

Short Communication

Bellamya chinensis (Gray, 1834) (Gastropoda: Viviparidae), a new alien snail species for the European fauna

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Abstract

Bellamya chinensis, an Asian snail species, is reported for the first time from the Netherlands. These records are also the first reports from Europe. The species is commercially sold for garden ponds and aquaria, from which they may have escaped or been released. It is anticipated that this species will become invasive in the Netherlands and beyond.

Key words: *Bellamya chinensis*, Viviparidae, non-native species

In North America, two non-indigenous species from the genus *Bellamya* (Gastropoda: Viviparidae) are widespread and considered to be invasive. The two originally Asian species, Chinese mystery snail (*Bellamya chinensis* (Gray, 1834)) and Japanese mystery snail (*B. japonica* (von Martens, 1861)), have never been reported from Europe (P. Glöer, pers. com.). The finding of living specimens of *B. chinensis* in 2010 in the Netherlands at three different sites represents the first examples.

Identification

Adult shells of *Bellamya chinensis* are uniform in color without banding and vary between light to dark olive-green and brownish. The lip has a black color. There are up to seven whorls that are convex and have a clear suture (Figure 1A). Shells found in the Netherlands measure up to 70 millimeters in height and 51 millimeters in width. Embryonic shells taken from the brood pouch, which in Viviparidae are generally more characteristic than adult shells, have in frontal view a depressed protoconch below the successive whorl. The sculpture of embryonic shells shows dense spiral striae, with perpendicular shallow grooves (Figures 1B and

1C). Three of these spiral striae bear periostracal hairs of up to 0.4 mm in length.

Viviparidae known from the Netherlands, including the non-native *Viviparus acerosus* (Bourguignat, 1862), all belong to the genus *Viviparus* (Soes et al. 2009). Shells of *Viviparus* species differ, among others, by their banded shells, sizes, elevated embryonic shells, and different patterns of hairs on the first whorls of young specimens (Smith 2000; Glöer 2002).

The closely related *B. chinensis* and *B. japonica* have often been confused and several investigators have considered both species to be conspecific. A study by Smith (2000) based on North American material showed clear and consistent differences in both shell morphology and anatomy. *B. japonica* should differ from *B. chinensis* particularly with respect to the embryonic shell (Smith 2000). The protoconch of *B. japonica* is elevated instead of depressed. The spiral striae are less dense in *B. japonica* and the sculpture lacks grooves perpendicular to the striae. Furthermore, adult shells of *B. japonica* are more elongated and lack the ‘shoulders’ of *B. chinensis* (Figure 2). In older literature the genus name *Cipangopaludina* has been commonly used for both species. In this paper the currently more used name *Bellamya* is preferred.

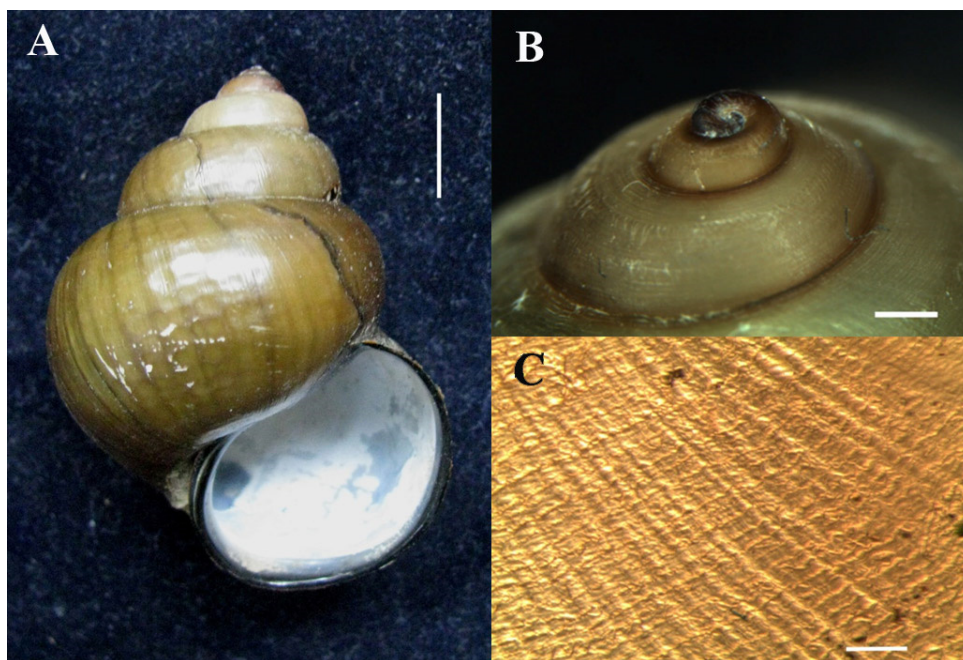


Figure 1. (A) An adult *Bellamyia chinensis* from the Eijsder Beemden, the Netherlands. Scale bar = 10 mm. Photo by D.M. Soes. (B) The apex of a juvenile *B. chinensis* from the Eijsder Beemden. Scale bar = 1 mm. Photo by D.M. Soes. (C) The sculpture of a juvenile *B. chinensis* from the Eijsder Beemden. Scale bar = 0.2 mm. Photo by D.M. Soes.



Figure 2. *Bellamyia chinensis* (left) and *B. japonica* (right) adult and juvenile shells. Photo by Rob Dillon.

Figure 3. Distribution map of *Bellamy chinensis* in the Netherlands. 1 = Eijsder Beemden, 2 = 's-Gravenzande, 3 = Vinkeveen.



Distribution

Bellamy chinensis has its original range in East-China, Taiwan, Korea, and Japan (Chiu et al. 2002). It has been introduced and established in freshwater ponds and lakes in Canada and the USA including the Hawaiian Islands (Cowie 1997; Karatayev et al. 2009). Established populations are especially numerous in the southeastern part of Canada and the northeastern part of the USA, and the Great Lakes Region (Jokinen 1982). Records from Europe are absent (P. Glöer, pers. com.).

In the Netherlands *B. chinensis* has so far been recorded from three localities (Figure 3). Specimens from the Eijsder Beemden (50°47'35.31"N, 5°41'49.24"E) in the very south of the Netherlands were collected on 31 July 2010. This

location is part of the floodplains of the river Meuse. The first specimen from the second site near the village of 's-Gravenzande in the west of the Netherlands (52°00'49.97"N, 4°10'17.07"E) was collected on 2 November 2009. More specimens were collected on 19 August 2010. The third location is in the central part of the Netherlands in the village of Vinkeveen (52°12'43.42"N, 4°56'10.80"E). Single specimens were collected on 28 June and 22 August 2010.

In the Eijsder Beemden and 's-Gravenzande both adults and juveniles were found alive. Therefore we assume the existence of self-sustaining populations of *B. chinensis* at these sites. In Vinkeveen only two living adult specimens were found. Therefore, the presence of a self-sustaining population at this site is uncertain.



Figure 4. The Eijsder Beemden location. Photo by D.M. Soes.



Figure 5. The location of *Bellamya chinensis* in the village of 's-Gravenzande. Photo by D.M. Soes.



Figure 6. A half buried *Bellamya chinensis* feeding on detritus in the substrate. Photo by Stef Keulen.

The first reports of *B. chinensis* from the USA are from the early 1890s and came from San Francisco, where live specimens, imported from Japan, were for sale in a Chinese market (Wood 1892). *B. chinensis* is commonly consumed in Asia, which probably promoted its subsequent spread to North America. *B. chinensis* is also known to be popular in the North American aquarium and ornamental trade and associated activities are expected to be an important source of new populations (Karatayev et al. 2009). The way of entry into the Netherlands is probably also related to pet trade for garden ponds or aquaria. In Europe this species is still rare in trade, but it has actually been traded in the Netherlands and was found in a garden pond in 2008 (D.M. Soes, pers. obser.). The location near the village of Vinkeveen is remarkable because of the co-occurrence of *Orconectes virilis* (Hagen, 1870), an invasive North American crayfish. The first records of this species in 2004 are from the Vinkeveen area, also suggesting that both species have a common origin here (Soes and Koese 2010).

Further spread from established populations may occur naturally or as a result of human activities like boating (Solomon et al. 2010). Because the southernmost locality has an open connection with the River Meuse, and the localities near 's-Gravenzande and Vinkeveen are connected to large water systems, the species may be expected to disperse. Also human activities noted in the present localities, such as boating (Eijsder Beemden and Vinkeveen) and dredging ('s-Gravenzande) may promote further spread.

Ecology

In the Eijsder Beemden (Figure 4) *Bellamya chinensis* is particularly common in a large, shallow pond (≈ 2 hectares). The pond is murky with little aquatic vegetation (*Elodea nuttallii* (Planch.)) and has a muddy bottom. Living specimens were seen near the shore with densities of one to two per square meter. The animals dug deep into the mud, particularly in shallow water (Figure 6). The mollusc fauna of this pond was relatively poor in species with 10 additional species found: *Bithynia tentaculata* (Linnaeus, 1758), *Potamopyrgus antipodarum* (Gray, 1843), *Valvata piscinalis* (Müller, 1774), *Stagnicola palustris* s.s. (Müller, 1774), *Radix balthica* (Linnaeus, 1758), *Lymnaea stagnalis* (Linnaeus, 1758), *Physella acuta* (Draparnaud,

1805), *Planorbis corneus* (Linnaeus, 1758), *Planorbis planorbis* (Linnaeus, 1758) and *Anisus vortex* (Linnaeus, 1758). *B. chinensis* has also been found in low numbers in a small lake nearby, which has an open connection with the River Meuse. The lake is normally isolated from the pond but may become connected during winter high floods. Also in this lake *B. chinensis* was found on muddy substrates; no specimens were found on more pebbly substrates. In both localities the open water was not sampled.

The second locality near the village of 's-Gravezande consists of small eutrophic ditches, in total about 500 meters in length (Figure 5). The ditches were almost completely covered with floating vegetation comprising mainly of *Spirodela polyrhiza* (L.), *Lemna gibba* L., *Lemna minuta* Kunth and *Wolffia arrhiza* (L.). Some small patches of submersed vegetation of *Ceratophyllum demersum* L. and *Potamogeton pectinatus* L. were present. The bottom substrate was soft with locally thick layers of dead duckweed. Other mollusks found were *B. tentaculata*, *V. piscinalis*, *Bathymphalus contortus* (Linnaeus, 1758), *S. palustris* s.s., *R. balthica*, *L. stagnalis*, *P. acuta*, *P. corneus* (Linnaeus, 1758), *P. planorbis*, *A. vortex*, and *Sphaerium corneum* (Linnaeus, 1758). Density of *B. chinensis* at this site was less than 0.5 specimen per square meter.

At the third location in the village of Vinkeveen two specimens were collected at separate occasions in a large ditch with little vegetation consisting mainly of *Nuphar lutea* (L.) and *Ceratophyllum demersum* L. The bottom substrate was soft and rich in detritus. Few other snail species were detected namely: *B. tentaculata*, *V. piscinalis*, *P. corneus*, *L. stagnalis* and *P. acuta*.

The described habitats in the Netherlands match the other known habitats of *B. chinensis* quite well. The species is most commonly found in standing and slowly flowing waters with a sandy, muddy or silt bottom. These waters may include ditches, ponds, lakes and canals (Jokinen 1982). *B. chinensis* feeds here on bottom material, which is ingested non-selectively. The species does not readily feed on plants; snails fed exclusively on spinach do not perform well in comparison with snails fed detritus (Mohrman 2007).

B. chinensis seems to be well adapted to the Dutch temperate climate. The winter of 2009-2010 was relatively harsh, with a medium temperature of 1.1°C, against a normal medium

temperature of 3.3°C. This apparently did not harm the population in the shallow pond in the Eijsder Beemden. Two reproducing Dutch populations indicate that summer temperatures are not likely to be limiting either. This had already been demonstrated in North America where the species is found in a comparable temperate climate (Jokinen 1982). Also experiences in aquaria yielded a temperature tolerance range of 0 – 30°C, which confirms the tolerance of this species to the Dutch climate (Karatayev et al. 2009).

Impact

With *Bellamya chinensis* being present in the Netherlands for only such a short time, no signs of impact could be noted. As it is a relatively large snail species and densities can be high, it has been speculated that negative impact is inevitable (Bury et al. 2007). Johnson et al. (2009) reported that the presence of *B. chinensis* negatively influenced population sizes of *Physella gyrina* and *Lymnaea stagnalis* in mesocosm experiments. Competition for food would be the most likely explanation for these effects. But such negative impact on gastropod assemblages have not yet been confirmed in field studies (Solomon et al. 2010). The mesocosm experiments also indicated that *B. chinensis* may alter benthic communities by altering their algal biomass, algal species composition and nutrient cycling (Johnson et al. 2009), from which it cannot be excluded that the presence of *B. chinensis* may have ecological consequences.

Chinese mystery snails have been reported to serve as vectors for several parasites, which are however exotic to the Netherlands (Jokinen 1982; Chai et al. 2009). Most of these, like *Angiostrongylus cantonensis* (Chen, 1935) and several members of the family Echinostomatidae need high temperatures or primary hosts not present in Europe (H. Cremers, pers. com.). In North America actual introductions of parasites by *B. chinensis* have not been reported yet. As with other potential impacts the possibility of *B. chinensis* serving as a vector for exotic parasites must be considered as data deficient.

Concluding remarks

Bellamya chinensis is suited for the Dutch climate and its preferred habitat is common in the lowlands of the Netherlands. It may be

anticipated that this species will be able to establish itself firmly in the Netherlands and beyond, like it did in northern America. Its actual population development warrants further investigation, especially as information on its ecological impact is inconclusive.

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