

Sundadontina mabilli (Rochebrune, 1882), a valid freshwater mussel species from Southern Vietnam (Unionidae: Gonideinae: Pseudodontini)

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Abstract

Here we report on the first molecular-genetic data for the little-known freshwater mussel species, *Sundadontina mabilli* (Rochebrune, 1882), from Southern Vietnam, based on new samples collected around the type locality. Comparative morphological studies and molecular analyses confirmed the valid status of this taxon. According to the multi-locus phylogeny, *Sundadontina mabilli* represents a well-supported clade within the genus and is sister to *S. tumida*. Current data reveals that the range of the species is located in the Dong Nai River basin and Mekong Delta.

Key words new samples, DNA sequencing, integrative taxonomy, multi-locus phylogeny.

Introduction

The Pseudodontini (Bivalvia: Unionidae: Gonideinae) is known as the most species-diverse tribe among freshwater bivalve molluscs on the Indochina Peninsula (Bolotov et al. 2017a, 2017b, 2020, 2023;

Konopleva et al. 2021; Jeratthitikul et al. 2021, 2022, 2025; Jeratthitikul & Sutcharit 2023). Notably, representatives of the subtribe Pseudodontina Frierson, 1927 generally inhabit waterbodies of the Sundaland Subregion (Mekong and Chao Phraya basins, Thai-Malay Peninsula, and the Greater Sunda Islands). In contrast, the range of the subtribe Indopseudodontina Bolotov, Konopleva, Kondakov & Vikhrev, 2023 covers the West Indochina Subregion (Bolotov et al. 2023). In spite of recent extensive sampling efforts, five nominal Pseudodontini species described from the Sundaland Subregion, are, *Sundadontina mabilli* (Rochebrune, 1882), *S. moreleti* (Crosse & Fischer, 1876), *S. ovalis* (Morlet, 1889), *S. ponderosa* (Preston, 1909), and *Pseudodon thomsoni* Morlet, 1884, remained known only from museum collections and historical literature (Bolotov et al. 2023). Recently, Jeratthitikul et al. (2025) revised the taxonomic status of *Sundadontina moreleti* based on a large series of newly collected topotypes and transferred this species to the genus *Songkhlanai* Konopleva et al., 2023. Moreover, *Pseudodon thomsoni* Morlet, 1884 was synonymized with *Songkhlanai moreleti* (see Jeratthitikul et al. 2025). Nonetheless, the rest of taxa still require revision with DNA sequence data.

One of these species, *Sundadontina mabilli*, was described from ‘Cochinchine’ (now Southern Vietnam). Haas (1920) recognized it as a representative of the subgenus *Bineurus* Simpson, 1900. Later on, this author synonymized this nominal species with *Bineurus mouhotii* (Lea, 1863) (Haas 1969). Other malacologists considered this species as a representative of the genus *Pseudodon* Gould, 1844 (Brand 1974; He and Zhuang 2013). Finally, Bolotov et al. (2020) transferred *Pseudodon mabilli* to the genus *Sundadontina* Bolotov et al., 2020 based on morphological traits.

The most recent broad-scale overview of the unionid fauna of Vietnam was carried out by Do et al. (2018). Among the Pseudodontini of Southern Vietnam and the Mekong Delta area, several species of *Pilsbryconcha* and *Pseudodon* were listed. Specimens of *Sundadontina mabilli* from Dong Nai River were possibly mentioned as *Pseudodon inoscularis* (Gould, 1844) due to some similar morphological traits (Do et al. 2018). However, recent taxonomic revision of the tribe Pseudodontini showed that *P. inoscularis* is confined to its type locality, i.e. the Dawei (historically Tavoy) River basin in Myanmar (Bolotov et al. 2023).

In this paper, we present the first molecular data for *Sundadontina mabilli*, a little known nominal species of the subtribe Pseudodontina. New samples of this species were collected from a few sites in Southern Vietnam, not so far from its type locality. We also provide brief information on the phylogenetic affinities, range, and ecology of this species.

Materials and Methods

Living specimens of *Sundadontina mabilli* were collected from two localities of the Dong Nai River basin in Southern Vietnam (Figures 1, 2). The single dry shell was also found in an artificial channel at the Nui Cam Mountain in the Mekong Delta (Figure 1). The tissue snips were fixed in 96% ethanol and deposited in the collections of RMBH – Russian Museum of Biodiversity Hotspots, N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences (Arkhangelsk, Russia) and the Federal Scientific Center of the East Asia Terrestrial Biodiversity of the Far Eastern Branch of the Russian Academy of Sciences (Bioresource Collection No 2797657, Vladivostok, Russia).

For morphological analyses, we studied the original description of Rochebrune (1882) and the images of a syntype (Figure 3), provided by the Muséum national d'Histoire naturelle, Paris (MNHN). We mainly compared differences in the shell shape and outlines, umbo projection, sculpture, hinge structure, shape and development of anterior and posterior muscle scars (Bolotov et al. 2023).

New sequences of the mitochondrial *cytochrome c oxidase subunit I* (*COI*), *small ribosomal RNA* (*16S rRNA*), and the nuclear *28S ribosomal RNA* (*28S rRNA*) gene fragments were generated for five specimens using primers and laboratory protocols as described in our previous works (e.g., Bolotov et al. 2017a, 2017b) (Table 1). The alignment of gene fragments through MUSCLE algorithm and calculation of uncorrected *COI* p-distances between species within *Sundadontina* were performed using MEGA11 (Tamura et al. 2021).

The maximum likelihood multi-locus phylogeny of the tribe Pseudodontini was based on the newly obtained molecular data, as well as on sequences from previously published datasets (Bolotov et al. 2023: Supplementary Dataset 1; Jeratthitikul et al. 2024, 2025). For calculations, we used IQ-TREE

v. 1.6.12 (Nguyen et al. 2015; Trifinopoulos et al. 2016) with an automatic identification of the best evolutionary models for each partition (Kalyaanamoorthy et al. 2017) and 5000 ultrafast bootstrap replications (Hoang et al. 2017). The best-fit models of sequence evolution for each partition were as follows: TIM2+I+G (*COI*); TIM2+I+G (*16S rRNA*); and TIM3+G (*28S rRNA*).

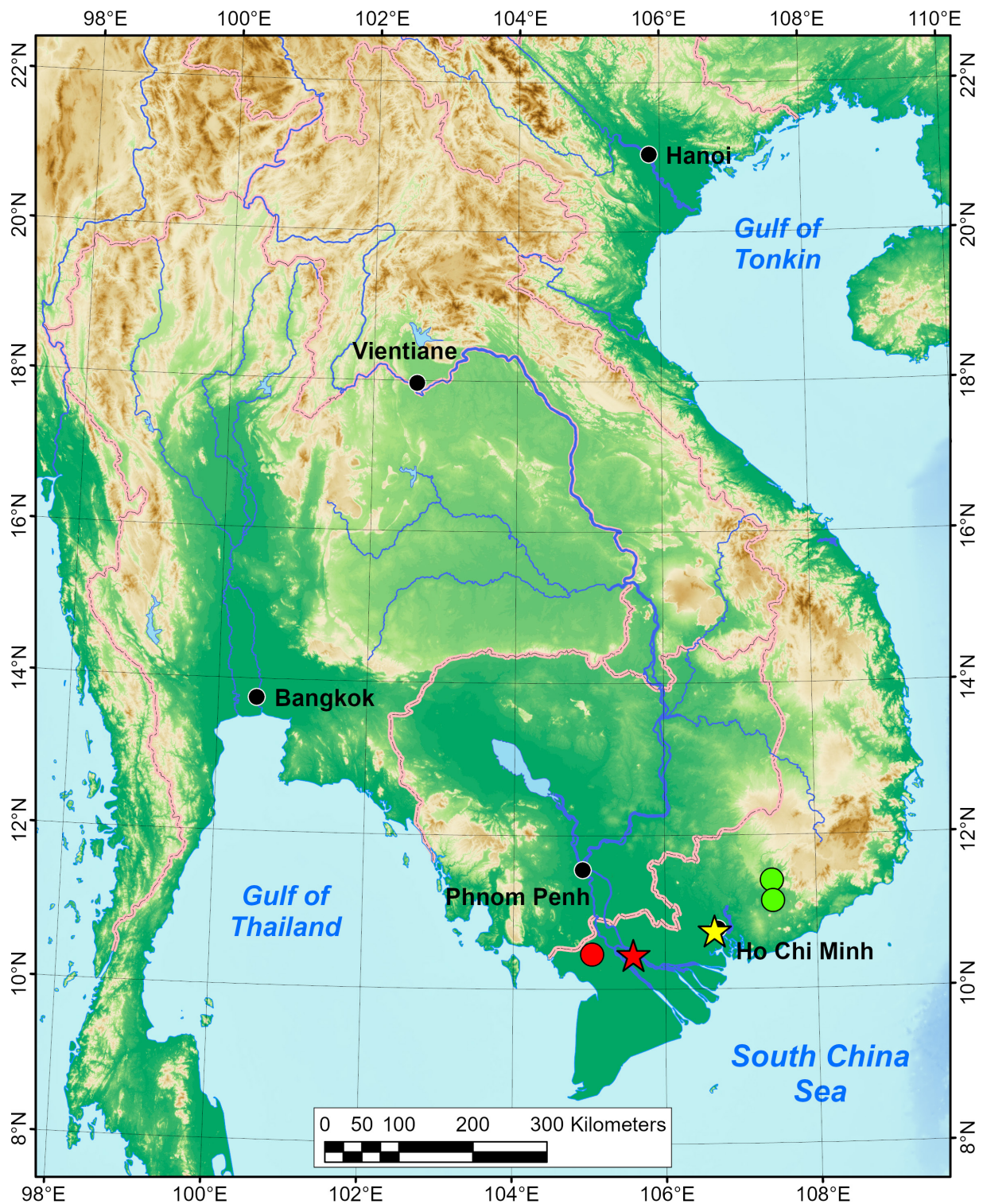


Figure 1. Records of *Sundadontina mabilli* (Rochebrune, 1882) in Southern Vietnam. The yellow star indicates the first type locality (Ben Thanh Market, Ho Chi Minh City) and the red star indicates the second type locality (Lower Mekong); the green circles indicate new records of this species based on DNA sequences; and the red circle indicates a dry shell-based record from the Mekong River basin. Map: Mikhail Y. Gofarov.

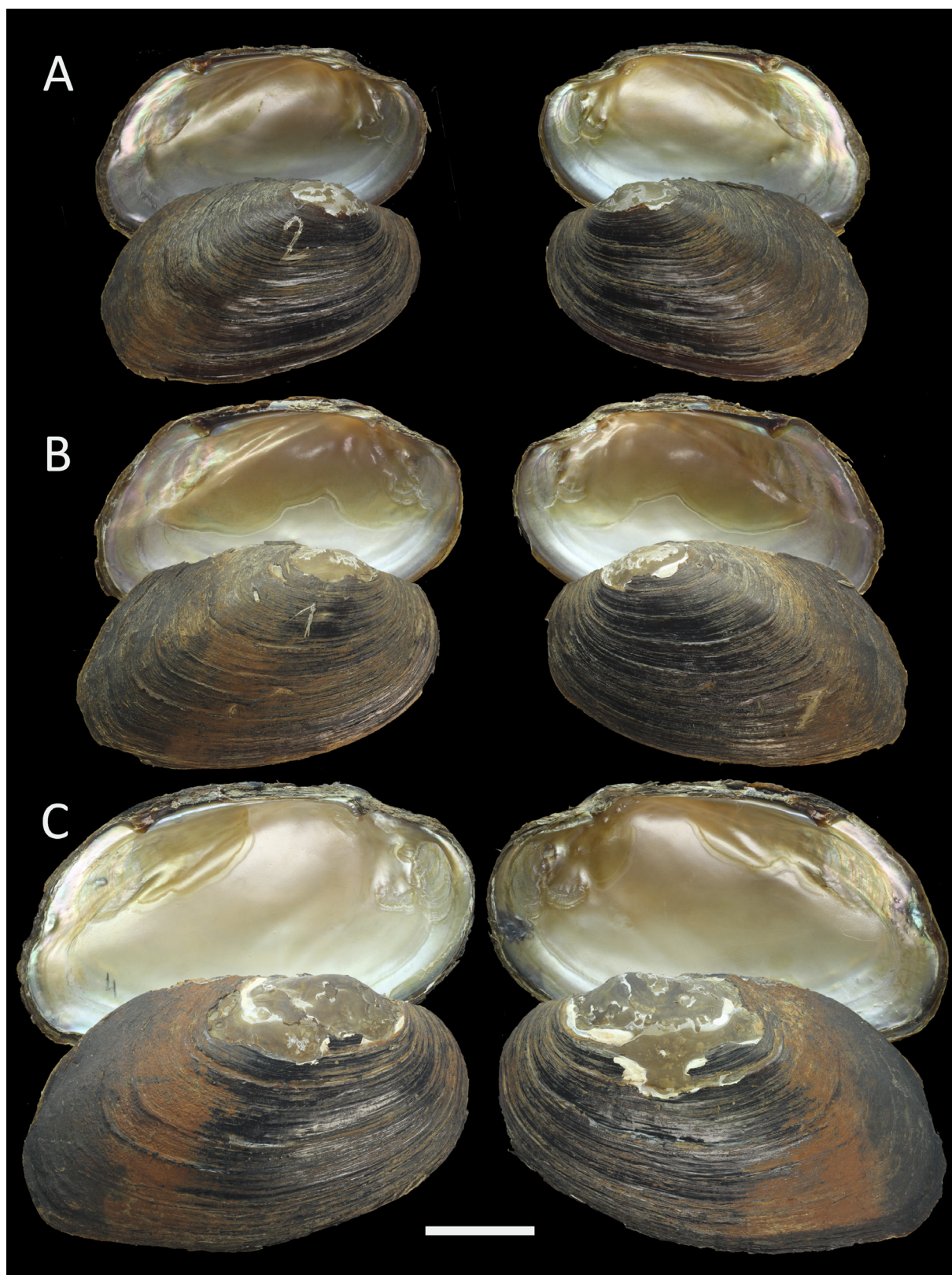


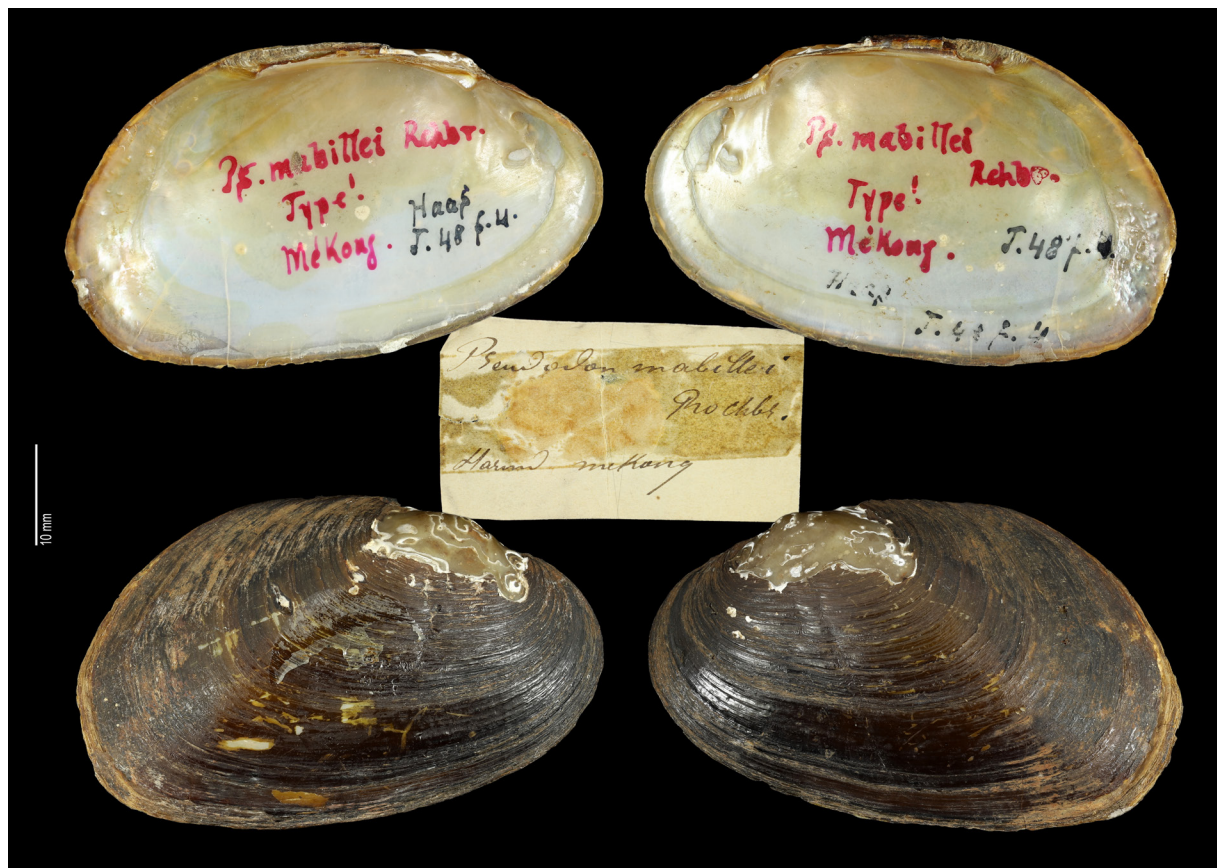
Figure 2. New samples of *Sundadontina mabilli* (Rochebrune, 1882), tributary of Dong Nai River, Southern Vietnam (external view of the left and right valves). (A) RMBH biv 1647/2; (B) RMBH biv 1647/1; (C) RMBH biv 1647/4. Scale bar = 20 mm. Photos: Ekaterina S. Konopleva.

Table 1. Information on new DNA sequences of *Sundadontina mabilli* (Rochebrune, 1882) from Southern Vietnam generated in this study.

Specimen Voucher	Locality	COI	16S rRNA	28S rRNA
RMBH biv 1647_1	Southern Vietnam: unnamed stream, Dong Nai River basin	PV563001	PV563006	PV563879
RMBH biv 1647_2	Southern Vietnam: unnamed stream, Dong Nai River basin	PV563002	PV563007	PV563880
RMBH biv 1647_3	Southern Vietnam: unnamed stream, Dong Nai River basin	PV563003	PV563008	PV563881
RMBH biv 1814_2	Southern Vietnam: La Ngà River, Dong Nai River basin	PV563004	PV563009	PV563882
RMBH biv 1814_3	Southern Vietnam: La Ngà River, Dong Nai River basin	PV563005	PV563010	PV563883

Results

Morphological studies revealed that the collected specimens correspond to the original description and an available syntype of *Pseudodon mabilli* Rochebrune, 1882 (see Taxonomic account). The type specimen seems to be a young individual and is very similar to some of our specimens (e.g., Figure 2A), which have higher dorsal margin and wider posterior side of the shell, than the older specimens with smoother outlines. All individuals mainly differ by oval-elongated, solid shells with dark-brown periostracum, sometimes with a copper tint, a rather thick knob-like pseudocardinal tooth on each valve, and well-developed anterior muscle scars. The general morphological characteristics of this species also follow the features of *Sundadontina* representatives (see Konopleva et al. 2021).

**Figure 3.** Syntype of *Sundadontina mabilli* (Rochebrune, 1882) MNHN-IM-2000-1740 (external view of the left and right valves) with label. Scale bar = 10 mm. Photos: Priscillia Gaël Bourguignon, MNHN.

According to the multi-locus phylogeny (Figure 4), sequences generated from our samples form a divergent, well-supported clade within the genus *Sundadontina* (BS = 99). The nearest congener for *Sundadontina mabilli* is *S. tumida* with an uncorrected *COI* p-distance of 5.8 ± 0.9 % ($\pm$ St. Err).

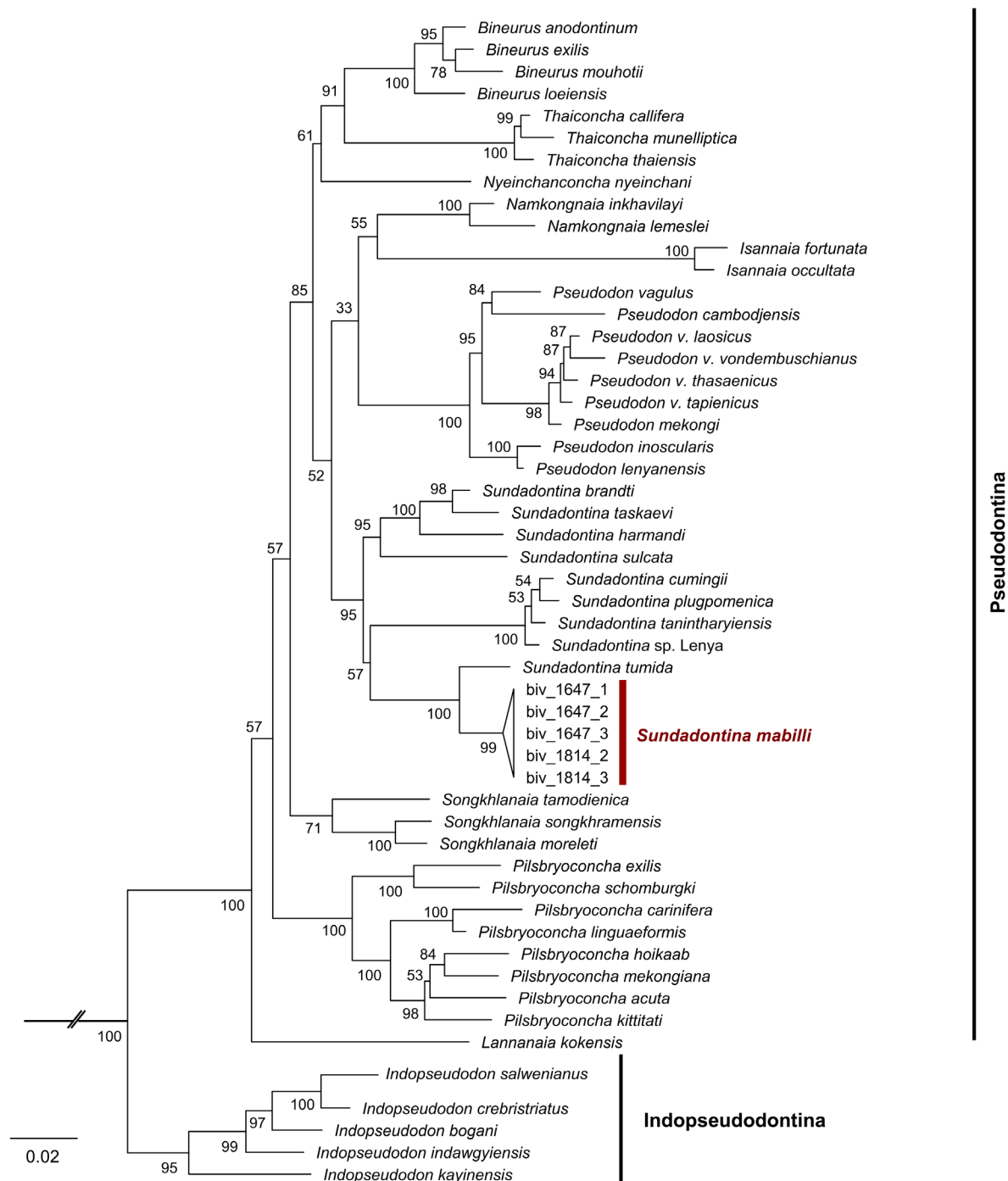


Figure 4. Maximum likelihood phylogeny of the multi-locus dataset (*COI*+*16S rRNA*+*28S rRNA*) of the tribe Pseudodontini. Name of the species under discussion (*Sundadontina mabilli*) is red. Numbers near nodes are ML ultrafast bootstrap support values (BS). Scale bar indicates the branch lengths. Outgroup is not shown.

Taxonomic account

Family Unionidae Rafinesque, 1820

Subfamily Gonideinae Ortmann, 1916

Tribe Pseudodontini Frierson, 1927

Subtribe Pseudodontina Frierson, 1927 (type genus: *Pseudodon* Gould, 1844; by original designation).

Genus *Sundadontina* Bolotov et al., 2020 (type species: *Anodonta cumingii* Lea, 1851; by original designation)

***Sundadontina mabilli* (Rochebrune, 1882)**

Type and type locality. Syntype MNHN-IM-2000-1740; “Shiglioni Breithon, Cochinchine (M. Pierre), M.P.” (Rochebrune 1882). Other spellings of this toponym are as follows: “Spiglioni-Briton”, “Spiglumi-Britton”, “Spiglumi-Breiton” (see Fischer 1891). At first glance, this locality could be decoded as follows: Saigon – Bến Thành, Cochinchine [= Bến Thành Market, 10.7725°N, 106.6980°E, Ho Chi Minh City, Southern Vietnam]. If our assumption is correct, the mussel sample was bought in the central market of Saigon (now Ho Chi Minh City). Historically, this market was situated on the shore of the Saigon River next to the Citadel of Saigon. “MP” means M[uséum] [de] P[aris]; “Harmand, Mekong” [= Lower Mekong, 10.44°N, 105.58°E, Southern Vietnam]. This writing is marked on the syntype label and inside of both valves (Figure 3). Thus, type locality includes two sites, one of which corresponds to the original description (market in Saigon), and the other complies with the label (Lower Mekong).

Images of the syntype are available on the online database of the Muséum national d'Histoire naturelle, Paris (MNHN; <https://science.mnhn.fr/institution/mnhn/collection/im/item/2000-1740?listIndex=2&listCount=6>).

Material examined. SOUTHERN VIETNAM: unnamed stream, 11.4105° N, 107.4166° E, tributary of Dong Nai River, 04.xi.2023, 8 specimens (RMBH biv 1647, including biv 1647/1, biv 1647/2 and biv 1647/3 sequenced), D. M. Palatov leg.;

La Ngà River, 11.1413° N, 107.4289° E, Dong Nai River basin, 25.xi.2014, 8 specimens (FEB RAS № 2797657 (shells); Genetic data: RMBH biv 1814, including biv 1814/2 and biv 1814/3 sequenced), L. A. Prozorova and N. X. Quang leg.;

artificial channel at the Bay Nui Mountains, 10.4534° N, 105.0362° E, An Giang Province, Tri Ton District, Mekong Delta, 24.xi.2012, 1 specimen (FEB RAS No. 2797657, No. 7519 LAP, only empty shell), L. A. Prozorova and N. X. Quang leg.

Diagnosis. The shell is elliptic, elongated, solid, moderately inflated; anterior margin is prognathous, rounded, the ventral margin is curved, the dorsal margin is slightly elevated, and the posterior slope has two hardly visible radial folds, stretching from the umbo to the posterior margin. The umbo is rather small, moderately projected, eroded. Periostracum is dark brown, sometimes with a copper color tint in the posterior margin, growth lines are clearly visible; the nacre is shining and area around the umbo has golden color. The pseudocardinal tooth on the right valve is massive, somewhat triangular and convex, shifted with the dorsal edge towards the umbo; the pseudocardinal tooth in the left valve is usually smaller, knob-like and concave. Lateral teeth are reduced. The anterior adductor muscle scars are oval-shaped, rather deep, connected or closely banded with the anterior retractor and protractor muscle scars. The posterior adductor muscle scars are more rounded and usually less developed. The pallial line is contiguous, becoming more visible with age.

Habitat and ecology. This species inhabits mountain watercourses with different type of substrate. As for the newly collected samples, some specimens inhabited a small mountain stream with cobble substrate (Figure 5A, B); the others were found in a stream with clay substrate and an artificial channel (only dry shell, Figure 5C, D).

Distribution. Dong Nai River basin and Mekong Delta in Southern Vietnam.

Comments. Rochebrune (1882) studied the Indochinese collection of the Muséum national d'Histoire naturelle, Paris, from Cochinchine and Cambodia. The type locality of *S. mabilli* in the original description record (Rochebrune 1882) was defined as Cochinchine, which should correspond to the southern region of Vietnam.

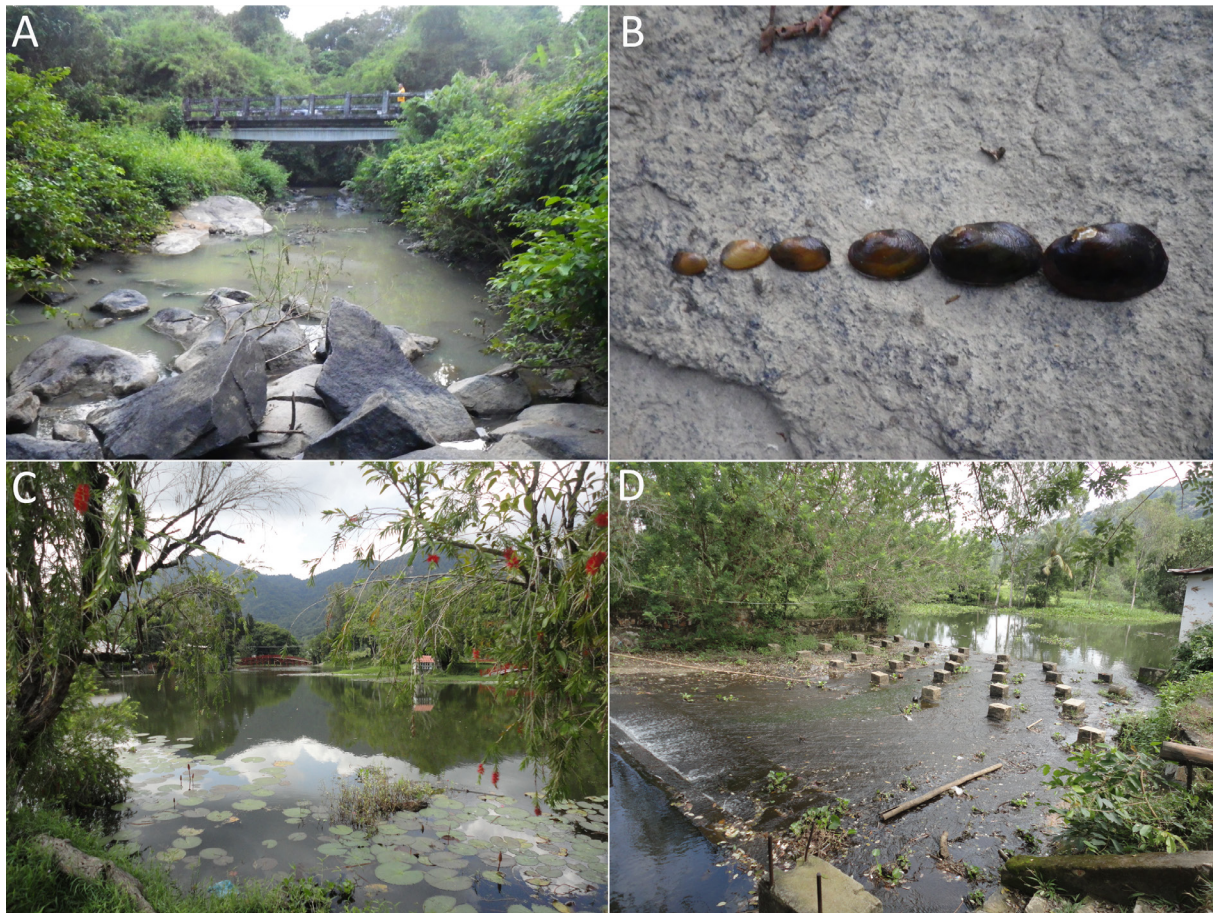


Figure 5. Habitats and shells of *Sundadontina mabilli* (Rochebrune, 1882) from Southern Vietnam. La Ngà River, Dong Nai River basin (A) and specimens of *S. mabilli* from this locality (B); different views of artificial channel at the Nui Cam Mountain, Nui Cam Nature Reserve, Mekong Delta (C, D). Photo: Larisa A. Prozorova.

Discussion

A number of questions arose regarding the exact type locality of *Sundadontina mabilli*. Rochebrune (1882) separated Cochinchine and Cambodia in his work, as did the French botanist Jean Baptiste Louis Pierre (Pierre 1880-1907), who was mentioned as a collector. The original description of *S. mabilli* states Cochinchine (Rochebrune 1882) as the type locality, that is, more likely, points on Southern Vietnam. However, the available museum syntype also has an original label “Harmand, Mekong” (Figure 3). In the subsequent works, some malacologists such as Morlet (1889) and Fischer (1891) also added Tonle Sap Lake, Cambodia (“Lac Tonle Sap”) as a habitat. Among the synonyms of *Bineurus mouhotii* (Lea, 1863), Brandt (1974) listed “*Pseudodon mabiliei* Rochebrune” and mentioned site “Mekong pres Sombor-Sombor” [Mekong River at Sambour, Cambodia], which, more likely, was confused with the type locality of *Bineurus anodontinum* (Rochebrune, 1882) (Konopleva et al. 2021). Our suggestion is to compromise and recognize both localities. The proposed localities cover Southern Vietnam (former Cochinchine) and the watercourses in the range of this territory, including the Lower Mekong Basin. Site “Shiglioni Breithon” remains the unknown locality, so it was reasonable to assume, that specimen could get to Pierre and later into Rochebrune’s collection from the central market of Saigon (Ho Chi Minh). Pierre himself worked and directed the Saigon Zoo and Botanical Gardens for a long time (Oustalet 1880-1881, p.64; Pierre 1880-1907) and had an opportunity to get some biological material from Southern Vietnam and surrounding areas.

Based on morphological, phylogenetic, and distribution data, we confirmed the validity of *Sundadontina mabilli*, a nominal species from Southern Vietnam. The range of this species apparently covers Dong Nai River basin and Mekong Delta with preferable habitats in small mountain watercourses. Living specimens of *S. mabilli* were found only in the Dong Nai River basin. However, a

single dry shell, morphologically identical to this species, was also collected from the Mekong Delta. This is not surprising, because several ichthyological studies confirmed a similarity of fish fauna of the Dong Nai River and the Lower Mekong due to the past connections during the Quaternary (Freyhof et al. 2000; Huy et al. 2022).

Sundadontina mabilli is apparently a habitat specialist, as are the majority of species in the genus *Sundadontina* (see Bolotov et al. 2023), which prefers lotic ecosystems in mountain and submountain areas in a restricted territory. The fact, that only one dry shell without living specimens was collected in the anthropogenic habitat of the Mekong Delta, confirmed the negative effect of artificial channels, dam pond constructions and other anthropogenic impacts (Zieritz et al. 2018). Specific environmental conditions suitable for *Sundadontina mabilli* propose further studies and monitoring efforts for this species.

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