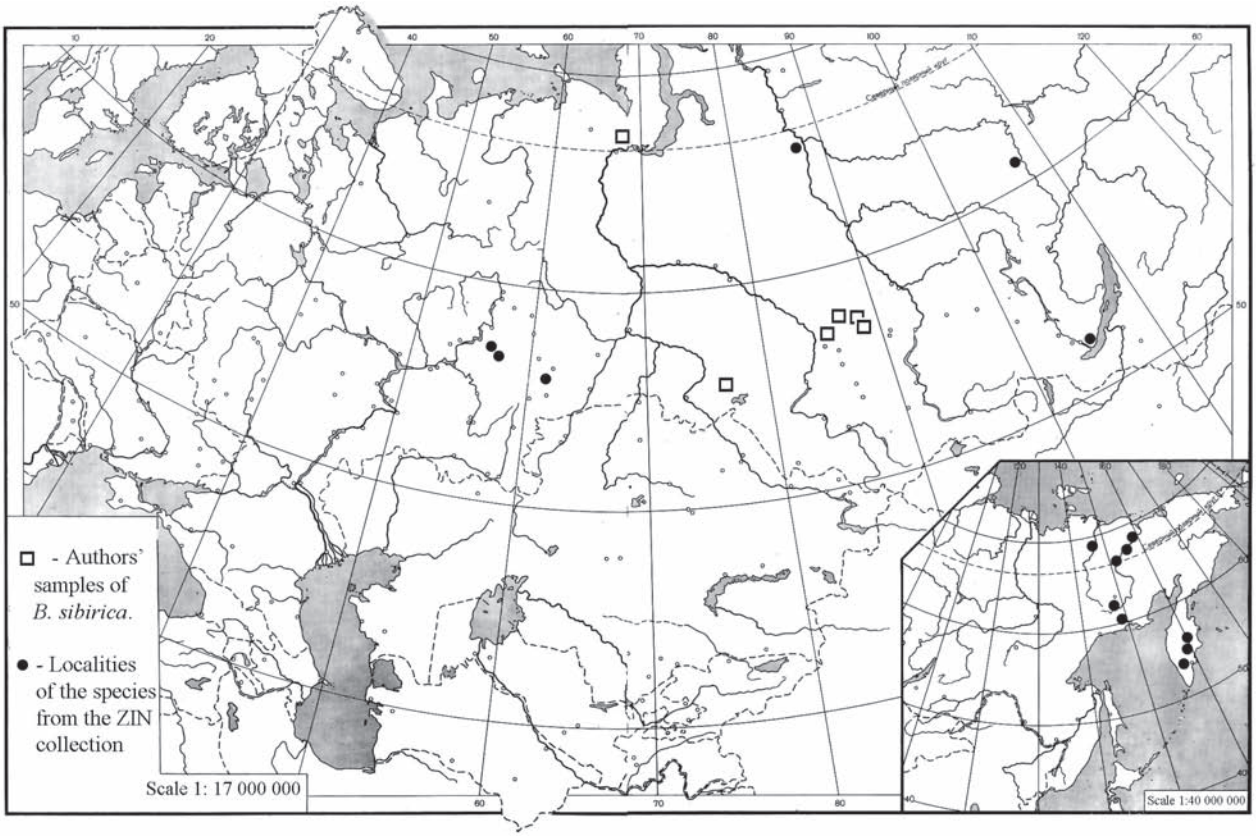

Fig. 6. Range of *Boreoelona sibirica* (based on the samples of the species from the ZIN and MSAM collections).

Fig. 7. A typical habitat of *Boreoelona sibirica*. A bay of the Vylposl channel near Labytnangi Town (Tyumen Region). 19.07.2007.

Nebenfluss der Sylva bei Kungur" ("Babka River, a tributary of the Sylva [river] near Kungur"). Possibly, syntypes of *B. troschelii* var. *sibirica* were taken from this sample.

Judging from the Russian faunistic literature (Starobogatov & Streletzkaja 1967; Bogatov & Zatravkin 1990; Dolgin 2001; Prozorova & Shed'ko 2003; Prozorova & Zasypkina 2005) and materials from the ZIN (determined by Ya. I. Starobogatov, T. Ya. Sitnikova) and MSAM collections, the species is widely distributed throughout Siberia and in the north part of the Far East eastwards to Kamchatka Peninsula (Fig. 6). Several empty shells of *B. sibirica* from the Baikal Lake are kept in the ZIN collection (determined by T. Ya. Sitnikova). It is absent in the Primorye Region (Bogatov & Zatravkin 1990).

In Western Siberia, the species is rather widely distributed though it does not occur in the southern part of the region (south of 54° N). We observed *B. sibirica* in a number of waterbodies situated in the Lower and Middle Ob' and Irtysh River basins (see Fig. 6). Empty shells of this snail have been discovered from the malacological collection of Prof. S. I. Korzhinsky established by him in 1887 in some waterbodies of the Middle Urals (currently Perm' and Sverdlovsk regions of Russia). These localities do not belong to the Irtysh River drainage basin and are situated at the western side of the Ural Mountains not so far from Kungur Town, which is the type locality of *B. troschelii* var. *sibirica*.

From our field observations, *B. sibirica* prefers to inhabit permanent waterbodies with rich vegetation. The snails are living in shallow coastal zones or in bays of large lakes (Fig. 7) in the bottom mud sediments. It often occurs in floodplain waterbodies, oxbows and river channels (see Table 1). Dolgin (2001) notices that the abundance of *Boreoelona sibirica* in the Eastern Siberian waterbodies is commonly very high and reaches sometimes 120 specimens on a square metre.

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