Galba robusta sp. nov. from Yemen (Gastropoda: Lymnaeidae)

Galba robusta sp. nov. из Йемена (Gastropoda: Lymnaeidae)

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Mollusks of the genus *Galba* Schrank, 1803, inhabiting north-east Africa and the Arabian Peninsula, are separated into two morphologically distinct groups. The first group contains two conchologically indistinguishable species, *G. truncatula* (O.F. Müller, 1774) and *G. schirazensis* (Küster, 1862). The second group includes one species characterized by significantly larger size and different shell proportions as compared to *G. truncatula* and *G. schirazensis*. This species is new one and described here as *G. robusta* **sp. nov.** with type locality situated in Yemen. It is hypothesized that *G. robusta* **sp. nov.** has a vast distribution, ranging from Central Iran southwards to East Africa. A comparison of the new taxon with two nominal species of Galba, *G. mweruensis* (Connolly, 1929) and *G. umlaasianus* (Küster, 1862) described from East and South Africa, as well as some data on conchological variation of African representatives of this genus are given.

Моллюски рода *Galba* Schrank, 1803, населяющие северо-восток Африки и Аравийский полуостров, подразделяются на две морфологически различные группы. Первую из них образуют два вида, *G. truncatula* (O.F. Müller, 1774) и *G. schirazensis* (Küster, 1862), не различимые по признакам раковины. Вторая группа включает один вид, отличающийся значительно более крупными размерами и несколько отличными пропорциями раковины. Этот вид является новым для науки и описывается здесь как *G. robusta* **sp. nov.** с типовым местонахождением, расположенным в Йемене. Предполагается, что *G. robusta* **sp. nov.** может иметь очень широкий ареал, простирающийся от центрального Ирана до Восточной Африки на юге. Приведены сравнение морфологии раковины нового вида и двух номинальных видов рода *Galba* – *G. mweruensis* (Connolly, 1929) и *G. umlaasiana* (Küster, 1862) из Восточной и Южной Африки, а также данные о конхологической изменчивости африканских представителей этого рода.

Key words: freshwater pulmonate snails, taxonomy, Yemen, Lymnaeidae, *Galba*, new species

Ключевые слова: пресноводные легочные моллюски, систематика, Йемен, Lymnaeidae, *Galba*, новый вид

INTRODUCTION

During my work with collection of unidentified freshwater pulmonate mollusks of Asia kept in the Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg (ZIN hereafter), I have came across a small sample containing six specimens from Yemen belonging to a presumably not yet described species of the family Lymnaeidae. Its description as well as some taxonomic and nomenclatural considerations are given below. In addition to samples of ZIN collection, I used materials on African and Eurasian lymnaeids kept in the collections of the Natural History Museum (formerly British Museum), London, UK (BMNH) and the Laboratory of Macroecology and Biogeography of Invertebrates, Saint-Petersburg State University, Russia (LMBI).

Abbreviations for shell characters: WN – whorls number; SH – shell height; SW – shell width; SpH – spire height; BWH – body whorl height; AH – aperture height; AW – aperture width.

TAXONOMY

Class **GASTROPODA**

Subclass **HETEROBRANCHIA**

Order **HYGROPHILA**

Family **LYMNAEIDAE**

Genus ***Galba*** Schrank, 1803

***Galba* (*Galba*) *robusta* sp. nov.**
(Fig. 1A–C; Fig. 2A)

Holotype. Adult specimen, **Yemen**, without designation of settlement, from an ablution pool, 1971–1973, leg. N.V. Bel'gesov (ZIN 1/529–2018).

Paratypes. Five adult specimens, same data as for holotype (ZIN 2/529–2018).

Description. Shell medium-sized (SH up to 12.5 mm; Table 1), ovate-conical, yellowish or light brownish, with 4.75–5.50 whorls (Table 2). Spire widely conical, relatively short; its height does not exceed a half of SH. Whorls moderately convex; tangent line almost straight. Body whorl relatively high (BWH/SH ratio > 0.70) and moderately inflated. Shell width constitutes more than a half of SH. Aperture ovoid; columellar lip wide and thick; columellar fold weakly developed. Sculpture represented by growth lines of different width. Reproductive system typical of *Galba*. Praeputium and penis sheath of regularly cylindric shape, differently colored. Penis sheath rather narrow; its distal end weakly swollen (see Fig. 2A). Penis sheath is 2.5–3.5 shorter than praeputium.

Comparison. According to recent data (Bargues et al., 2011; Lotfy & Lotfy, 2015), there are two species of *Galba* inhabiting the Arabian Peninsula and adjacent areas: *G. truncatula* (O.F. Müller, 1774) and *G. schirazensis* (Küster, 1862). The latter has been characterized as a "cryptic" species not distinguishable from *G. truncatula* (compare Fig. 1D–E and Fig. 3D). *Galba robusta* **sp. nov**. differs from both these species by larger absolute shell size (SH of *G. schirazensis* and *G. truncatula* usually does not exceed 10 mm; see Table 2). Bargues et al. (2011) provided data on size of more than 250 specimens of *G. schirazensis* and *G. truncatula* from Africa, Mediterranean region, Middle East, and South America: maximum shell heigth in *G. schirazensis* was 8.06 mm (9.33 in *G. truncatula*). Whorls of *G. robusta*

Table 1. Shell measurements of holotype and two largest paratypes of *Galba robusta* **sp. nov.**

Measurement / index	Holotype	Paratype 1	Paratype 2
WN	5.0	5.25	5.50
SH, mm	12.2	11.7	11.4
SW, mm	7.0	6.5	6.2
SpH, mm	5.7	5.8	5.7
BWH, mm	9.0	8.7	8.1
AH, mm	6.7	6.2	5.9
AW, mm	5.1	4.6	3.8
SW/SH	0.57	0.56	0.54
SpH/SH	0.47	0.50	0.50
BWH/SH	0.74	0.74	0.71
AH/SH	0.55	0.53	0.52
AW/AH	0.76	0.74	0.64

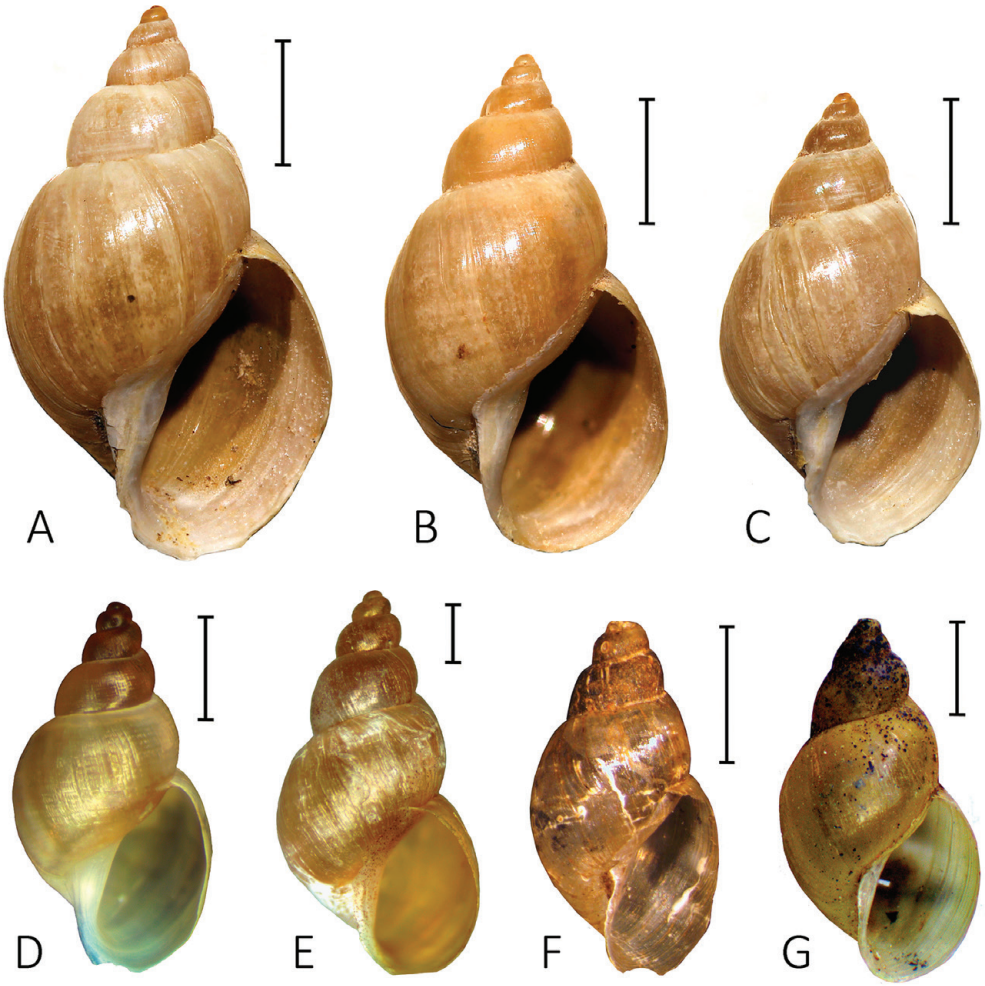

Fig. 1. *Galba*, shell: A–C, *G. robusta* **sp. nov.** (A, holotype; B, C, paratypes); D, *G. truncatula*, Germany, ditch in vicinities of Thangelstedt Town (topotype); E, *G. truncatula*, Azerbaijan, vicinities of Afurdja (LMBI); F, *G. mweruensis*, Mweru, north of Kenya Mt., Kenya, holotype (BMNH); G, *G. umlaasiana*, Ethiopia, Sebetta River, 25 km N from Addis-Ababa (ZIN). Scale bars 2 mm. D and E, photos by D. Palatov.

sp. nov. are moderately or weakly convex, while shells of *G. schirazensis* and *G. truncatula* are characterized by strongly convex and sometimes even shouldered whorls (see Fig. 1D and E). Columellar lip in *G. robusta* **sp. nov**. is well developed and thick, whereas in two other species it is rather thin and narrow. Spire in *G. robusta* **sp. nov**. is relatively lower than in the two other species (see Table 2). To outline it briefly, the significantly larger shell size in association with wide chalky-white columellar lip and moderately or weakly convex whorls constitute a set of diagnostic traits allowing one to distinguish between *G. robusta* **sp. nov**. and *G. truncatula* / *G. schirazensis* species group. Reproductive morphologies of *G. robusta* **sp. nov**. and *G. truncatula* / *G. schirazensis* are similar, though penis sheath in *G. robusta* **sp. nov**. is relatively narrower and less swollen at its distal end than it is observed in *G. truncatula* / *G. schirazensis*. However, all

Table 2. Conchological characteristics of different species of *Galba*: above lines, minimum and maximum values; below lines, mean value ± standard deviation (σ).

Measurement / index	*Galba robusta* **sp. nov.** (n=6)	*G. mweruensis*[1] (n=12)	*G. umlaasiana*[1] (n=28)	*G. truncatula*, topotypes[2] (n=20)
WN	4.75–5.50 5.17±0.27	4.00–5.00 4.71±0.28	4.25–5.00 4.64±0.21	4.50–5.25 4.86±0.26
SH, mm	9.3–12.2 11.0±1.0	5.9–8.8 7.2±0.9	6.2–9.6 7.3±0.7	5.4–8.0 6.6±0.8
SW, mm	5.4–7.0 6.3±0.5	3.0–4.5 3.8±0.4	3.4–5.3 4.0±0.5	2.9–4.3 3.6±0.4
SpH, mm	3.9–5.8 5.2±0.7	2.9–4.4 3.6±0.4	2.9–5.1 3.6±0.5	2.6–4.4 3.4±0.6
BWH, mm	7.2–9.0 8.2±0.6	4.5–6.4 5.4±0.6	4.5–7.5 5.6±0.7	3.9–5.5 4.6±0.5
AH, mm	5.4–6.7 6.0±0.5	3.0–4.5 3.8±0.5	3.2–5.8 3.9±0.6	2.9–4.0 3.3±0.3
AW, mm	3.8–5.1 4.3±0.5	2.0–2.9 2.6±0.3	2.1–3.7 2.6±0.4	1.6–2.6 2.1±0.2
SW/SH	0.54–0.58 0.57±0.01	0.51–0.58 0.53±0.02	0.51–0.59 0.55±0.02	0.51–0.59 0.54±0.02
SpH/SH	0.42–0.50 0.47±0.03	0.46–0.54 0.50±0.02	0.46–0.58 0.49±0.03	0.46–0.55 0.52±0.03
BWH/SH	0.71–0.77 0.75±0.02	0.73–0.78 0.75±0.02	0.70–0.79 0.76±0.02	0.55–0.76 0.71±0.03
AH/SH	0.52–0.58 0.54±0.02	0.51–0.57 0.53±0.02	0.48–0.57 0.53±0.02	0.46–0.55 0.51±0.03
AW/AH	0.64–0.77 0.72±0.05	0.61–0.81 0.68±0.05	0.50–0.78 0.66±0.05	0.55–0.68 0.63±0.03

[1]Locality – Ethiopia, Sebetta River (ZIN); [2]Locality – vicinities of Thangelstedt, Thuringien, Germany (LMBI).

Fig. 2. *Galba*, copulatory apparatus: A, *G. robusta* **sp. nov.**; B, *G. truncatula*, Abkhazia, floodplain pool near Inkit Lake (LMBI); C, *G. truncatula*, Russia, Yamal Peninsula, floodplain of Shchuchya River (LMBI). Scale bars 2 mm. B and C, photos by D. Palatov.

these observations are of limited value due to small number (n = 3) of dissected *G. robusta* **sp. nov**.

Etymology. The species epithet is derived from the Latin word "robustus" – solid, robust.

Distribution. The species is known from the type locality only though its range may be much wider (see Discussion).

DISCUSSION

Traditionally, all *Galba*-like lymnaeids of Africa and Arabian Peninsula were identified with the Palearctic species *Galba truncatula* (Wright, 1963; Brown, 1965, 1980, 1994; Brown & Wright, 1980; van Damme, 1984; Neubert, 1998), whose type locality is situated in vicinities of Thangelstedt town, Germany. However, the comparison of conchological traits of *G. robusta* **sp. nov.** and *G. truncatula* has revealed some differences between them (see "*Comparison*" above) and, from the morphological point of view, the Yemen specimens are apparently distinct from both *G. truncatula* and its closest relative, *G. schirazensis*. The absence of profound differences in reproductive anatomy between these two species and *G. robusta* **sp. nov.** are, in my opinion, negligible, since *G. truncatula* and *G. schirazensis* also do not differ from each other by any substantial differences in the morphology of their copulatory apparatuses, except for a slight difference in the mean values of the praeputium: penis sheath lengths ratio (Bargues et al., 2011).

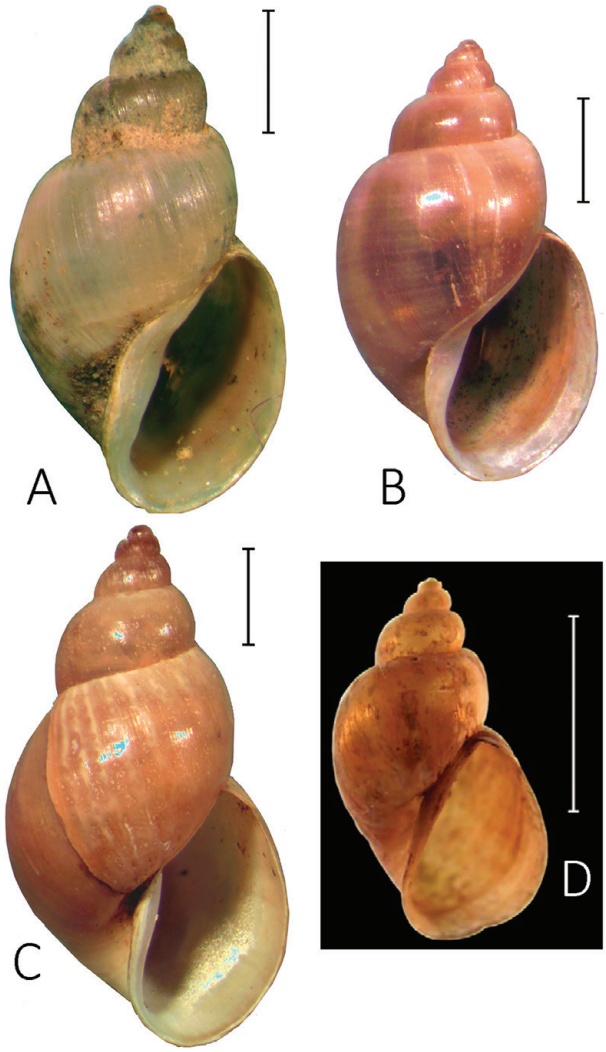

Fig. 3. *Galba*, shell: A, *G. truncatula* var. *major*, Iran, pond on mountain near Soh, N of Isfahan, 12.07.1926, leg. H.E.J. Biggs (BMNH, Acc. No. 2258); B, *G. truncatula*, Ethiopia, 10 km W of Ambo towards Guder, irrigation drain, 09.06.1969, leg. D.S. Brown (BMNH, Reg. No. 20041470); C, *G. truncatula*, Ethiopia, 12 km N of Debra Berhan (town centre) towards Dessie, stony stream, 28.03.1969, leg. D.S. Brown (BMNH, Reg. No. 20041471); D, *G. schirazensis*, Egypt (after Bargues et al., 2011, modified). Scale bars: 2 mm (A–C); 4 mm (D).

One may argue that the larger shell size of *G. robusta* **sp. nov.** is not a good taxonomic trait since different ecological factors to affect the shell size in *Galba* (and other pond snails) are known. So called "parasitic gigantism" is among these factors. This factor represents a stimulation of growth by parasites that results in the increase of the living space available to parasites (Dillon,

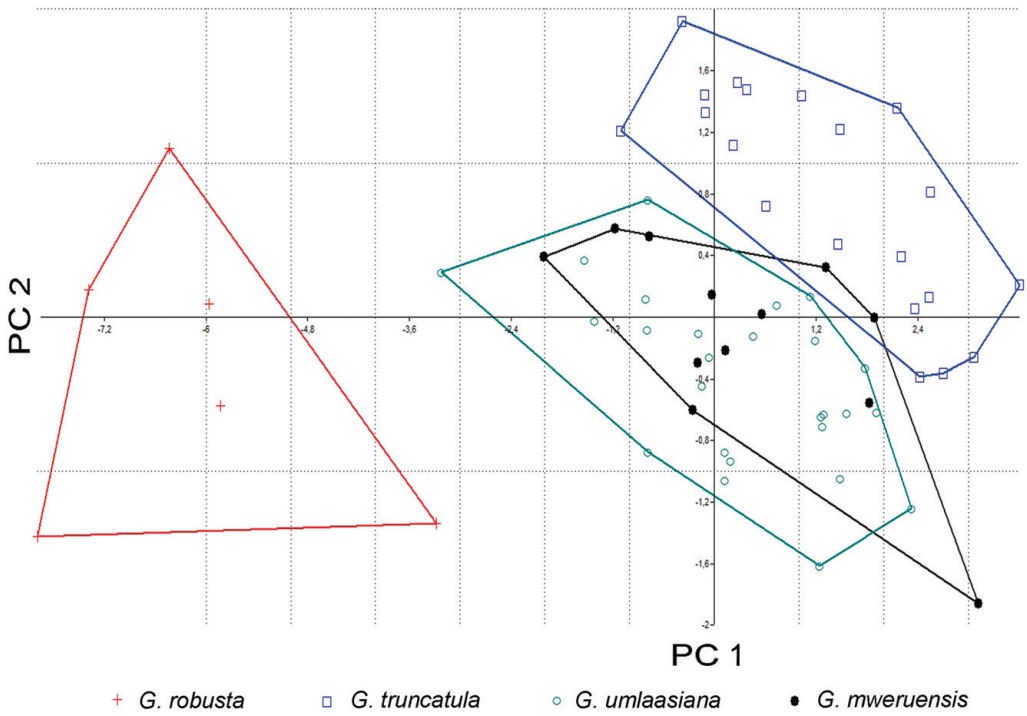

Fig. 4. Principal component analysis based on whorls number and six shell measurements listed in Table 2. Two first principal components (PC) explain 96.5 % of variance (PC1 – 86.4%, PC2 – 10.1%).

2000). Indeed, this phenomenon has been registered in different genera of lymnaeids, not excluding *Galba* (Żbikowska et al., 2006; Novobilský et al., 2013). However it seems unlikely that the type series of *G. robusta* **sp. nov.** (n=6) consists exclusively of parasitized snails. Besides, during dissection, no signs of heavy infestation of snails by trematode larvae (encysted larvae, diminution of genitals or their distorted shape) have been seen. At last, some authors have recently doubted the very reality of the phenomenon of 'parasitic gigantism' in application to *Galba* (Novobilský et al., 2013). Therefore, I think that the parasitic gigantism may be ruled out as a possible reason for increased shell size in the new species described here.

Two nominal species of *Galba* with type localities situated in Africa are known (Hubendick, 1951; Brown, 1994): *G. mweruensis* (Connolly, 1929) and *G. umlaasiana* (Küster, 1862). Therefore I need to discuss them to check the possibility that the Yemen specimens may belong to either of them. Though most authors regard both these species as synonyms of *G. truncatula* (Hubendick, 1951; Brown, 1994), Kruglov & Starobogatov (1985) accepted *G. mweruensis* and *G. umlaasiana* as two distinct species and placed them into the section *Afrogalba* Kruglov et Starobogatov, 1985 of the subgenus *Orientogalba* Kruglov et Starobogatov, 1985 of the genus *Lymnaea* (Lamarck, 1799).

I studied the holotype of *G. mweruensis* kept in BMNH (reg. number 1937. 12.30.9299). It is a minute shell (5.3 mm height), thin-walled, with rather narrow columellar lip (see Fig. 1F). Morphologically it is very similar, if not identical, to *G. truncatula*. The shell of *G. umlaasiana* as it is depicted in the original description (Küster, 1862, Taf. 6, figs. 4 and 5), super-

ficially resembles the shell of *G. robusta* **sp. nov**. However, the type locality of *G. umlaasiana*, the Umlaas River, lies in South Africa, i.e. very far from Yemen. Certainly, there is a small possibility that some species of *Galba* is widely distributed from the Arabian peninsula through East Africa southwards to the Umlaas River basin, and thus the specimens from Yemen may theoretically be conspecific with Küster's species. Unfortunately, the whereabouts of Küster's collection is unknown; most probably it was destroyed in the Second World War (Naggs, 1997). The true identity of the taxonomic name *Limnaeus umlaasianus* Küster, 1862 (= *G. umlaasiana*) thus remains unknown due to the lost of its type series. I failed to find specimens of it neither in BMNH nor in several other large Western European museums (including those of Vienna, Berlin, Paris, and Gothenburg), however ZIN collection contains a sample of *Galba*-like snails from Ethiopia identified by Ya.I. Starobogatov as "*Lymnaea umlaasiana*". Though I am not fully sure that these shells are identical to *G. umlaasiana* sensu Küster, I examined this sample and found that conchologically these specimens are similar to *G. mweruensis* (compare Figs. 1F and G) and hardly may belong to *G. robusta* **sp. nov.** The Ethiopian shells are of smaller size (Table 2) and their columellar lips are narrow and thin.

The principal component analysis of shell measurements given in Table 2 (Fig. 4) has shown that specimens of *G. robusta* **sp. nov.** form a cloud of points visibly separated from the cloud formed by three other species (*G. mweruensis*, *G. truncatula*, *G. umlaasiana*) that brings another evidence of the morphological distinctness of the species from Yemen. Therefore I think that there is no total evidence of conspecificity of *G. robusta* **sp. nov.** with *G. umlaasiana*. The identity of the two species is not impossible, but only future molecular study of specimens from Arabia, East and South Africa will allow to check this assumption.

Working with collection of BMNH, I found three more specimens resembling *G. robusta* **sp. nov**. conchologically, though their conspecificity remains unproved and thus hypothetical. Two of these specimens were collected in Ethiopia (see Fig. 3 B, C), and another one, in central Iran (see Fig. 3 A). Two shells from Aden (Yemen) illustrated by Wright (1963: pl. 1, figs. 18 and 19) may also belong to *G. robusta* **sp. nov**.

To conclude, I hypothesize that there is a previously undescribed species of *Galba* in the Near East and, possibly East Africa, distinct from *G. truncatula* and *G. schirazensis*. Its range may be rather large, with southward boundary lying somewhere in East Africa or even in the southern part of this continent (if Küster's *Limnaeus umlaasianus* is identical to *G. robusta* **sp. nov.**). Since the molecular taxonomic methods are the main tool to reveal the actual diversity of *Galba*, including cryptic taxa (Bargues et al., 2007, 2011), it is very desirable to undertake a genetic study of *Galba* from the Arabian Peninsula to check my hypothesis about species status of lymnaeids described above as *G. robusta* **sp. nov**.

ACKNOWLEDGEMENTS

I am indebted to Dr. Pavel V. Kijashko (ZIN), Lidiya L. Yarokhnovich (ZIN) and Jonathan Ablett (BMNH) for their invaluable help during work with collections. I thank Katrin Schniebs (Dresden), who sent me a sample of topotypes of *G. truncatula* from Germany, and Dmitry Palatov (Moscow), who made photos of shells and copulatory apparatuses of *G. truncatula*. My taxonomic work on Lymnaeidae has been supported by grants of the Russian Foundation for Basic Research (Project No. 14-04-01236), the Russian Ministry of Education and Science (Project No. 6.1352.2017/4.6), and the President of Russia Grant Council (Project No. MD-2394.2017.4).

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Received 4 March 2018 / Accepted 29 April 2018

Scientific editor: P.V. Kijashko