

Rapid Communication**First record of the acute bladder snail *Physella acuta* (Draparnaud, 1805) in the wild waters of Lithuania**Rokas Butkus^{1,*}, Giedrė Višinskienė² and Kęstutis Arbačiauskas^{2,3}¹Marine Research Institute, Klaipėda University, Herkaus Manto Str. 84, LT-92294 Klaipėda, Lithuania²Nature Research Centre, Akademijos str. 2, LT-08412 Vilnius, Lithuania³Department of Zoology, Institute of Biosciences, Vilnius University, Saulėtekio al. 7, LT-10257 Vilnius, Lithuania

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OPEN ACCESS**Abstract**

The acute bladder snail *Physella acuta* (Draparnaud, 1805) was observed for the first time in the wild waters of Lithuania at one site in the lower reaches of the Nevėžis River in 2015. The restricted distribution and low density suggest recent introduction. Although *P. acuta* in the first half of the 20th century was reported in ponds of the Kaunas Botanical Garden, they appear to have vanished as of 2012. Thus we conclude that recent invasion into the wild most probably has resulted from disposal of aquarium organisms.

Key words: aquarium trade, local distribution, recent introduction, river**Introduction**

The acute bladder snail *Physella acuta* (Draparnaud, 1805) (in synonymy with *Physa acuta* Draparnaud, 1805) is a small air-breathing snail with a left-handed (sinistral) light horny yellowish shell and pointed apex. It is one of the most widespread freshwater snail invaders. The species was first described from France and this led to early speculation of a European origin for the species. It is now established that North America is the native range of the species (Dillon et al. 2002; Anderson 2003; Taylor 2003; Lydeard et al. 2016). Currently *P. acuta* is widespread and occurs on all continents except Antarctica (Bousset et al. 2014; Ng et al. 2015).

In Lithuania, *P. acuta* was historically reported from artificial ponds of the Kaunas Botanical Garden (Schlesch 1937; Schlesch and Krausp 1938; Šivickis 1960); however, the species has never been seen in wild waters. The snail inhabits natural freshwater bodies in neighbouring countries, in particular Poland and Belarus (Semenchenko et al. 2008; Lewin et al. 2015), and invasion of the species into Lithuanian wild waters has been predicted (Butkus et al. 2014). In this work, we report the first record of *P. acuta* in the wild waters of Lithuania and discuss the probable vectors of introduction.

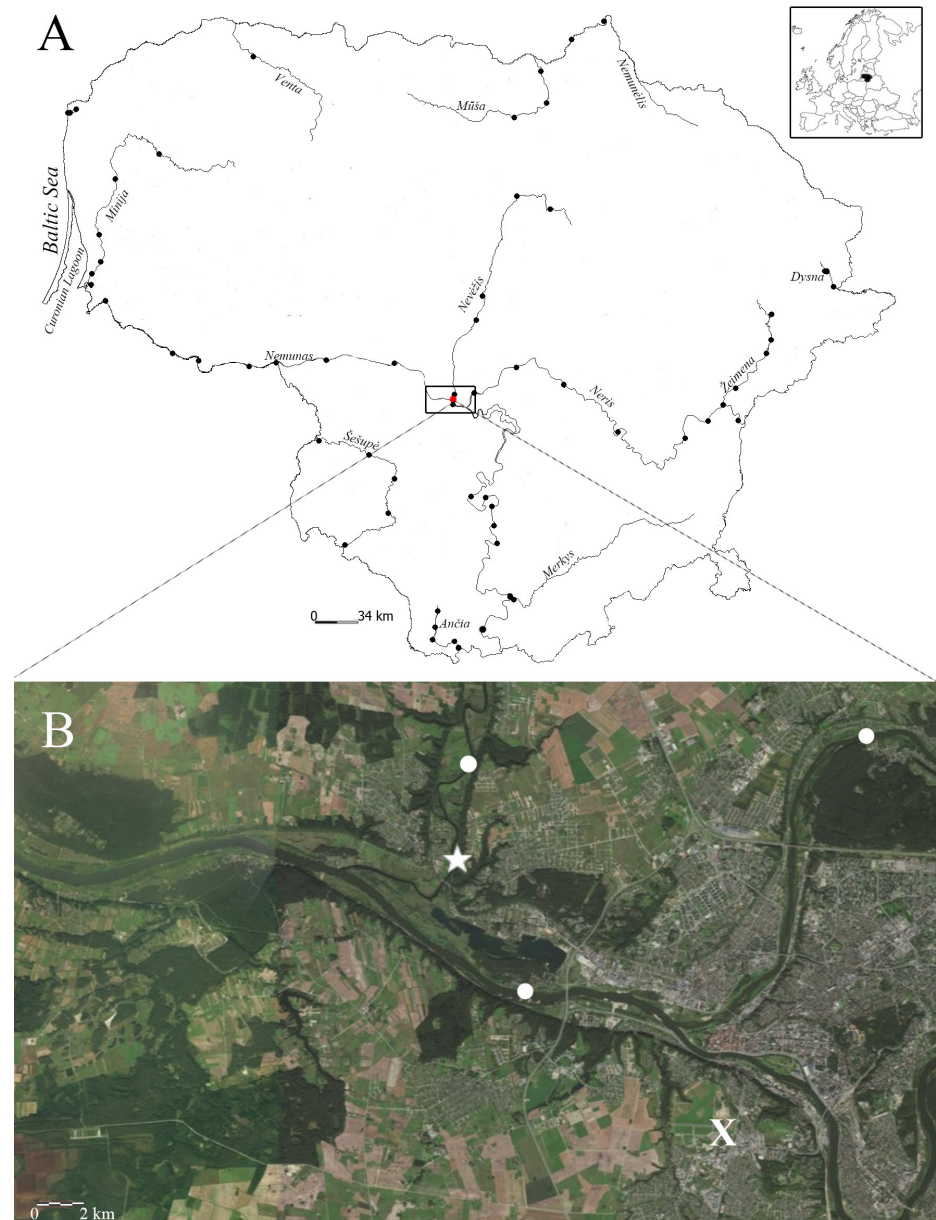


Figure 1. Sampling sites (closed circles, $n = 61$) in the 13 Lithuanian rivers surveyed for nonindigenous macroinvertebrates (A) and the locality of the record of *Physella acuta* (B). The red circle and the star indicate the sampling site at which the species was recorded; 'X' shows the location of the Kaunas Botanical Garden.

Materials and methods

A survey of macroinvertebrates was conducted at 61 sites in the 13 largest rivers of Lithuania in 2015 (Figure 1). All samples were collected using a standard dip net. For each study site, semi-quantitative samples—one kick sample and one sweep sample per site—were collected in wadeable depths (up to 150 cm) using a 5-min sampling effort for each sample. In the field, the whole collected material was fixed in 4% formaldehyde. In the laboratory, samples were sorted and molluscs were preserved in 70% ethanol until further investigation. The snail *P. acuta* was identified based on its left-handed (sinistral) shell with pointed apex, the well-distinctive feature of the species (Šivickis 1960).

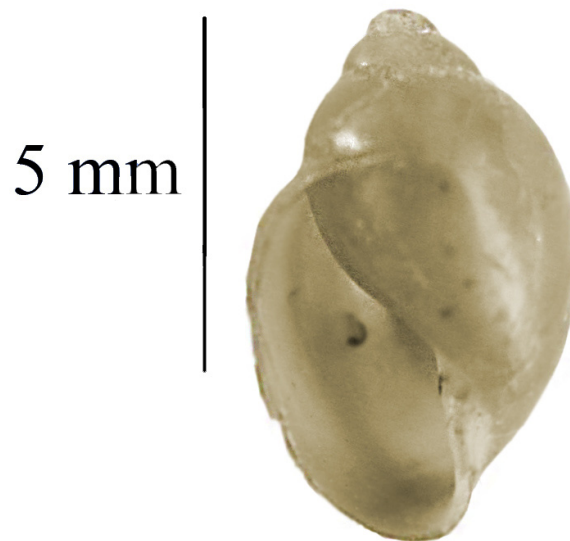


Figure 2. The shell of a *Physella acuta* found in the Nevėžis River. Photograph by R. Butkus.

Results

Of the 61 sites sampled, *P. acuta* (Figure 2) was detected at one site in the lower reaches of the Nevėžis River (lat. 23°47'39.8"; long. 54°55'57.8"; Figure 1). Although the snail was not present in the kick sample, 24 individuals were found in the sweep sample. The species was absent from the adjacent upriver site and nearest sampling point in river Nemunas, which were ~ 2.8 km and ~ 6 km away, respectively.

Physella acuta comprised 2.5% of total mollusc abundance at the detection site. Two other non-indigenous mollusc species were detected there—*Dreissena polymorpha* (Pallas, 1771) and *Lithoglyphus naticoides* (Pfeiffer, 1828). The latter snail was the dominant mollusc species by number. Native molluscs were represented by the bivalves *Anodonta anatina* (Linnaeus, 1758), *Sphaerium corneum* (Linnaeus, 1758), *Sphaerium rivicola* (Lamarck, 1818), *Pisidium amnicum* (O. F. Müller, 1774) and the gastropods *Gyraulus albus* (Müller, 1774), *Lymnea stagnalis* (Linnaeus, 1758), *Radix auricularia* (Linnaeus, 1758), *Bithynia tentaculata* (Linnaeus, 1758) and *Viviparus viviparus* (Linnaeus, 1758).

Discussion

Physella acuta was recorded for the first time in a natural habitat, i.e. wild waters, in Lithuania in the lower reaches of the Nevėžis River. Previously the species had been reported exclusively from ponds of the Kaunas Botanical Garden (lat. 23°54'37"; long. 54°52'15"; Figure 1) (Schlesch 1937; Schlesch and Krausp 1938; Šivickis 1960). However, the most recent survey performed in 2012 did not detect the species at that site. The long-term application of herbicides for aquatic weed control may have caused the local extinction of *P. acuta* from these ponds (Butkus et al. 2014).

The exact time, source and vector of *P. acuta*'s recent invasion into the wild in Lithuania remains undetermined, although some assumptions and conclusions can be drawn. Natural dispersal from neighbouring countries in which it is present is possible, but unlikely. *Physella acuta* has been recorded in the Nemunas River basin in Belarus ~ 30–40 km upstream from the Lithuanian border (Semenchenko et al. 2008). Thus, downstream migration may have occurred. However, *P. acuta* has not been seen in the main waterway of the Nemunas River, either in the 2008 survey (Butkus et al. 2014) or the 17 sites surveyed in this 2015 investigation.

The potential for dispersal from ponds in the Kaunas Botanical Garden when the species existed previously to the Nemunas and further to the Nevėžis cannot be excluded. There is a small possibility that descendants of *P. acuta* snails from the Kaunas Botanical Garden dispersed naturally and they may be in the lag phase of expansion and still at undetectable density. However, the species was not recorded in rivers in 2008 (Butkus et al. 2014) and the present study recorded it as absent from the Nemunas.

Our current data coincide with the results of other studies (Yakovleva et al. 2011; Semenchenko et al. 2008) indicating restricted distribution and rather low density of *P. acuta*. This can be interpreted as indicating quite recent introduction of the snail. The species locality is situated in densely populated area, the suburb of the Kaunas City, thus, the introduction of the species through release of aquarium organisms into the Nevėžis River seems the most probable source of the recent invasion. The primary introduction of the snail into the ponds of the Kaunas Botanical Garden in the first half of 20th century may also have resulted from the aquarium trade, which is assumed to be a primary factor in the worldwide dispersion of this species (Duggan 2010; Vinarski 2017).

The aquarium trade is considered one of the most important vectors for the spread of various aquatic organisms, and has been linked to the introduction of more than 150 animal species to natural ecosystems around the world (Chang et al. 2009). The increasing popularity of ornamental organisms in both private and public aquariums has promoted the human-mediated spread of *P. acuta*. Around the 1910s, the species became a common organism in botanical gardens in most countries of Northern and Central Europe (Vinarski 2017). The release of ornamental organisms outside their native range is a very common introduction vector responsible for primary and secondary invasions (Koehn and MacKenzie 2004; Duggan 2010; Fuller 2015).

Currently *P. acuta* is recorded at only one site in the Nevėžis River. However, this invasive snail may be more widespread in Lithuanian inland waters, and evaluation of its exact distribution is warranted. Although *P. acuta* is considered to be a warm water species, its occurrence in neighbouring countries suggests the climatic conditions in Lithuania to be suitable for the long-term survival of the species. Human-mediated

introductions via release of aquarium organisms (Duggan 2010), anthropogenic alteration of natural habitats (Strzelec et al. 2006; Spyra and Strzelec 2014) and natural species dispersal may allow *P. acuta* to further expand its range into Lithuanian waters.

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