

Galba schirazensis in Bhutan (Gastropoda: Pulmonata: Lymnaeidae), a thought-provoking record

EDMUND GITTENBERGER

National Biodiversity Center Naturalis, P.O. Box 9517, NL-2300RA Leiden, The Netherlands; GiMaRIS, Rijksweg 75, 2171AK Sassenheim, The Netherlands; egittenberger@yahoo.com [corresponding author]

ADRIAAN GITTENBERGER

GiMaRIS, Rijksweg 75, NL-2171AK Sassenheim, The Netherlands

KEZANG TOBGAY

Royal Botanical Garden, National Biodiversity Centre, Serbithang, Ministry of Agriculture and Forests, Thimphu, Bhutan

CHOKI GYELTSHEN

National Biodiversity Centre, Serbithang, Ministry of Agriculture and Forests, Thimphu, Bhutan



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There is extensive literature on *Galba truncatula* (O.F. Müller, 1774) because this cosmopolitan lymnaeid freshwater snail species acts as an intermediate host for the trematode *Fasciola hepatica* Linnaeus, 1758 which causes fascioliasis, a serious disease in livestock species and humans. For a variety of reasons, the recent rediscovery of the conchologically sibling species *G. schirazensis* (Küster, 1862), with a nearly equally large distribution, asks for a critical reconsidering of the literature, as these publications on “*G. truncatula*” might partially be on *G. schirazensis* or a combination of both species, and that may reduce their relevance for studies on population genetics (Bargues et al., 2011).

Galba truncatula (Fig. 1) and *G. schirazensis* (Fig. 2) differ only slightly and maybe overlap (Alda et al., 2021) in their shell characters. The inner lip of the aperture is more clearly divided into a parietal and a columellar part in the former species. In *G. schirazensis*, the inner lip is straighter (Bargues et al., 2011; Glöer, 2019). According to some authors, there are diagnostic differences in the genital tract: in *G. schirazensis* the phallotheca is half as long as the praeputium, instead of only about a quarter of as long in *G. truncatula* (Kruglov, 2005; Bargues et al., 2011; Glöer, 2019), but this is contradicted by Alda et al. (2021), while referring to all *Galba* species as cryptic.

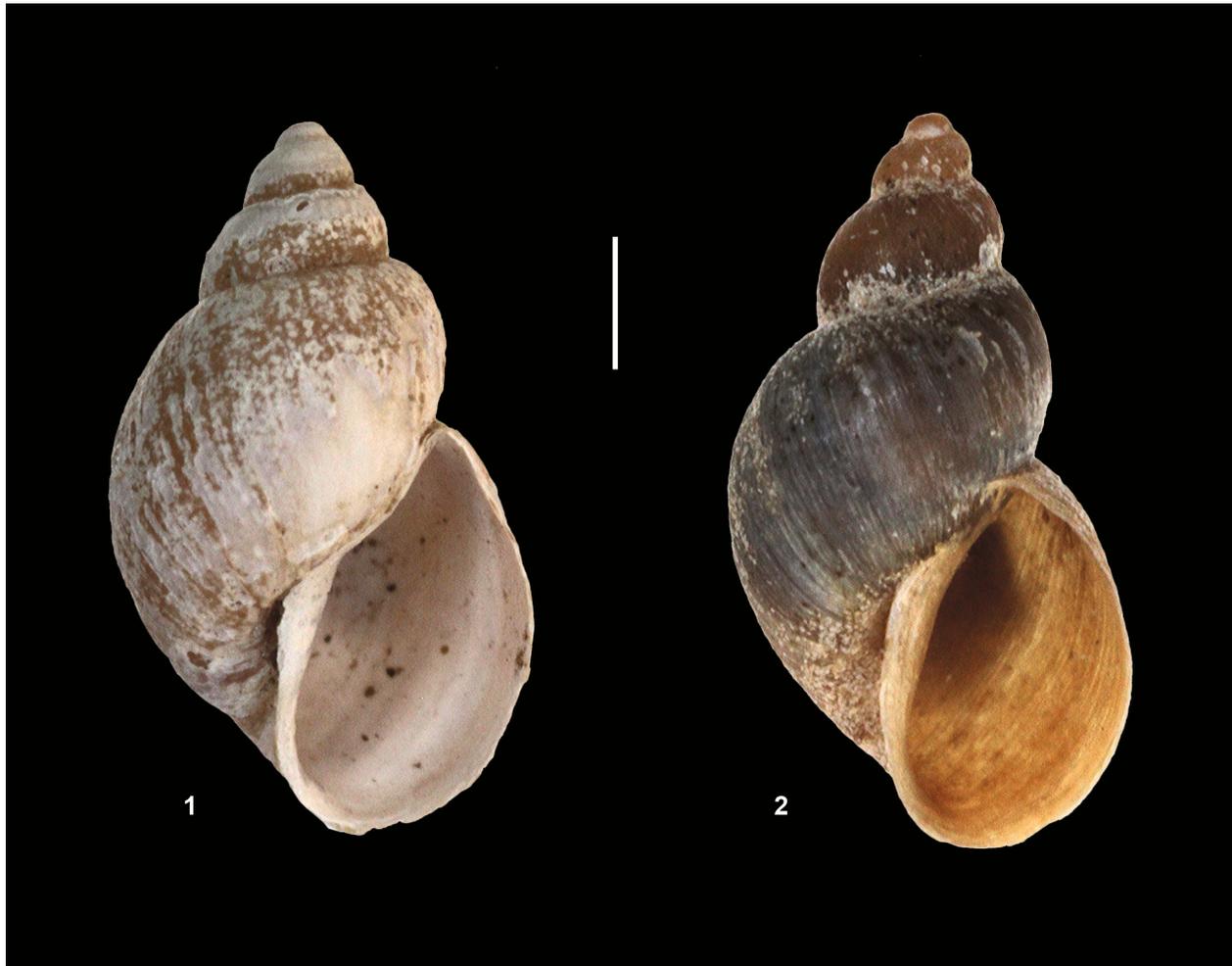
In the Russian literature (Kruglov, 2005), Iran, Afghanistan, Central Asia, and the Caucasus are mentioned as the range of “*Lymnaea* (*Galba*) *schirazensis*”, and the diagnostic part of the genital tract of an animal from Yovon town in Tajikistan (38°19'N 69°03'E) is illustrated to ensure the

identification. In the western literature (Bargues et al., 2011; Lounnas et al., 2018; Glöer, 2019), *G. schirazensis* has been dealt with in great detail. However, conflicting hypotheses are proposed for the centre of origin and subsequent dispersal of the species. On one hand, Bargues et al. (2011) postulated that *G. schirazensis* has spread from an area in the Near East around 10,000 years ago by hitch-hiking with ancient livestock, on the muddy legs of the animals, into Asia along the “Silk Road” and similarly with cattle via southern Europe to the New World. On the other hand, Lounnas (2018) hypothesized that this species has its native range in the New World, whereas Old World populations result from recent introductions. Both biogeographical scenarios are unlikely in light of its discovery in the southeastern Himalayan border zone, far from long-distance livestock routes.

Recently, *G. schirazensis* was recorded in the Kingdom of Bhutan, Thimphu district, west of Geneykha (= 5 km E of Chhuzom) at an altitude of 2,750 m a.s.l. (Fig. 1). Our initial misidentification (unpublished) was corrected by the results of a DNA analysis. As primers we used Git04_COI_F (forward) and do.R (reverse), as specified in the literature (Gittenberger et al., 2004). PCR conditions were: hold 95 °C for 5 sec, 50 cycles of 60 sec at 95 °C, 55 °C and 72 °C, respectively, and final hold at 72 °C for 7 sec. Our 646 bp COI sequence (GenBank acc. no. MW694785) had a 100% match with a sequence of *G. schirazensis* from Iran (GenBank acc. no. JF272607). This convincingly ascertains the identification.

The shells from near Geneykha are typical for *G. schirazensis* by having a nearly straight inner lip (Fig. 2). Empty shells from other localities in Bhutan might represent *G. truncatula* (Fig. 1).

The occurrence of *G. schirazensis* in an isolated dead-end valley in Bhutan, ca 3,500 km east of Iran and nearly 2,500



Figures 1–2. *Galba* spec. **1.** *G. cf. truncatula* (O. F. Müller, 1774), Bhutan, district Wangdue Phodrang, 40 km SSE of Wangdue Phodrang, altitude 527 m a.s.l., 27°9'25"N 90°4'5"E, E. Gittenberger, Choki Gyeltshen & Kezang Tobgay leg. 24.ix.2019 (NBCB1231); actual shell height 5.4 mm. **2.** *G. schirazensis* (Küster, 1862), Bhutan, district Thimphu, west of Geneykha (= 5 km E of Chhuzom), in a brooklet with prayer wheel along the road, 2,750 m a.s.l., 27°18'43"N 89°36'10"E, E. Gittenberger, Choki Gyeltshen & Pema Leda leg. 25.x.2018 (NBCB1230); actual shell height 5.6 mm. Scale bar = 1 mm.

km southeast of the record in Tajikistan, without any connection to livestock transport routes, is in conflict with the biogeographical narratives in the literature (Bargues et al., 2011; Lounnas, 2018; Glöer, 2019). Obviously, there is lack of data here. Therefore, we refrain from additional biogeographical conjectures and solely present a global distribution map (Fig. 3) on the basis of our finding and the data in the literature (Kruglov, 2005; Bargues et al., 2011; Lounnas, 2018; Glöer, 2019; Alda et al., 2021).

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REFERENCES

- ALDA, P., LOUNNAS, M., VÁZQUEZ, A.A., AYAQUI, R., CALVOPIÑA, M., CELI-ERAZO, M., DILLON JR., R.T., RAMÍREZ, L.C.G., LOKER, E.S., MUZZIO-AROCA, J., NÁRVAEZ, A.O., NOYA, O., PEREIRA, A.E., ROBLES, L.M., RODRÍGUEZ-



Figure 3. Worldwide records map of *Galba schirazensis*, compiled from data in the literature (Kruglov, 2005; Bargues et al., 2011; Lounnas, 2018; Glöer, 2019; Alda et al., 2021). The record for Bhutan is indicated with a star.

- HIDALGO, R., URIBE, N., DAVID, P., JARNE, J., POINTIER, J.-P., HURTREZ-BOUSSÈS, S. 2021. Systematics and geographical distribution of *Galba* species, a group of cryptic and worldwide freshwater snails. — *Molecular Phylogenetics and Evolution* 157: 1–12.
- BARGUES, M.D., ARTIGAS, P., KHOUBBANE, M., FLORES, R., GLÖER, P., ROJAS-GARCÍA, R., ASHRAFI, K., FALKNER, G. & MAS-COMA, S. 2011. *Lymnaea schirazensis*, an overlooked snail distorting fascioliasis data: genotype, phenotype, ecology, worldwide spread, susceptibility, applicability. — *PLoS ONE* 6 (9): e24567.
- GLÖER, P. 2019. The freshwater gastropods of the West-Palaearctis. Volume I. Fresh- and brackish waters except spring and subterranean snails. Identification key, anatomy, ecology, distribution: 1–399. Published by the author, Hetlingen, Germany.
- KRUGLOV, N.D. 2005. Mollusks of the family Lymnaeidae (Gastropoda Pulmonata) in Europe and northern Asia: 1–507. SGPU Publishing, Smolensk. [In Russian.]
- LOUNNAS, M., CORREA, A.C., ALDA, P., DAVID, P., DUBOIS, M.-P., CALVOPIÑA, M., CARTON, Y., CELI-ERAZO, M., DUNG, B.T., JARNE, P., LOKER, E.S., NOYA, O., RODRIGUEZ-HIDALGO, R., TOTY, C., URIBE, N., POINTIER, J.-P. & HURTREZ-BOUSSES, S. 2018. Population structure and genetic diversity in the invasive freshwater snail *Galba schirazensis* (Lymnaeidae). — *Canadian Journal of Zoology* 96 (5): 425–435.
- GITTENBERGER, E., PIEL, W.H. & GROENENBERG, D. 2004. The Pleistocene glaciations and the evolutionary history of the polytypic snail species *Arianta arbustorum* (Gastropoda, Helicidae). — *Molecular Phylogenetics and Evolution* 30: 64–73.