



## New record of the Oval Orb Mussel *Sphaerium ovale* (Férussac, 1807) (Mollusca, Bivalvia, Sphaeriidae) from north-eastern France

Nouvelle donnée de la Cyclade ovale, *Sphaerium ovale* (Férussac, 1807) (Mollusca, Bivalvia, Sphaeriidae), dans le Nord-est de la France (région Grand Est)

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**Résumé étendu** – Nous signalons dans cet article la présence, dans un bras mort de la Moder, de la Cyclade ovale, *Sphaerium ovale* (Férussac, 1807), un petit bivalve morphologiquement très proche de *Sphaerium corneum* (Linné, 1758) et de *Sphaerium nucleus* (S. Studer, 1820). Cette espèce est documentée dans la région Grand Est uniquement sur la base de six données ADNe dont trois en Champagne-Ardenne, deux en Alsace et une en Lorraine. Récemment des individus vivants ont été récoltés en Alsace, dans le Bas-Rhin, à proximité de Fort-Louis sur un site géré par le Conservatoire d'Espaces Naturels d'Alsace. L'habitat correspond à un bras mort de la Moder périodiquement alimenté par les crues de la Moder et par les eaux de la nappe phréatique. La flore y est mésotrophe à oligotrophe, avec notamment une belle population d'*Utricularia neglecta* Lehm, 1828. La profondeur du bras est comprise entre quelques dizaines de centimètres à plus de 1,30 mètre avec un substrat peu vaseux et des affleurements de gravier en plusieurs endroits. L'échantillonnage a été réalisé à l'aide d'un filet à mailles fines (500 µm) sur une zone de quelques mètres carrés près du rivage. Au total, 7 spécimens vivants ont été collectés, dont 3 adultes et 4 juvéniles. Les plus grands individus mesurent 12 mm de largeur et présentent des valves ovales, renflées et quasiment équilatérales. Le plateau cardinal n'est pas rétréci au niveau des dents cardinales. La dent cardinale C3 est modérément incurvée et bifide postérieurement alors que les dents C2 et C4 sont courtes et légèrement incurvées. La C4 atteint le milieu de la C2. La surface interne de la coquille présente une forte densité de pores, notamment près de l'umbo, avec un espacement moyen d'environ 30 µm. Les empreintes du muscle adducteur postérieur et du muscle

rétracteur du siphon sont séparés ou très proches l'une de l'autre, mais non fusionnées. Le lobe dorsal du néphridium entoure complètement le tube péricardique. *Sphaerium nucleus* se distingue de *S. ovale* sur base de la forme du rein, carré et fermé, et par la forme des coquilles nettement plus sphérique, en forme de "noyau de cerise". *Sphaerium corneum* se distingue de *S. ovale* sur la base (i) d'une plus faible densité de pores, espacés d'environ 100 µm, (ii) d'un plateau cardinal rétréci au niveau des dents cardinales, (iii) de C4 presque aussi longue que C2, (iv) d'empreintes musculaires postérieures complètement fusionnées, et (v) par un rein allongé et ouvert. Nos données représentent donc le premier signalement de l'espèce dans le Nord-est de la France basé sur des observations de spécimens vivants. Nous recommandons aux opérateurs de terrain de conserver tous les spécimens du groupe *S. corneum/ovale/nucleus* afin de fournir des identifications soutenues par l'ensemble des caractères présentés ci-dessus. Pour ce faire, les spécimens doivent être préalablement rapidement ébouillantés puis conservés dans de l'éthanol 80°. Un premier examen de la densité des pores doit au moins permettre de reconnaître *S. corneum* alors que l'examen de la forme du rein, à fort grossissement sous loupe binoculaire, est nécessaire pour séparer *S. nucleus* de *S. ovale*.

If sibling species are a stimulating challenge for taxonomists, requiring integrative approaches, they are often daunting for the citizen science community. However, a significant amount of

regional data on species occurrence is recorded by amateur naturalists (Levrel *et al.* 2010) and some species remain poorly documented due to a lack of operational identification tools that are accessible to the widest range of users. This could lead to biases in our knowledge of the composition of species communities, as well as of the distribution, ecology and threat status of these elusive species (e.g. for freshwater molluscs in Lopes-Lima *et al.* 2021). To reduce these gaps, and given the lack of taxonomic expertise (especially for mollusc group), it is necessary to provide/use appropriate identification tools, invest in taxonomic training and/or switch to molecular methods that are less prone to misidentification. For example, identification approaches based on diagnostic anatomical characters have led to a better understanding of the distribution in north-eastern France of morphologically similar species within the genera *Stagnicola* Jeffreys, 1830 [*S. corvus* (Gmelin, 1791) vs. *S. palustris* (O.F. Müller, 1774) vs. *S. fuscus* (C. Pfeiffer, 1821)] (Umbrecht & Bichain 2020) and *Oxyloma* Westerlund, 1885 [*O. elegans* (Risso, 1826) vs. *O. sarsi* (Esmark, 1886)] (Bichain, Ryelandt & Umbrecht 2021).

Similarly, among bivalves, the Oval Orb Mussel *Sphaerium ovale* (Férussac, 1807) shows a high degree of morphological overlap with *Sphaerium corneum* (Linnaeus, 1758) and *Sphaerium nucleus* (S. Studer, 1820). The taxonomic history of the former species is complex (Korniushin 2001), but it is considered a "good" species (MolluscaBase 2024) on the basis of morpho-anatomical characters (Korniushin & Hackenberg 2000). *Sphaerium ovale* is widespread from Europe to Siberia with the exception of Iceland, Ireland, Scandinavia, northern Russia, Sicily and the Greek islands (IUCN 2011, Welter-Schultes 2012). According to Zettler & Glöer (2006), the species inhabits a range of aquatic habitats, including running water (rivers, canals and streams) and permanent standing water (ditches, old arms of rivers) on a variety of substrates, including sandy silt, fine sand and coarse sand. Furthermore, these authors also suggest that *S. ovale* has similar habitat requirements to *Euglesa pulchella* (Jenyns, 1832). In France, occurrence data are scarce (INPN 2024) and very few of them are supported by publications illustrating specimens collected and/or diagnostic characters used. The species is absent from previous checklists (Bichain *et al.* 2019, Bichain *et al.* 2021) and regional red lists (Geissert, Bichain & Bertrand 2003, Bichain 2015) for north-eastern France. However, the Oval Orb Mussel has recently been recorded from environmental DNA [eDNA] surveys in that large area (Bichain *et al.* 2023) and from live specimens sampled in Alsace, north of Strasbourg (new data presented here). The main objective of this contribution is consequently to describe the habitat where these specimens were collected and to provide diagnostic characters to help identify this poorly known species.

The specimens were collected [second and third authors] on 09 September 2024 in a natural site located near the Rhine at Fort-Louis (48.810109°N; 8.059376°E; altitude 118m), north of Strasbourg. The site is managed by the *Conservatoire d'Espaces Naturels d'Alsace*, a French NGO partly funded and mandated by public authorities. The habitat corresponds to a dead arm of the Moder (Figures 1A & 1B), periodically fed by the floods of the river Moder and by the phreatic aquifer. The flora is mesotrophic to oligotrophic, with a settled population of *Utricularia neglecta*

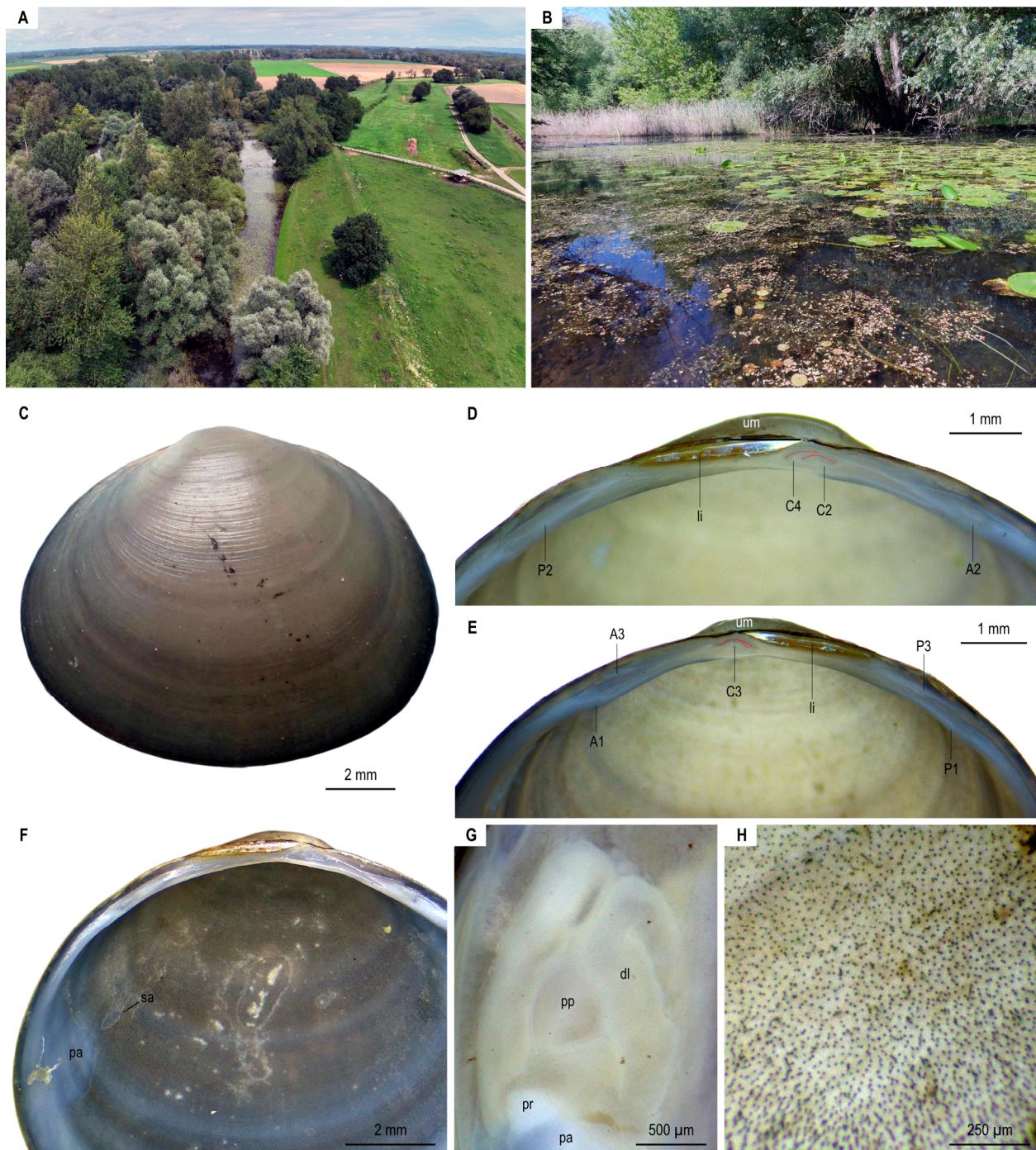
Lehm, 1828. The sampling area is well exposed to the sun, with depths ranging from a few tens of centimetres to over 1.30 metres. The substrate is sandy silt with gravel outcrops in several places. Sampling was carried out with a fine mesh net (500 µm) over an area of a few square metres near the shore.

A total of 7 live specimens were collected, including 3 adults and 4 juveniles. The shells are round-oval, tumid and nearly equilateral (Figure 1C). The largest individuals measure 12 mm in length, 10 mm in height and 6 mm in diameter. The umbo is broad, rounded and not prominent. The sculpture consists of very fine, irregular, concentric riblets, with some stronger growth lines. The ligament is short, narrow, barely visible between umbo. The periostracum is dull to silky, slightly greenish to horny brown. The juveniles have the same external features, but their shells are distinctly rounded and pale green. The hinge plate is long and thin, not constricted at the cardinal teeth. The cardinal teeth are very small, C3 moderately curved and bifid posteriorly (Figure 1E); C2 and C4 very short, close together and slightly curved, C2 more than C4 (Figure 1D). The C4 reaches the midpoint of C2. The inner surface of the shell has a high density of pores, especially near the umbo, with an average spacing of about 30 µm (Figure 1H). The posterior muscle scars (posterior adductor and siphonal adductor) are separate or very close to each other, but not fused (Figure 1F). The dorsal lobe of the nephridium (kidney) surrounds the pericardial tube completely, which is visible between its branches (Figure 1G).

These characters fully correspond to the diagnostic characters of *Sphaerium ovale* given by Korniushin & Hackenberg (2000). In addition, these authors distinguish *S. nucleus* on the basis of the shape of the kidney, which is square and closed, and by the shell that is more tumid. According to Korniushin & Hackenberg (2000), *Sphaerium corneum* has (i) a lower density of pores, spaced at about 100 µm near the umbo, (ii) a hinge plate narrowed at the cardinal teeth, (iii) the C4 tooth almost as long as the C2 tooth, (iv) completely fused posterior muscle scars, and (v) an elongated, open kidney.

Previously, *Sphaerium ovale* had only been recorded in north-eastern France from eDNA data (see Bichain *et al.* 2023 for more details). Molecular identification was based on a 16S sequence (not deposited in GenBank) obtained from samples collected in Normandy and the Seine basin (Prié *et al.* 2020). A total of 6 eDNA samples were positively matched to this "*S. ovale*" haplotype in north-eastern France: (i) in the river Aisne near Villers-en-Argonne (2020-07-10; 49.019095°N; 4.970704°E; 147 m); (ii) in the river "Zinsel du Nord" near Zinswiller (2021-09-02; 48.913195°N; 7.604711°E; 178 m); (iii) in the river Ill near La Wantzenau (2022-05-24; 48.667220°N; 7.878553°E; 128 m); (iv) in the river Blaise near Arrigny (2021-09-27; 48.628365°N; 4.698859°E; 113 m); (v) in the river Marne near Vouécourt (2021-09-16; 48.267236°N; 5.138557°E, 223 m) and (vi) in the river Voir near Rives-Dervoises (2021-09-17; 48.480756°N; 4.697181°E; 119 m).

However, these results should be treated with caution. Indeed, these eDNA occurrences have not been confronted with traditional field surveys and it remains unclear how well the reference database of Prié *et al.* (2020) can accurately identify species within the genus *Sphaerium*.



**Figure 1** - Sampling site and shell of *Sphaerium ovale* (A. Férrussac, 1807) in north-eastern France

**A.** Aerial view of the sampling site; **B.** Sampling site corresponding to a dead branch of the Moder; **C.** Outer surface of the shell; **D.** Hinge detail of the left valve; **E.** Hinge detail of the right valve; **F.** Muscle scars on the left valve; **G.** Nephridium (kidney); **H.** Pores on the inner surface of the shell near the umbo. **Abbreviations:** **dl** dorsal lobe of nephridium, **li** ligament, **pa** posterior adductor muscle on **1G** (posterior adductor muscle scar on **1F**), **pp** pericardial part of the nephridium, **pr** pedal retractor, **sa** siphonal adductor muscle scar, **um** umbo.

Our data therefore represent the first record of the species in north-eastern France based on direct observations of live specimens. We recommend that field workers preserve all specimens that are morphologically close to the *S. corneum/ovale/nucleus* group. Specimens should be boiled quickly and then stored in 80% ethanol. An initial examination of pore density near the umbo should at least allow *S. corneum* to

be separated from *S. ovale/nucleus*, although a more careful examination of the shape of the kidney is required to separate *S. nucleus* from *S. ovale*.

This work is an example of virtuous collaboration between taxonomists and natural environment managers. Indeed, these specimens of *Sphaerium ovale* and the linked environmental data

were collected by field technicians from CEN Alsace (second and third authors, see also Acknowledgements) following training sessions in sampling methods and freshwater mollusc identification provided by the first author. According to Cardoso et al. (2011), training and identification tools were appropriate solutions to reduce the biodiversity knowledge gap, especially for understudied groups such as molluscs.

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