

The Asian tramp snail *Bradybaena similaris* in a tropical greenhouse in Arnhem, The Netherlands

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The occurrence of the Asian tramp snail *Bradybaena similaris* (Férussac, 1821) is reported from a tropical greenhouse in Burgers' Zoo near Arnhem, The Netherlands, where the species has been present at least since 2002. The snail was introduced unintentionally from an unknown source, probably with plant material. The morphology of the genitalia is compared with descriptions in the literature from Brazil and Nosy-Be island (Madagascar). This appears to be the first European record for the species.

Keywords: Gastropoda, Stylommatophora, Hygromiidae, Bradybaenidae, invasive species

In 2002 the first two authors independently collected respectively a juvenile and an adult shell of a land snail species unfamiliar to them in the tropical greenhouse "Burgers' Bush", Burgers' Zoo, Arnhem, The Netherlands. In 2005 the second author collected a larger sample, which the first author recognized as *Bradybaena similaris* (Férussac, 1821). This snail was introduced unintentionally from an unknown source, probably with plant material. During joint visits by all authors in 2008 and 2009 the species was found abundantly.

This probably represents the first published record of *B. similaris* from The Netherlands. The species was not mentioned by Meeuse & Hubert (1949) in their overview of Dutch greenhouse snails. We have searched in vain for records from other European countries. However, there are reports of interception by United States custom officials from plant material and vegetables imported from Germany, Portugal and Spain (Dundee, 1974), though this does not necessarily imply that the species actually lived in these countries.

The native range of *B. similaris* is probably East and Southeast Asia, but it has been introduced to tropical and subtropical areas in South America, southern North America, Madagascar and many islands in the Pacific and Indo-Pacific (Cowie et al., 2008), South Africa (Connolly, 1939) and even to Bermuda in the western Atlantic (Bieler & Slapcinsky, 2000). In many places the species is reported to cause damage to crops and ornamental plants and/or act as vector of parasites, notably in China, Japan, Brazil, the southern states of the U.S.A. and Hawaii.

The species is distinct from other Dutch land snail species by a combination of characters like size (up to 15 mm), the subglobose shape, the dull brownish colour, the narrow umbilicus (partly obscured by the columellar margin of the aperture), the roundish aperture with thickened lip (figs 1-3), the smooth apex, and the sculpture of radial growth lines crossed by extremely fine but distinct spirals. In crawling snails the long, dark tentacles are conspicuous (figs 4-5). Although *B. similaris* is known to be polymorphic for shell colour and banding (Honda & Asami, 1993), all shells observed in Burgers Bush were unbanded and dull pale brown, except for a single pale yellow shell.



Figs 1-5, *Bradybaena similaris* (Férussac, 1821) from Burgers Bush, Arnhem, The Netherlands. 1-3, different views of a shell (actual shell width 13.7 mm). 4-5, crawling specimens. 4, adult specimen; 5, juvenile (note the long tentacles).

We examined the genitalia of three specimens from Burgers Bush and compared these with the few data we were able to find in the literature. Picoral & Thome (1989) and Araujo (1989) describe and illustrate the genital morphology of Brazilian specimens, Schileyko (2004, Fig. 2185a-c) that of a specimen from Nosi-Be Island near Madagascar. The Dutch specimens largely agree with these reports. The transition of the penis into the epiphallus is more abrupt than depicted for Brazilian specimens and slightly more so than in the drawing by Schileyko. This may well be caused by the degree of contraction of the animals upon fixation. The vas deferens in Dutch specimens is attached to the penis sheath, as indicated for the Brazilian specimens, but not for the Madagascar specimen. The bursa copulatrix as drawn by Picoral & Thome is comparatively short and does not reach the albumen gland; according to the description and drawing by Schileyko the bursa does reach the albumen gland, like in the Dutch specimens. The Brazilian and Madagascar specimens seem to differ with respect to the morphology of the inner penis. Picoral & Thome depict an irregular pattern of anastomizing pilasters of variable width on the inner wall; Schileyko's drawing suggests the presence of a regular pattern of equally wide, parallel, sinuous pilasters. Dutch specimens agree in this respect best to the drawing of Picoral & Thome.

Genitalia of Dutch specimens agree in some aspects to the observations reported by Picoral & Thome (1989) and in others to those by Schileyko (2004), and the differences between these authors are likely to be due to intraspecific variability, preservation artefacts or inaccurate observations. However, the possibility of different *Bradybaena* species cannot be entirely ruled out. According to Schileyko (2004: 1692), the genus *Bradybaena* s.s. is rather speciose in Asia and in need of revision. For instance, Asami et al. (1993) recognize *B. pellucida* Kuroda & Habe, 1953 as a sibling species in Japan; both these species are polymorphic for shell colour and banding (Honda & Asami, 1993; Asami et al., 1993).

Data on the biology of *B. similaris* are available, mainly from Brazil (see e.g. Nocelle de Almeida & Almeida Bessa, 2001; Carvalho et al., 2009). Under artificial circumstances, the snails start to reproduce within 6 months after hatching. A snail produces on average 90 eggs during its life, but individual variation is considerable. According to some reports the snail feeds predominately on monocots, but most studies also report damage to dicots. The enormous tropical hothouse at Arnhem aims to give visitors an impression of the atmosphere in a tropical forest with high temperatures, high humidity and lush vegetation. Although *B. similaris* is not known to be a typical forest-dweller (Bentham Jutting, 1950; Honda et al., 1993), it appears to do well in Arnhem. It not only occurs on the floor, but is also present on leaves (especially on the underside) of shrubs up to at least three meter high. Overall the damage by the snail to the vegetation in the greenhouse seems to be limited.

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