

Is the semi-slug *Vitrinobrachium breve* (A. Férussac, 1821) (Gastropoda: Vitrinidae) really new for Belgium? A historical investigation

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Abstract. Recently, the first sightings of the semi-slug *Vitrinobrachium breve* have been reported in Belgium. However, this species was probably already present in the east of the country a century ago. We present a historical investigation starting from an illustration in a book by W. Adam on Belgian land molluscs published in 1960. The depicted shell was presented as that of the semi-slug *Eucoberesia diaphana* (Draparnaud, 1805) and was collected in 1923 in Malmedy. We show it most certainly belongs to *V. breve*. We also discuss the halo-effect hypothesis of an authoritative work in long-term identification errors and the historical biogeographic implications for these two species.

Key words. Semi-slug, museum collection, *Eucoberesia diaphana*, halo effect, biogeography

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INTRODUCTION

The semi-slug *Vitrinobrachium breve* (A. Férussac, 1821) (family Vitrinidae) is rare at the north-western edge of its range. Recent records have considerably expanded this species' distribution in this area: for example, eastern France (Geissert 1996; Hey 2017; Ryelandt 2022; Bichain *et al.* 2023), the Netherlands (Reinink 1999; de Bruyne *et al.* 2003; Majoor & Keulen 2009), Luxembourg (Groh pers. comm. 2021), and the western German states (Groh and Renker pers. comm. 2021). *Vitrinobrachium breve* was first reported in Belgium in 2017 (Bronne *et al.* 2022; Fig. 1). These finds of *V. breve* in north-western Europe could be due to a recent range expansion, either human-assisted or natural, or indicate that the species has long been overlooked (Bronne *et al.* 2022).

One of us (J.D.) was struck by the resemblance between the conchological characteristics of the shell presented by Bronne *et al.* (2022) and the illustration, supposedly of a shell of *Eucoberesia diaphana* (Draparnaud, 1805), in the book by Adam (1960: 264, fig. 98), a major work on the Belgian malacofauna (Fig. 2B).

SHELL DESCRIPTION

Eucoberesia diaphana and *V. breve* are two species of vitrinid semi-slugs, both characterised by a very thin, fragile, and rap-

idly expanding translucent shell. Their shells are distinctly flattened and ear-shaped, in contrast to the more globular shells of the other two vitrinids in Belgium, namely *Vitrina pellucida* (O.F. Müller, 1774) and *Phenacolimax major* (A. Férussac, 1807). *Eucoberesia diaphana* and *V. breve* also possess a wide, non-calcified membrane-like margin extending along the columellar side of the aperture (Fig. 2A, C). The shell of *E. diaphana*, which is more depressed, features a more flattened apex, with the broad membrane occupying one-third to one-half of the width of the shell base. Adult shells reach 6–7 mm (Welter-Schultes 2012; Wiese 2014). The last whorl occupies half the width of the shell. In basal view, the first whorl can be seen through a columellar opening. The shell of *V. breve* has an apex which protrudes slightly. The membrane is narrower, occupying a quarter of the width of the base of the shell. The last whorl occupies nearly two-thirds of the diameter of the shell, and there is no columellar opening allowing for the earlier whorls to be visible from below. Adult shells reach 5–6 mm in width (Welter-Schultes 2012; Wiese 2014). In adults, the number of whorls is less than two in *V. breve* and greater than two in *E. diaphana* (Kerney *et al.* 1999; Welter-Schultes 2012).

ENGELÉN'S ILLUSTRATION

The book by W. Adam (1960) on the non-marine molluscs

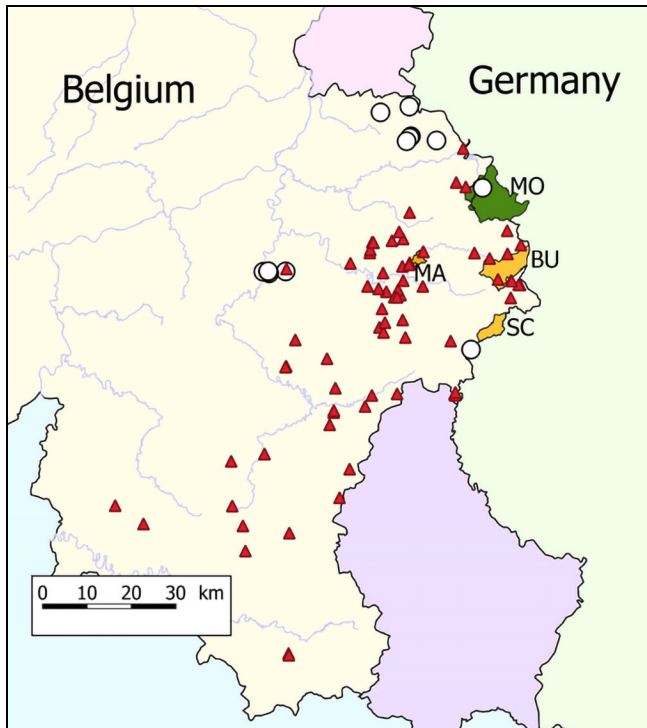


Figure 1. Municipalities mentioned in the text. Those shown in yellow are in present-day Belgium: BU = Büllingen; MA = Malmédy; SC = Schönberg. MO = Monschau, shown in green, is in Germany. White dots: recent (2017–2023) Belgian sightings of *Vitrinobrachium breve*, notably in the Vennbahn corridor, that crosses Monschau municipality. Red triangles: recent (2014–2023) Belgian sightings of *Eucobresia diaphana*. The present study suggests that the only reliable historical records for both *E. diaphana* and *V. breve* originate from Malmédy (1923). The reports of *Vitrina heyneimanni* in the other municipalities (BU and SC) were considered to be *E. diaphana* by Adam (1947), but we were unable to confirm these identifications.

of Belgium is rich in high-quality illustrations directly sourced from specimens housed in the collections of the Royal Belgian Institute of Natural Sciences (RBINS), Brussels. The caption of the figure accompanying the detail description of *Vitrina diaphana*, former name of *E. diaphana*, is: “Fig. 98. – *Vitrina diaphana* DRAPARNAUD, Malmédy, d = 5.3 mm. – (E.)”. The figure depicts a shell rendered using the dotted technique in apical, apertural and basal views (reproduced here as Fig. 2B). The featured specimen hails from Malmédy in eastern Belgium (Fig. 1). The abbreviation “E.” stands for Mr A. Engelen, one of the seven illustrators of the book.

A direct comparison with pictures of shells of *E. diaphana* and *V. breve* taken in the same canonical views (Callomon 2019) enables the reidentification of the shell illustrated in Engelen’s drawing (Fig. 2). The basal view, in particular,

exhibits characteristics typical of *V. breve*: a narrow membrane, the absence of a columellar opening, and a last whorl significantly larger than half the diameter of the shell. The apertural view also reveals a shell not so flattened as is usual in *E. diaphana* and with a pronounced apex. In the apical view, the general shape of the shell is more reminiscent of *V. breve*, with a quickly expanding spiral, less rounded shell and a significantly more off-centre apex. The meticulous attention evident in all of Engelen’s illustrative work instils confidence in its accuracy. Furthermore, the width (5.3 mm) falls within the typical range known in *V. breve* (5–6 mm) and excludes *Semilimax semilimax* (J. Férussac, 1802), whose shell in adults is 4–5 mm wide and with a wider membrane (Welter-Schultes 2012; Wiese 2014). Consequently, we conclude that the illustrated specimen is not consistent with *E. diaphana* but most certainly corresponds to *V. breve*.

HISTORICAL LITERATURE

In the introduction to his book, Adam (1960: 6) stated about the illustrations:

Ce travail était terminé en 1947. Pour des raisons indépendantes de la volonté de l’auteur, son impression a été considérablement retardée.

[The work was completed in 1947. For reasons beyond the author’s control, its printing was considerably delayed.]

In 1947, indeed, Adam published a large paper on Belgian molluscs. Among others, Adam (1947) mentioned all the vitrinid species reported from Belgium: *Vitrina pellucida*, *Vitrina major* (now *Phenacolimax major* (A. Férussac, 1807)), and *Vitrina diaphana*, but also *Vitrina annularis* (now *Oligolimax annularis* (Studer, 1820)), which he thought was certainly erroneous. *Vitrina brevis* (former name of *V. breve*) is not mentioned. Adam (1947) also included plates with pictures of shells, but of the vitrinids, only *V. pellucida* is illustrated.

In the section on *Vitrina diaphana*, Adam (1947) noted *Vitrina heyneimanni* as a synonym, and as for all species, he included a map plotting literature reports (7 white dots) and shells preserved in the RBINS collections (3 black dots). After review of the reported observations, Adam (1947) concluded that only the observations in High Belgium (altitudes 200–694 m a.s.l.) were reliable. The preserved shell from Ixelles/Elsene was considered by Adam to be the result of a mislabelling. The origin of the two other shells in collection is better documented. Adam (1947: 123) wrote:

E. Van Den Broeck (1870) et J. Purves (1870) ont cité l’espèce de Stoumont. Malheureusement, je n’ai

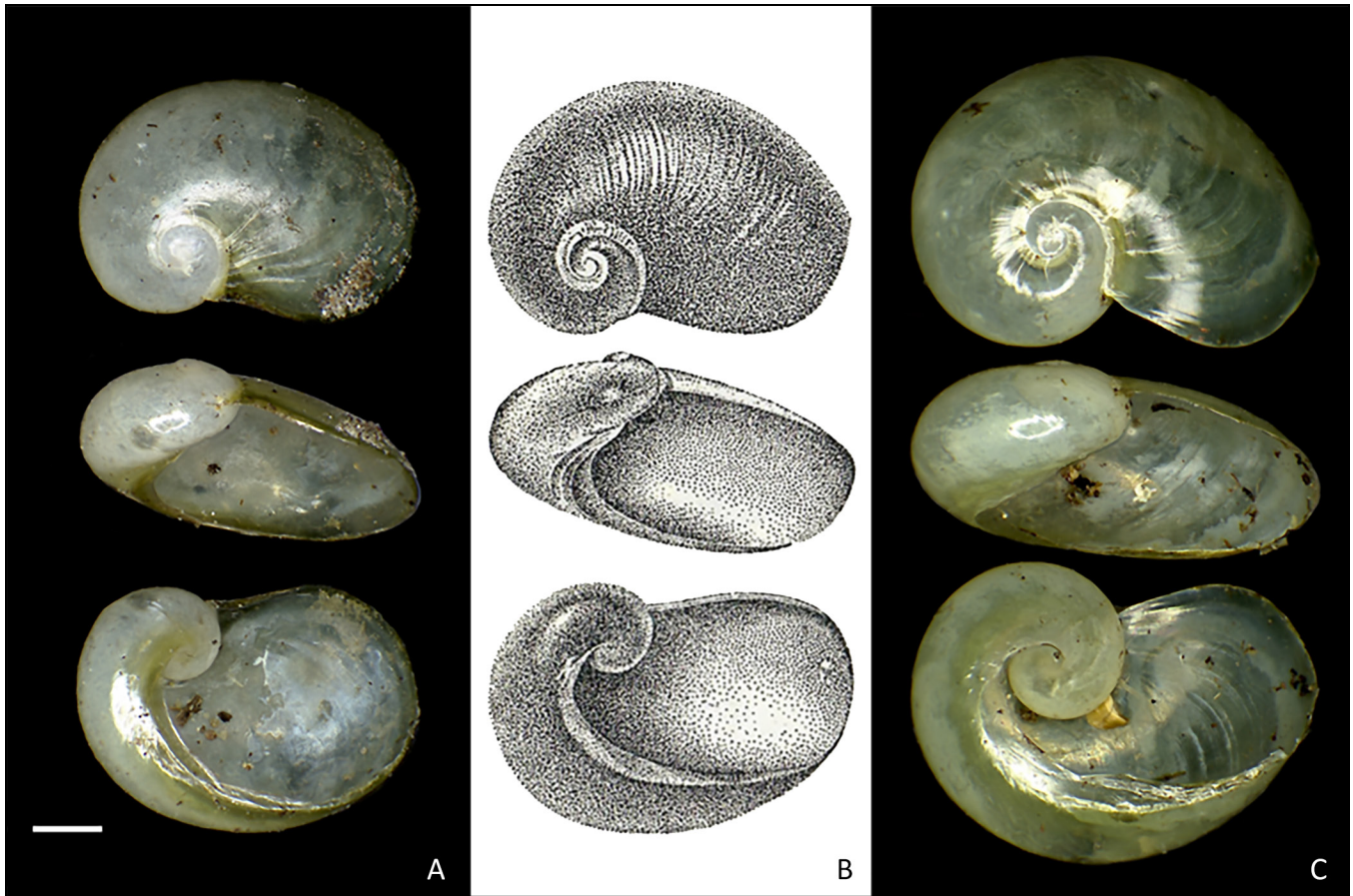


Figure 2. Comparison of the apical, apertural, and basal views (upper, middle, and lower images, respectively) of the shells of *Vitrinobrachium breve* and *Eucobresia diaphana* from Belgium. **A, B, *V. breve*:** (A) from Moresnet, width 4.9 mm, (B) from Malmedy, specimen collected in 1923 and illustrated by A. Engelen for Adam's (1960) book, width 5.3 mm. **C, *E. diaphana*,** from Hockai, width 6.0 mm. Scale bar: 1 mm.



Figure 3. *Eucobresia diaphana*. Apical, apertural, and basal views (left, centre, and right images, respectively) of a specimen collected and identified by P. Dupuis in Malmedy in 1923. Label text [*Vitr. heynemanni* Rock / Malmedy / Dupuis ded. X.23] is written by the hand of P. Dautzenberg. (RBINS INV.303693, from the P. Dautzenberg collection, I.G. 10591). Scale bar: 1 mm (label not to scale).

pas vu ce matériel. Pourtant des spécimens récoltés par L. Fredericq et P. Dupuis (1923) à Malmédy et à Büllingen appartiennent sans aucun doute à *Vitrina diaphana*...

[E. Van Den Broeck (1870) and J. Purves (1870) cited the species from Stoumont. Unfortunately, I didn't see this material. However, specimens collected by L. Fredericq and P. Dupuis (1923) at Malmédy and Büllingen undoubtedly belong to *Vitrina diaphana*....]

In the paper by Fredericq & Dupuis (1923), we gain further insights into their observations in "New Belgium", the former temporary unofficial name referring to the territories acquired through the Treaty of Versailles after World War I and since been completely forgotten. Fredericq (in Fredericq & Dupuis 1923: 427) wrote:

J'ai profité de plusieurs séjours dans le District de Malmédy, de mai à septembre 1923, pour y rechercher et récolter les Mollusques à coquille tant terrestres que d'eau douce. J'ai eu la bonne fortune, en septembre 1923, de rencontrer à Malmédy M. le major Paul Dupuis, conservateur au Musée royal d'Histoire naturelle de Belgique, qui se livrait à la même occupation et avait déjà réuni une intéressante série de Mollusques, dont il a bien voulu me communiquer la liste, liste pour ainsi dire identique à la mienne. M. Dupuis a eu l'extrême obligeance de contrôler mes déterminations principalement en ce qui concerne les espèces qui m'étaient peu familières.

[I took advantage of several stays in the Malmedy district, from May to September 1923, to search and collect shelled molluscs, both terrestrial and freshwater. I had the good fortune, in September 1923, to meet in Malmédy Major Paul Dupuis, curator at the Royal Museum of Natural History of Belgium, who was engaged in the same occupation and had already assembled an interesting series of molluscs, of which he kindly communicated the list to me, a list almost identical to mine. Mr. Dupuis was extremely kind enough to check my determinations mainly with regard to species that were unfamiliar to me.]

Fredericq compiled a list of species along with the corresponding locations, notably for *V. heynemanni* on page 433: "Bévercé-Malmédy, Büllingen, Schönberg". These three locations (Fig. 1) correspond to the three dots on Adam's (1947) map within the territory of the "New Belgium". The only other vitrinid mentioned in the entire paper is *Vitrina pellucida*. Fredericq and Dupuis also emphasized that *V. heynemanni* had never been recorded in Belgium.

Boettger (1912) reported observations of Vitrinidae in the Malmedy region, which was then part of the Kingdom of Prussia. Neither *Vitrina heynemanni* nor *V. brevis* are mentioned by him, while *V. diaphana* is mentioned from O. le Roi's collection (early 20th century) in Monschau and Reichenstein, which nowadays are included in the Monschau municipality (Fig. 1), located in Germany directly adjacent to the present-day German-Belgian border and c. 15 km from Malmedy.

MUSEUM COLLECTIONS

We attempted to find Belgian specimens of *Eucoberesia diaphana* and *Vitrinobrachium breve* in the RBINS, as Adam (1947, 1960) directly referred to specimens in that institution's collections. We also checked the Philippe Dautzenberg collection, a very rich private collection acquired in 1929 by the RBINS. We investigated whether Professor L. Fredericq had potentially deposited any specimens in either RBINS or the Museum of Zoology of the University of Liège, the university where he worked. However, the databases of these two institutions contained no records. No malacological collections are housed at the Scientific Station of High Fens, University of Liège, although this institution does hold specimens directly contributed by L. Fredericq (J. Delcourt pers. obs.).

The investigation at the RBINS collection unfortunately did not yield any of the specimens of *E. diaphana* reported by Adam (1947, 1960), notably under the name *Vitrina heynemanni*. Nevertheless, the Dautzenberg collection yielded a single Belgian shell reported as *Vitrina heynemanni* (INV30333) and collected by Dupuis in 1923 in Malmedy (Fig. 3). This shell, with a very wide membrane, a flat apex, and more than two whorls, definitely belongs to *E. diaphana*. It does not match the specimen illustrated in Adam's (1960) book. No specimen labelled as *Vitrinobrachium breve* (or a synonymized name) from Belgium was found in the two collections.

HISTORICAL DISCUSSION

After the Treaty of Versailles in 1919, former Prussian territories came under Belgian control, arousing the interest of Belgian scientists and naturalists. The malacological research conducted by Paul Dupuis and Léon Fredericq is in line with this new interest. Léon Fredericq, a renowned professor of physiology and a naturalist, notably established a scientific station in 1924 dedicated to studying the specificities of this "New" Belgium (Nolf 1937). This station, which is part of the University of Liège, still exists. Fredericq explored the elevated region in search of potential glacial

relicts, a highly popular subject at the time. This endeavour was one of the motivations behind his search for molluscs in this area (Fredericq 1923; Fredericq & Dupuis 1923).

In September–October 1923, Dupuis collected specimens from Malmedy and Büllingen, which he identified as *V. heynemanni*, and deposited in the RBINS collection (Adam 1947). Another specimen of *E. diaphana* was entrusted to Dautzenberg's private collection. This specimen returned in 1929 in the RBINS following Dautzenberg's bequest of his collection to the museum (Pelseneer 1936; Duchamps 1986, 1989). Dupuis died in 1931, and in 1932 Adam was hired to take over management of the enormous collection after its acquisition by the RBINS. In addition, Adam undertook a revision of the Belgian malacofauna (van Goethem 1988). Before 1948, all known Belgian species were illustrated based on specimens in the RBINS collection (Adam 1947, 1960). *Eucobresia diaphana* seems to be mistakenly illustrated by a specimen of *V. breve* collected by Dupuis from Malmedy in 1923 and published by Adam (1960). The same illustration was used again in the publication of De Wilde *et al.* (1986). We have shown that this is not the specimen found in the Dautzenberg collection (Fig. 3).

IS VITRINOBRACHIUM BREVE UNDER-RECORDED?

Bronne *et al.* (2022) raised several hypotheses for the recent discoveries of *Vitrinobrachium breve*. One of them, the under-recording of a species already present in this region for a long time, seems to be supported by the presence of *V. breve* in Malmedy a century prior to its rediscovery in the region. In Luxembourg, fossils are recorded from the Holocene (c. 9400 BP; Granai *et al.* 2020). The same hypothesis is put forward for two other semi-slugs of the family Oxychilidae discovered in recent years, also in south-east Belgium: *Daudebardia brevipes* (Draparnaud, 1805) and *D. rufa* (Draparnaud, 1805) (Bronne & Van den Neucker 2020; Bronne *et al.* 2021).

One hypothesis is that Adam's (1960) book served as an authoritative reference, creating a halo effect (or an aura of influence), without malacologists or other Belgian naturalists questioning its content or consulting additional foreign sources. Thus, any individual or shell of *V. breve* encountered would have been erroneously reported as *E. diaphana*. The four Belgian vitrinids can be categorized along an increasing gradation of the proportion size of last whorl over the width of the shell: *V. pellucida*, *P. major*, *E. diaphana*, and *V. breve*. If the existence of *V. breve* is ignored, all individuals obtaining the highest scores will naturally be identified as *E. diaphana*. A similar phenomenon was revealed by Bronne & Delcourt (2022) concerning the Oxychilinae. Four species

were previously known from Belgium—*Oxychilus draparnaudi* (H. Beck, 1837), *O. cellarius* (O.F. Müller, 1774), *O. alliarius* (J.S. Miller, 1822), and *O. navarricus helveticus* (Blum, 1881)—roughly classifiable according the width of the umbilicus proportional to the width of the shell, with *O. navarricus helveticus* having the smallest umbilicus ($\frac{1}{8}$ of the shell width on average). Oxychilid specimens with a tiny umbilicus have been identified as belonging to this species prior to Bronne & Delcourt (2022) disclosing that many of them belong to a species previously unknown in Belgium, *Morlina glabra* (Rossmässler, 1835). In the case of *E. diaphana* and *V. breve*, the potential for confusion might have been exacerbated by illustrations featuring a specimen not corresponding to the correct species.

Furthermore, shells of Vitrinidae are often pictured with the photographic axis perpendicular to the surface on which the fragile shell is placed, and not parallel to the shell axis (as in strict apical view). This is notably the case in popular field guides such as that of Welter-Schultes (2012) and in Figure 3. The relative proportions can differ significantly between apical views of casually placed shells and strictly positioned shells (compare apical views of Figs 3 and 2C), potentially leading to misidentification.

Those considerations highlight the difficulty of the identification of snails based on shells only. Adam (1960: 264) pointed out the black body colouration of *E. diaphana*. While the body colouration of *E. diaphana* can be light grey to black (Welter-Schultes 2012; Bichain & Ryelandt 2023), *V. breve* typically exhibits a darker grey to black body (Kerney *et al.* 1999; Welter-Schultes 2012; Wiese 2014). Thus, body colour is variable and with overlap in the two species and is not helpful for their identification. Adam (1960: 264) also discussed the genital anatomy of *E. diaphana* and noted that the right ommatophore retractor (ROR) passes between the vagina and the penis. Indeed, the penis of *E. diaphana* is notably well developed, and the ROR passes between the female genitalia and the penis (Hausdorf 2002; Giusti *et al.* 2011). These characteristics are not present in *V. breve* following Hausdorf (2002), although they were disputed by Giusti *et al.* (2011). Nevertheless, none of the differences between the genitalia of these species were mentioned by Adam: 1) the presence of a penial appendix in *V. breve* and its absence in *E. diaphana*; 2) the convergence the penis, duct of the bursa copulatrix, and oviduct at a common point in *V. breve* and, hence, the absence of a vagina. In *E. diaphana*, the penis opens into the vagina below the duct of the bursa copulatrix (Kerney *et al.* 1999). Additionally, information on colour and the absence of a description of the genitalia in Adam's (1960)

book may have also contributed to the confusion between the two species.

Given the possibility of these errors, all historical data related to *E. diaphana* in Belgium must be approached with caution.

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