

# CATHAIKA

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## A remarkable new species of *Aegistohadra* Wu, 2004 from Guizhou, southwest China (Gastropoda: Stylommatophora: Camaenidae)

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**Abstract:** *Aegistohadra jiangrixini* Z.-Y. Chen, **sp. nov.** is described and illustrated from Maolan National Nature Reserve, Guizhou Province, China. The new species can be distinguished from other members of the genus by its smaller size, depressed conical shell, and the pattern of bands. This new species represents the first report of *Aegistohadra* Wu, 2004 in Guizhou Province.

**Key words.** New species, morphology, taxonomy, land snail, new provincial record

### Introduction

*Aegistohadra* Wu, 2004 is a small genus of Camaenidae Pilsbry, 1895 with 12 known species from Southwest China, North Vietnam and Laos (Wu, 2004, 2023; Jirapatrasilp *et al.*, 2022; Lee, 2022). *Aegistohadra* Wu, 2004, was originally established as a monotypic genus based on the type species *Aegistohadra delavayana* (Heude, 1885) with its anatomical features (Wu, 2004). However, only recently has the high shell variability of *Aegistohadra* been revealed through anatomical and molecular phylogenetic studies, leading to the reassignment of some species, previously classified under *Amphidromus* Albers, 1850 and *Camaena* Albers, 1850, into this genus (Jirapatrasilp *et al.*, 2022; Wu, 2023). The shell general shape of *Aegistohadra* species ranges from elongate conical to heliciform. In this paper, I describe a new species of *Aegistohadra* from Guizhou Province, China.

### Materials and methods

Images of living animal and shell habitus were taken using a Canon® 5D Mark IV digital camera with Canon® EF 100mm f/2.8L IS USM macro lens. Images of the microstructures were taken using a Canon® 5D Mark IV digital camera with a Canon® MP-E 65 mm f/2.8 1–5X macro lens. A Godox® MF12 flash was used as the light source. Zerene Stacker® (version 1.04) was used for image stacking. All images were modified and assembled into plates using Adobe Photoshop® 2021. Whorls were counted as described by Kerney and Cameron (1979). Specimens are deposited in the Mollusks collection of Museum of Hebei University (HBUMM, Baoding, China) and Mianyang Normal University (MYNU, Mianyang, China).

## Systematics

Family **Camaenidae** Pilsbry, 1895

Genus ***Aegistohadra*** Wu, 2004

*Aegistohadra* Wu, 2004: 112.

*Aegistohadra* – Jirapatrasilp *et al.*, 2022: 264; Wu, 2023: 60.

**Type species.** *Nanina delavayana* Heude, 1885, by original designation.

***Aegistohadra jiangrixini* Z.-Y. Chen, sp. nov.**

姜氏脐厚螺

(Figure 1, 2, 3B)

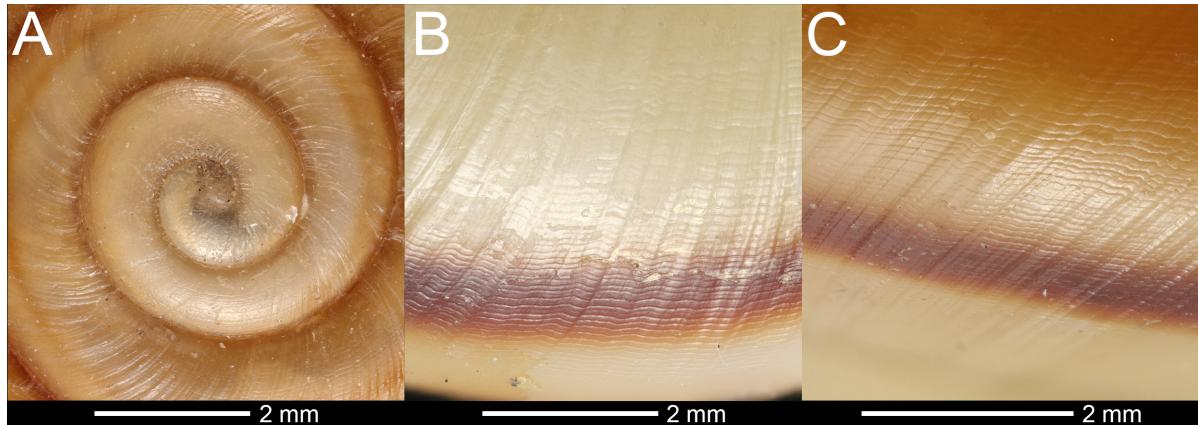
**Type materials.** *Holotype.* HBUMM (shell), Shishang Forest Scenic spot [石上森林], Maolan National Nature Reserve [茂兰国家级自然保护区], Libo County [荔波县], Qiannan Buyi and Miao Autonomous Prefecture [黔南布依族苗族自治州], Guizhou Province, China. 2024.X.15, leg. Ri-Xin Jiang. *Paratypes.* HBUMM (3 shells), MYNU (2 shells), Botanical Garden, Shishang Forest Scenic spot [石上森林], Maolan National Nature Reserve [茂兰国家级自然保护区], Libo County [荔波县], Qiannan Buyi and Miao Autonomous Prefecture [黔南布依族苗族自治州], Guizhou Province, China. 2019.VI.16. 780m. leg. Lu Qiu.

**Etymology.** This species is named after entomologist Ri-Xin Jiang, the collector of the holotype.

**Diagnosis.** A small *Aegistohadra* with a depressed sinistral shell and rounded periphery, a broad band along the periphery, a dark and narrow band on each side of the peripheral band, and an uppermost band attached to the suture.



**Figure 1.** Shell of *Aegistohadra jiangrixini* sp. nov., holotype.



**Figure 2.** *Aegistohadra jiangrixini* sp. nov., holotype. **A.** Protoconch. **B.** microstructures on the ventral side of body whorl. **C.** microstructures on the periphery of body whorl.

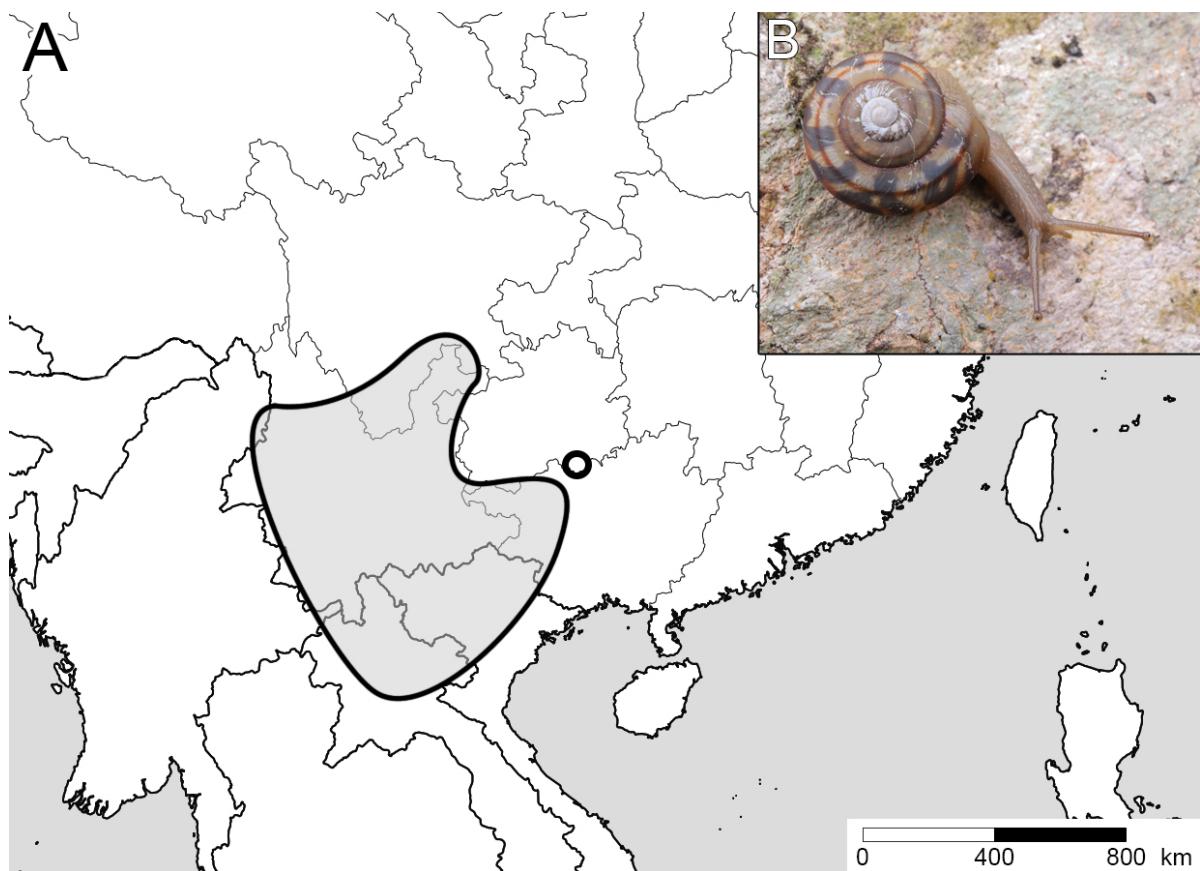
**Description.** Shell (Fig. 1) medium, small size for the genus, sinistral, thin but solid, depressed conical, with 4.75 slightly convex whorls separated by impressed suture. Protoconch (Fig. 2A) consisting of 1.5 whorls, very fine radial structure present near the suture. Shell surface with thin spiral furrows starting from protoconch (16–20 per 1 mm on body whorl) and irregular prominent growth lines (Fig. 2B–C). Body whorl peripherally rounded. Shell pale yellow with chestnut bands appearing and deepening about one whorl after the protoconch: one broad band on the periphery, partially covered by lower whorls on upper whorls; one darker, narrower band on each side of the periphery band, with the lower band fully covered by lower whorls, visible only at the body whorl; the most upper one much narrower and attached suture. Aperture oblique, ovate, suddenly descending in front, angulo-palatal margin of the aperture reaches to the lower band. Peristome slightly expanded and reflexed. Columella oblique. Umbilicus open, small, approximately 1/6 of shell major diameter, slightly covered by reflexed columella.

**Measurements.** Shell height: 13.0 mm, shell width: 25.5 mm (holotype).

**Differential diagnosis.** The conchological traits of the new species align with the revised diagnosis of *Aegistohadra* proposed by Jirapatrasilp *et al.* (2022). While *Aegistohadra* exhibits significant variability in shell morphology, there is a general trend among known species where the shell shape transitions from depressed to conical and elongate-conical as shell size decreases. *Aegistohadra jiangrixini* sp. nov., however, represents a smaller member of the genus with a distinctly depressed shell. This unique morphology sets it apart from other depressed species by size and from conical species of comparable size by shape. The banding pattern of *Aegistohadra jiangrixini* sp. nov. somewhat resembles that of *Aegistohadra jiahei* (Yang *et al.*, 2012), *Aegistohadra mirifica* (Bavay & Dautzenberg, 1909) and *Aegistohadra baii* Wu, 2023. It features a relatively broad peripheral band that is partially obscured by the suture but becomes visible near the aperture due to its descending aperture.

**Remarks.** The new species was found in crevices of tree trunks and bark. A photograph of a living juvenile individual shows pigmentation in the head region, but no prominent head wart has developed, which may be associated with the individual not yet reaching sexual maturity.

**Distribution.** Southwest China: Guizhou. This species is known from the type locality only. This is the first record of *Aegistohadra* found in Guizhou Province.



**Figure 3.** **A.** Distribution of *Aegistohadra*. Grey region: all previously known *Aegistohadra*; circle: *Aegistohadra jiangrixini* sp. nov. **B.** Living juvenile individual of *Aegistohadra jiangrixini* sp. nov. from the type locality.

### Acknowledgements

Thanks go to Ri-Xin Jiang [姜日新] (Guizhou University) and Lu Qiu [邱鹭] (Mianyang Normal University) for sharing the specimens of this species, to Zhong-Guang Chen [陈重光] (Nanchang University) and an anonymous reviewer for their helpful comments on the manuscript. This study was funded by research grants from the Malacological Society of London and the Melbourne Research Scholarship.

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## 贵州省脐厚螺属一新种（腹足纲：柄眼目：坚螺科）

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### 摘要

本文报道了产自贵州茂兰国家级自然保护区的脐厚螺属 *Aegistohadra* Wu, 2004 一新种：姜氏脐厚螺 *Aegistohadra jiangrixini* Z.-Y. Chen, sp. nov.。该新种系脐厚螺属在贵州的首次报道。与同属其他物种相比，姜氏脐厚螺具有较小的壳体、扁锥形的贝壳及其特有的色带形态等显著的区分特征。

**关键词：**新种，形态学，分类学，陆生贝类，省级新纪录

## Notes on wentletrap snail *Alexania inazawai* (Kuroda, 1943) from Xiamen, China, and its obligatory ectoparasitic behaviour on Orange-Striped Anemone *Diadumene lineata* (Verrill, 1869)

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**Abstract:** *Alexania inazawai* (Kuroda, 1943) is an ectoparasitic epitoniid obligatorily feeding on the sea anemone *Diadumene lineata* (Verrill, 1869). *Alexania inazawai* is originally described from Japan and had several records in China in recent years. In this work, *Alexania inazawai* populations discovered from three different sites in Xiamen are reported, and their habit and the evolutionary feature of this species is discussed.

**Key words.** China, Xiamen, malacofauna, obligatory parasite.

### Introduction

Epitoniidae Berry, 1910, commonly known as wentletraps, is a large family within Caenogastropoda. Most wentletraps have white, conical shells and are predatory or ectoparasitic benthic gastropods that feed on anthozoans (Cnidaria), including sea anemones (Actiniaria), flower corals (Zoantharia), and stony corals (Scleractinia). Uniquely, a specialized group of planktonic wentletraps, including *Janthina* Röding, 1798, and *Recluzia* Petit de la Saussaye, 1853, feeds on colonial cnidarians such as *Physalia* Lamarck, 1801, *Velella* Lamarck, 1801, and *Porpita* Lamarck, 1801 (Gittenberger *et al.*, 2006; Churchill *et al.*, 2011; Gittenberger & Hoeksema, 2013; Beu, 2017).

The epitoniid genus *Alexania* Strand, 1928, comprises several benthic species with globose shells. This genus was originally named *Alexandria* Tomlin, 1926, with its type species, *Alexandria natalensis* Tomlin, 1926, described from South Africa (Tomlin, 1926). However, *Alexandria* was later recognized as a junior homonym of *Alexandria* Pfeffer, 1881, prompting Strand (1928) to propose the replacement name *Alexania*. Subsequently, Strand (1932) proposed *Tomlinula* Strand, 1932 as another replacement name for *Alexandria* Tomlin, 1926, though it became a junior objective synonym of *Alexania*.

The monotypic species *Habea inazawai* Kuroda, 1943 was originally described from Kamakura, Japan, and assigned to the family Epitoniidae based on its anatomical and ecological characteristics (Kuroda, 1943). Another species, *Habea callizona* Habe, 1961, was described from Kashiwaima, Japan (Habe, 1961). This species has a shell shape similar to the former but features a distinct banded pattern (Habe, 1961; Tsuchida & Hasegawa, 2017).

Robertson and Habe (1965) later recognized, based on similarities in the radular structures and

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<http://zoobank.org/urn:lsid:zoobank.org:pub:4A1DD804-96C9-40BA-B1F3-9039B89A3854>

shell characteristics, that *Habea* Kuroda, 1943 is a synonym of *Alexania* Strand, 1928. They also proposed that *Alexania* exhibits obligatory ectoparasitic behaviour, specifically on *Diadumene* species. Tsuchida and Hasegawa (2017) provided illustrations of *Alexania inazawai* and *Alexania callizona* and noted that *Alexania inazawai* is often found attached to *Diadumene lineata* on rocks in intertidal zones.

*Alexania inazawai* from China was firstly reported in a result on intertidal fauna in southeastern China, but the detailed distribution was not mentioned (Liu *et al.*, 2023). In this paper, we report on three intertidal sites in Xiamen where *Alexania inazawai* were observed, represent the first record of this species in China. Its habitat and habits are also discussed.

## Materials and methods

Living individuals of *Alexania inazawai* were observed from the intertidal zones in Xiajinwan [厦金湾], Huangcuo [黄厝] and Zengshan [曾山], respectively in the east, southeast and south of Xiamen Island from May, 2022 to February, 2023. Shell materials attached on *Diadumene lineata* on the reefs in Zengshan at extremely low tide were collected for study. Identification of *Alexania inazawai* and its sympatric species based on Tsuchida and Hasegawa (2017) and Zhang (2008). Photos of the shell specimens were taken using Nikon D80 camera with Laowa 60mm F2.8 Macro 2:1 lens and were modified in Adobe Photoshop CS6 2012.

## Systematics

### Family **Epitoniidae** S. S. Berry, 1910 (1812)

#### Genus ***Alexania*** Strand, 1928

*Alexandria* Tomlin, 1926: 287 (non *Alexandria* Pfeffer, 1881 [Echinodermata]).

*Alexania* Strand, 1928: 63 (replacement name of *Alexandria* Tomlin, 1926).

*Tomlinula* Strand, 1932: 193 (replacement name of *Alexandria* Tomlin, 1926).

*Habea* Kuroda, 1943: 12. [Type species: *Habea inazawai* Kuroda, 1943, type by monotypy]

*Stenacme* Pilsbry, 1945: 113. [Type species: *Stenacme floridana* Pilsbry, 1945, type by original designation]

**Type species.** *Alexandria natalensis* Tomlin, 1926, type by typification of replaced name.

#### ***Alexania inazawai* (Kuroda, 1943)**

稻泽亚梯螺

(Fig. 2A–H, Fig. 3A–B)

*Habea inazawai* Kuroda, 1943: 12; Habe, 1961: 417, 423.

*Alexania inazawai* – Tsuchida & Hasegawa, 2017: 901, pl. 190, fig. 5.

*Alexania inazawai* – Liu *et al.*, 2023: 521, figs in text.



**Figure 1.** Recorded sites of *Alexania inazawai* in Xiamen.

**Material examined.** Living individuals were observed in Xiajinwan [厦金湾], Huangcuo [黄厝] and Zengshan [曾山], all from Xiamen, Fujian Province, China. A female and a male shell specimens collected from Zengshan are in Li-Wen Lin's private collection.

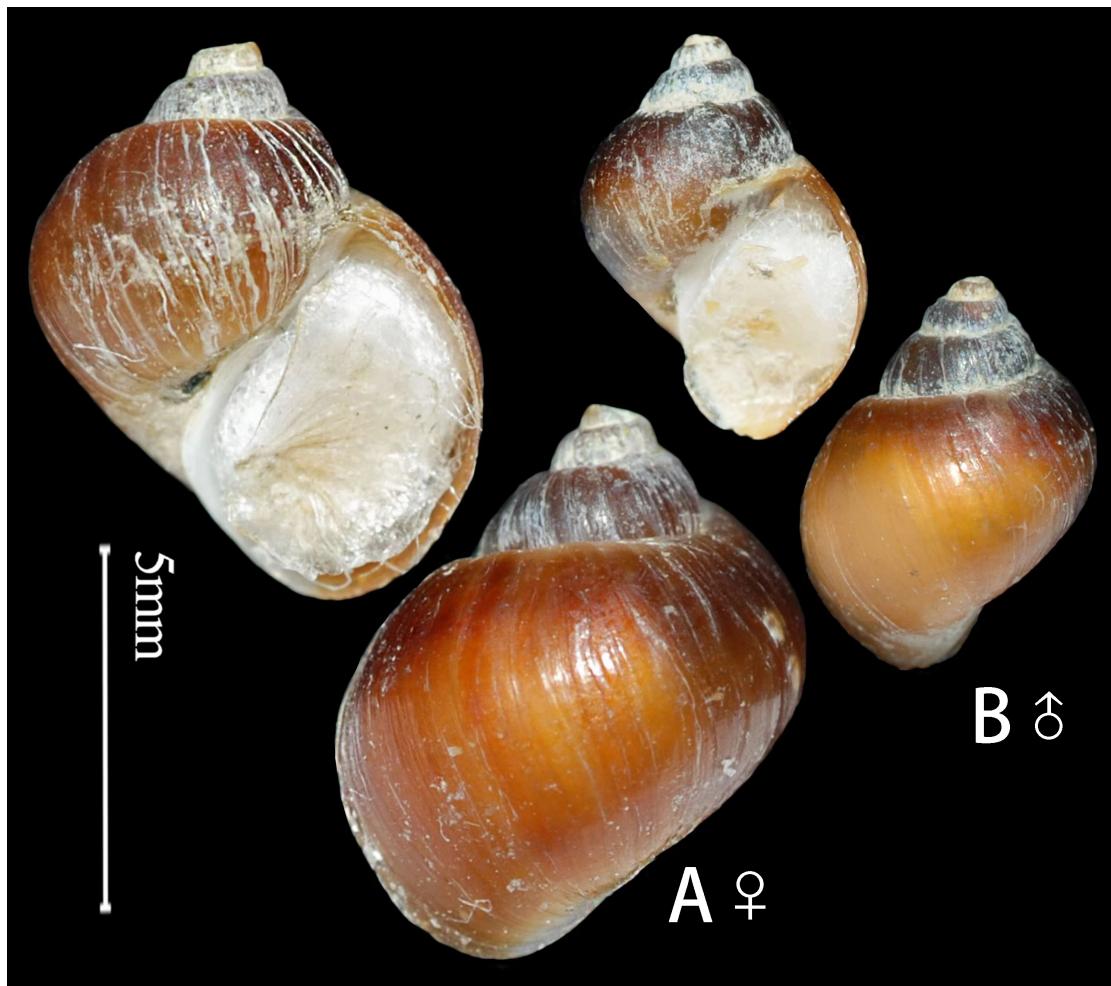
**Description.** Shell fragile, pale reddish-brown. Spire small; body whorl increases rapidly, forming inflated shape. Aperture round, outer lip thin. Columellar lip white and relatively thick, covering umbilicus. Female shell larger and generally more globose than male. In Xiamen individuals, female shells 7–11 mm; male shells rarely over 5 mm. Operculum thin, horny.

Soft part light grey to light yellow with dark grey patterns; characterized by epipodium-like flaps extending from both sides of foot, completely covering shell (Fig. 4H).

**Distribution.** CHINA: Fujian (Xiamen); JAPAN (Sagami Bay, Seto Inland Sea and western Japan Sea).

**Habitat.** *Alexania inazawai* is found on reefs in intertidal zones where the orange-striped anemone *D. lineata* grows in high densities. In Zengshan, the reefs inhabited by *A. inazawai* are fully exposed at low tide and are about three-quarters submerged at high tide. *Alexania inazawai* is well adapted to temporary exposure to air as the tides ebb and flow.

In the same environment in Xiamen, many other common intertidal mollusks were observed coexisting with *A. inazawai*, including *Mitrella bella* (Reeve, 1859), *Patelloidea pygmaea* (Dunker, 1860), *Littoraria sinensis* (Philippi, 1847), *Planostrea pestigris* (Hanley, 1846), *Barbatia grayana* (Dunker, 1867), *Neotrapezium sublaevigatum* (Lamarck, 1819), *Acanthochitona rubrolineata* (Lischke, 1873), and *Acanthopleura loochooana* (Broderip & G. B. Sowerby I, 1829).



**Figure 2.** Shells of *Alexania inazawai*. **A.** the female shell; **B.** the male shell.

**Habit.** The behaviour of *A. inazawai* aligns closely with that of typical epitoniid species (excluding *Janthina* and *Recluzia*), maintaining an obligatory or general parasitic relationship with coelenterates such as sea anemones and corals (Gittenberger & Hoeksema, 2013; Kokshoorn *et al.*, 2007).

Although we lack complete knowledge of the life history of *A. inazawai* due to the difficulty of observing its planktonic veliger stage, the diet and reproductive habits of adult snails are easily observed at low tide in intertidal zones. *Alexania inazawai* feeds exclusively on *D. lineata*, a common sea anemone species widely distributed in the Northern Hemisphere. The adult snails live on or near *D. lineata* and rarely move more than 5 cm away from their hosts. Most of the snails observed by the authors were attached to the sea anemones, feeding through their elongated proboscises. Other sea anemone species observed in the same habitat did not have any *A. inazawai* on them.

Usually, one female *A. inazawai* is accompanied by one to three males, all residing on the same anemone. Females lay eggs directly on the surface of the sea anemones or nearby. Around 20 to 30 egg capsules are clustered together on sea anemones or reefs, with both females and males remaining near the egg capsules.



**Figure 3.** The scenery of Zengshan. Arrows pointing to the reefs where *Alexania inazawai* lives.

### Discussion

The population of *Alexania inazawai* appears seasonally and somewhat randomly at various sites in Xiamen. Since 2021, the authors and others have conducted extensive field observations during different months, revealing that *A. inazawai* spawns in spring and summer, with few individuals observed on the reefs after September. In Zengshan, the population was concentrated in a relatively small reef area (Fig. 3). In 2022, approximately one-fiftieth of the observed *D. lineata* were consumed by *A. inazawai*, and this population completely disappeared by 2023 and 2024. The population density in Xiajinwan was low, with no more than five individuals recorded by the authors. In contrast, the population at Huangcuo in 2022 was thriving, with snails found attached to nearly every sea anemone observed, although this population also vanished by 2023. The density of *D. lineata* remains relatively constant at the same site during the same season each year, suggesting that the significant fluctuations in the population of *A. inazawai* may be attributed to variable local ocean currents, which affect the appearance of veligers. Reports on *A. inazawai* outside Japan are scarce (Liu *et al.*, 2023); however, extensive fieldwork indicates that this species also has a wide distribution in China. *Alexania inazawai* was first recorded from Fujian and Taiwan in Southeast China (Liu *et al.*, 2023; Liu Y., pers. comm.). Subsequent results have emerged from Qingdao and Yantai in Shandong Province, North China. Molecular analyses have confirmed that specimens from Shandong are conspecific with those from Japan (Han X., pers. comm.).

The adult habits of *A. inazawai* resemble those of traditionally known wentletrap snails, such as *Epitonium* spp. and *Amaea* spp., which are commonly found in intertidal zones and shallow continental shelves in Chinese waters (Zhang, 2008). However, *Alexania inazawai* exhibits distinct shell morphology, differing from the conical, tall-spined shells with developed ribs typical of common wentletrap snails. Instead, its shell morphology is more similar to that of *Recluzia* and *Janthina*, characterized by thin, globose shells, although it possesses a horny operculum, a feature typical of traditional wentletrap snails (Beu, 2017; Tsuchida & Hasegawa, 2017). Anatomical studies have shown that *Recluzia* and *Janthina* belong to the family Epitoniidae, supported by molecular analysis indicating they represent a specialized group of planktonic wentletrap snails that have late differentiated within the phylogenetic tree of Epitoniidae (Beu, 2017; Takano & Kano, 2014). As

anticipated, *Alexania inazawai* is closely related to the clade of *Recluzia* and *Janthina*, which may explain its habits resembling those of traditional wentletrap snails and its shell morphology similar to *Recluzia* (Churchill *et al.*, 2011; Beu, 2017). Other epitoniid genera, such as *Globiscala* (de Boury, 1909), *Alora* (H. Adams, 1861), and *Iphitus* (Jeffreys, 1883), also feature thin, globose shells (Tsuchida & Hasegawa, 2017). Thus, further research is necessary to clarify the relationships among these genera, the *Recluzia*-*Janthina* group, *Alexania inazawai*, and traditional wentletrap snails.



**Figure 4.** *Alexania inazawai* in life. **A.** Huangcuo, 5 July 2022. **B–C.** Huangcuo, 22 June 2022. **D–F.** Xiajinwan, 17 February 2023. **G–H.** Zengshan, 22 May 2022. Photos: Dan-Dan Zhong (A–F), Li-Wen Lin (G–H).

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## 福建厦门潮间带的稻泽亚梯螺及其专性寄生纵条矶海葵的记述

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### 摘要

稻泽亚梯螺 *Alexania inazawai* (Kuroda, 1943) 是一种专一以纵条矶海葵 *Diadumene lineata* (Verrill, 1869) 为食的寄生性海生腹足纲动物。这个物种最初描述于日本，近些年在中国有过多次记录。本文中作者报道了来自厦门三个不同采样点的种群，并对这个物种的习性和演化特征进行探讨。

**关键词：**中国，福建，软体动物相，专性寄生



## A new species of *Trichelix* Ancey, 1887 from northeast Guangxi, China (Gastropoda, Stylommatophora, Camaenidae)

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**Abstract:** A new species of camaenid land snail, *Trichelix yao n. sp.*, is described from Guangxi, China, based on its morphological characteristics. *Trichelix yao n. sp.* differs from all known congeners by its distinctly depressed, non-biconcave shell with prominent furrows, a palatal fold that does not extend to the aperture, a basal fold that reaches the aperture and forms a tooth. This discovery extends the known distribution of *Trichelix* in southern China and helps bridge the distribution gap of this genus in Guangxi.

**Key words.** Taxonomy, land snails, Guangxi, new species, new provincial record

### Introduction

The genus *Trichelix* Ancey, 1887 is a group of small to medium-sized land snails, characterized by a slightly flattened to concave shell with a hairy periostracum, which will fall off when the shells reach full maturity for some species, the elevated parietal callus, and the descending anteriorly last whorl with external furrows (Ancey, 1887; Sutcharit *et al.*, 2020; Lin & Lin, 2022).

*Trichelix* currently includes seven species distributed across East Asia and continental Southeast Asia (Sutcharit *et al.*, 2020; Lin & Lin, 2022). *Trichelix horrida* (Pfeiffer, 1863) occurs in northern Laos and Vietnam (Sutcharit *et al.*, 2020). *Trichelix eucharista* (Pilsbry, 1901), *Trichelix diminuta* (Pilsbry & Hirase, 1905) and *Trichelix tokunoensis* (Pilsbry & Hirase, 1905) are restricted to the Amami Islands in the central Ryukyu Islands, Japan (Sutcharit *et al.*, 2020). The remaining three species are found in southern China: *Trichelix biscalpta* (Heude, 1885) from Chongqing, *Trichelix hiraseana* (Pilsbry, 1905) from Taiwan, and *Trichelix xiaoxiang* Lin & Lin, 2022 from Hunan (Sutcharit *et al.*, 2020; Lin & Lin, 2022).

In this study, *Trichelix yao n. sp.* is described and illustrated as a species new to science from Guangxi Zhuang Autonomous Region, China. This discovery fills a gap in the distribution records of *Trichelix* in Guangxi and suggests that additional, yet-undiscovered species of this genus may occur in this region.

## Materials and methods

Living specimens were first submerged in pure water for 6 h, then immersed in boiling water for 1 min. The separated animal tissues were fixed in 70% ethanol, while the corresponding empty shells were cleaned and air-dried. Shells were photographed using a Nikon D80 camera with a Laowa 60 mm F2.8 Macro 2:1 lens. The number of shell whorls was counted according to Kerney & Cameron (1979). Specimens were deposited in the Mollusk Collection, Museum of Hebei University (HBUMM, Baoding, China).

## Systematics

### Family **Camaenidae** Pilsbry, 1895

#### Genus **Trichelix** Ancey, 1887

*Trichelix* Ancey, 1887: 64; Schileyko, 2003: 1513; Sutcharit et al., 2020: 68.

*Helix (Stegodera) [Trihelix]* Pilsbry, 1890: 6 (as a group of subgenus, incorrect subsequent spelling); Pilsbry, 1895: 289.

*Moellendorffia* (*Trihelix*) – Pilsbry, 1905: 65. (incorrect subsequent spelling)

*Moellendorffia* (*Trichelix*) – Zilch, 1960: 612.

**Type species.** *Helix horrida* Pfeiffer, 1863, by monotypy.

#### *Trichelix yao* R.-X. Lin & L.-W. Lin, n. sp.

瑶绒粒螺

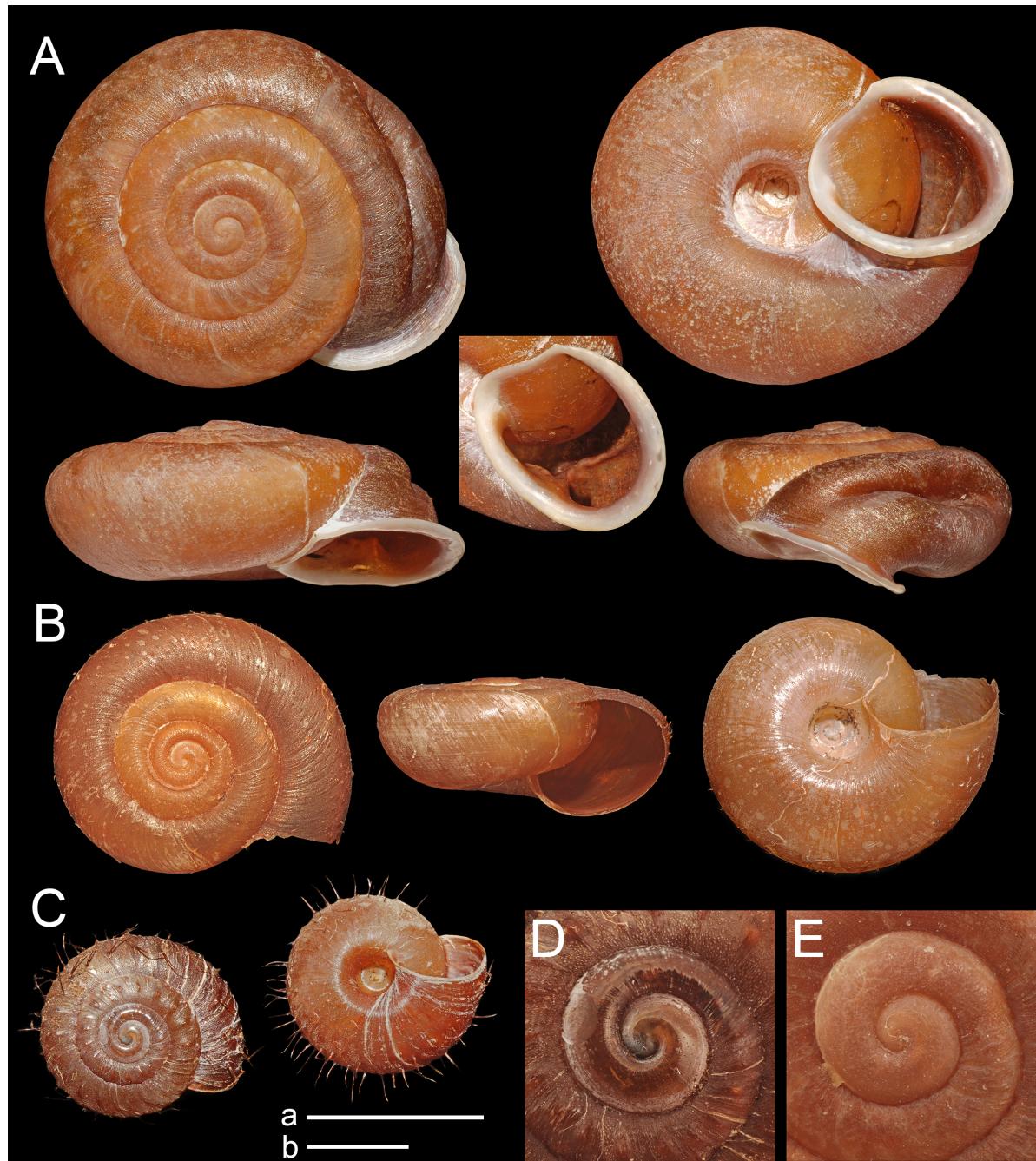
(Figures 1, 2)

**Type materials.** *Holotype*: HBUMM 10076, mature shell, Lianhuashan scenic area [莲花山景区], Dayaoshan National Nature Reserve [大瑶山国家级自然保护区], Jinxiu Yao Autonomous County [金秀瑶族自治县], Laibin City [来宾市], Guangxi Zhuang Autonomous Region [广西壮族自治区], China, 110°7'15"E, 24°9'16"N, 18 July 2024, leg. Wen-Yong Feng; *Paratypes*: HBUMM 10077, two subadult shells, other information same as holotype.

**Etymology.** The species is named after the Yao people, a minority ethnic group in China and continental Southeast Asia. Type locality of the new species, Dayao Mountain, is one of their traditional settlement areas.

**Diagnosis.** Shell medium-sized, depressed. Shell surface with long hairs but usually worn away upon maturity. Two palatal folds present, with corresponding deep furrows present distinctly on the shell surface. Upper palatal fold prominent, extending from  $\frac{1}{4}$  of the body whorl from aperture to a distance behind the aperture. Basal palatal fold extends from umbilical suture at  $\frac{1}{4}$  of the body whorl before aperture to just behind the aperture, weaker than former. Aperture oval, strongly downward sloping.

**Description.** *Shell* (Fig. 1) dextral, medium-sized, depressed with rounded periphery, consisting of 4.5 reddish brown and rather thick whorls separated by shallow suture. Protoconch composed of 1.5 smooth to somewhat glossy whorls. Shell surface with long and sparse periostracal



**Figure 1.** *Trichelix yao* n. sp. **A–C.** Shells. **D–E.** Protoconch. **A, E.** HBUMM 10076, holotype. **B.** HBUMM 10077/a, paratype. **C–D.** HBUMM 10077/b, paratype. Scale bar a = 10 mm (A–C), b = 2 mm (D–E). Photographs: Li-Wen Lin.

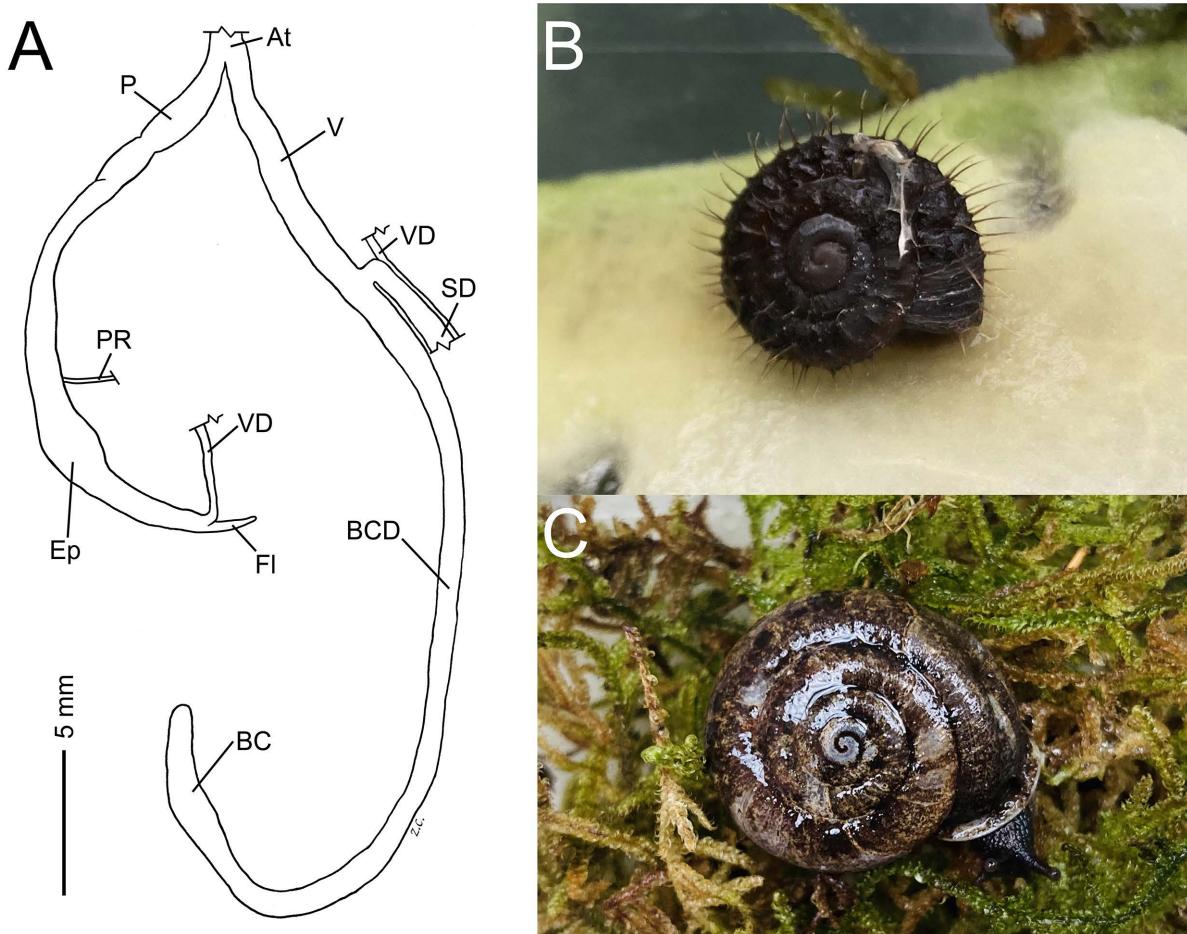
hairs, distinct in subadults but usually worn away upon maturity, leaving only blurred periostracal folds. Teleoconch surface with small tubercles arranged in oblique rows along the lines of growth, distinct on the dorsal side and around umbilical region. Two palatal folds present, highest parts oppositely positioned, with corresponding deep furrows present distinctly on the shell surface. Upper palatal fold prominent, situated along the periphery, extending from  $\frac{1}{4}$  of the body whorl from aperture to a distance behind the aperture, internally highest at its midpoint. Basal palatal fold

extends from umbilical suture at  $\frac{1}{4}$  of the body whorl before aperture to just behind the aperture, weaker than former. Body whorl strongly descending about  $\frac{1}{6}$  of a whorl behind the aperture. Aperture oval, strongly downward sloping, forming an angle with shell axis. Peristome expanded and very slightly reflexed, with a yellowish white margin. Parietal callus thicken but not expand. Umbilicus open and wide, approximately  $\frac{1}{5}$  of shell diameter, with protoconch visible inside.

**Genitalia** (Fig. 2A). Atrium short. Penis medium in length, consistent swelled, with longitudinal, thin, smooth pilasters internally. Epiphallus medium in length, distinctly inflated, longer than penis. Penis retractor muscle long, thick at the ends. Flagellum short and slightly thick, tapering distally. Vas deferens long and moderately thin. Vagina short and slightly thick. Spermoviduct cylindrical, shorter and thinner than vagina. Bursa copulatrix oval and thin, with a long and tapering pedunculus. Bursa copulatrix duct long, the middle part thinner than the ends.

**Measurements.** Adult: Shell height = 9.8 mm, shell width = 23.7 mm (*holotype*), subadult shells: shell height = 11.3–16.9 mm, shell width = 6.1–8.1 mm (*paratypes*).

**Remarks.** The new species can be distinguished from *Trichelix* species that lack lamellar teeth, which are primarily distributed in Vietnam and Laos, by the presence of such teeth. Among *Trichelix*



**Figure 2.** A. Genitalia of *Trichelix yao* n. sp. B–C. Living specimens of *Trichelix yao* n. sp. Abbreviations: At. Atrium; BC. bursa copulatrix; BCD. bursa copulatrix duct; Ep. epiphallus; Fl. flagellum; P. penis; PR. penial retractor muscle; SD. spermoviduct; V. vagina; VD. vas deferens. Images: Zhe-Yu Chen (A) and Ran-Xi Lin (B–C).

species with lamellar teeth, the new species differs from those without a biconcave shell shape mainly by having more shell whorls and deeper palatal folds, with the exception of *Trichelix biscalpta* (Heude, 1885) and *Trichelix hiraseana* (Pilsbry, 1905). *Trichelix biscalpta* is characterized by a long and strong upper palatal lamella that extends to the aperture, resulting in a curved aperture, which distinguishes it from the new species. While the new species shares some similarities with *Trichelix hiraseana*, it has a more rounded aperture and a basal lamella that is notably longer and deeper than that of the latter.

**Distribution and ecology.** This species is known from the type locality only, where it is typically active in leaf litter or humus.

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## 广西壮族自治区东北部绒粒螺属一新种记述

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### 摘要

本文基于形态学特征, 记述了产自广西大瑶山国家级自然保护区的陆生贝类一新种: 瑶绒粒螺 *Trichelix yao n. sp.*。该新种可通过以下特征与已知同属种相区分: 壳形明显扁平且非双凹型; 具两个腭褶, 对应的深沟在壳表清晰可见: 上腭褶不延伸至壳口, 基褶则延伸至壳口并形成齿突。这一新物种的发现拓展了绒粒螺属 *Trichelix* Ancey, 1887 在中国南方的分布范围。

**关键词:** 新种, 形态学, 分类学, 陆生贝类, 省级新纪录



## Littorinid fauna of Xiamen, China (Gastropoda, Littorinimorpha)

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**Abstract:** Littorinidae exhibits remarkable diversity in intertidal and subtidal zones worldwide, with many species closely associated with mangrove ecosystems. In recent years, the taxonomy of littorinids in the western Pacific has undergone substantial revisions through integrative studies of morphology, molecular phylogenetics, and ecological characteristics. In this paper, we report nine littorinid species recorded from various localities in Xiamen, Fujian Province, China. Specimens and live individuals were examined and photographed, their habitats documented, and certain taxonomic information updated based on the latest research.

**Key words.** Littorinidae, intertidal zones, mangroves, China, Fujian.

### Introduction

Littorinids, commonly known as periwinkles, are small to medium-sized marine gastropods adapted to intertidal and subtidal zones. Although typically abundant and easy to collect worldwide, the considerable variation in shell morphology and overlapping geographic ranges of similar species pose substantial challenges for taxonomic studies. Over the past half-century, integrative research combining shell and anatomical characteristics, molecular phylogenetics, and ecological traits has significantly advanced our understanding of these common yet taxonomically complex snails (Reid, 1989b; Reid, 2001).

Xiamen, a coastal city in Fujian Province, southeastern China, includes the main Xiamen Island and several smaller islands and peninsulas facing the Taiwan Strait to the east. The city features an extensive and diverse coastline encompassing reefs, sandy shores, mudflats, and mangrove forests, which collectively support high malacodiversity (Liu et al., 2023). Since the 1970s, large-scale land reclamation projects have dramatically altered the coastal landscape

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<http://zoobank.org/urn:lsid:zoobank.org:pub:A774AA43-6232-40FD-84B7-53C07A6FEB4A>

through the development of airports, ports, and tourist infrastructure. Nevertheless, the creation of wetland parks with transplanted and rehabilitated mangroves has contributed to a partial restoration of biodiversity in Xiamen's intertidal zones (Chen et al., 2021; Lin & Rolán, 2024).

The littorinid fauna of Xiamen comprises species from both the temperate zones of northern China and the subtropical regions of southern China and Southeast Asia. The earliest records of littorinids from the region are found in Yen (1933), who documented four species in a monograph on the marine mollusks of Xiamen: *Littorina brevicula* (R. A. Philippi, 1844), *Littorina scabra* (Linnaeus, 1758), *Littorina intermedia* R. A. Philippi, 1846, and *Littorina melanostoma* Gray, 1839. Subsequent works by D. G. Reid included references to Xiamen specimens and addressed taxonomic issues in this group (e.g., Reid, 1998; Reid, 2001; Reid, 2007). Chinese malacologists have also contributed monographs and reports documenting littorinid species from Xiamen and adjacent areas, focusing primarily on ecological observations and shell morphology (Yi & Li, 1988; Li et al., 1994; Chen et al., 2006; Chen et al., 2021; Chen et al., 2023; Liu et al., 2023). More recently, molecular techniques have been applied to littorinid studies in China. For example, the complete mitochondrial genome of *Littoraria ardouiniana* (Heude, 1885) was sequenced, providing novel insights into this species (Chen et al., 2024).

In this paper, we record nine littorinid species from five genera, based on fieldwork conducted between 2020 and 2024 at various sites in Xiamen. We also include one additional species previously recorded by Reid (2007) but not encountered during our surveys. Shells and



**Figure 1.** Studied sites of Littorinidae in Xiamen.

live specimens are photographed, and selected taxonomic information is updated in light of recent research.

### Materials and methods

Intertidal malacofaunal surveys were conducted at several readily accessible coastal sites in Xiamen (Table 1, Map 1). Littorinid species encountered during the surveys were documented, and representative specimens were collected from selected sites and deposited in Li-Wen Lin's private collection (LLWC, Fuzhou, China). For comparative purposes, two specimens of *Echinolittorina vidua* (A. Gould, 1859) [LLWC, Dongshan Island, Zhangzhou, Fujian Province, China], one specimen of *Littoraria flammaea* (Philippi, 1847) [LLWC, Rudong, Nantong, Jiangsu Province], and one specimen of *Peasiella roepstorffiana* (G. Nevill, 1885) [LLWC, Dadonghai, Sanya, Hainan Province] were also examined. Shell photographs were taken using a Nikon D80 camera equipped with a Laowa 60 mm F2.8 2:1 macro lens and edited with Adobe Photoshop CC 2019.

**Table 1.** Sampling locations and corresponding districts in Xiamen

Site No.	Location names	Location names in Chinese	Districts	Districts in Chinese
Site 1	Haiwan Park	海湾公园	Siming	思明区
Site 2	Gulangyu	鼓浪屿	Siming	思明区
Site 3	Baicheng - Hulishan Fortress	白城 - 胡里山炮台	Siming	思明区
Site 4	Zengshan	曾山	Siming	思明区
Site 5	Yazhou Haiwan	亚洲海湾	Siming	思明区
Site 6	Huangcuo	黄厝	Siming	思明区
Site 7	Xiajinwan - Guanyinshan	厦金湾-观音山	Siming	思明区
Site 8	Wuyuanwan Wetland Park	五缘湾湿地公园	Huli	湖里区
Site 9	Haicangwan Park	海沧湾公园	Haicang	海沧区
Site 10	Maluanwan	马銮湾	Haicang	海沧区
Site 11	Jimei School Village	集美学村	Jimei	集美区
Site 12	Xiatanwei	下潭尾滨海湿地公园	Xiang'an	翔安区
Site 13	Qianwu	前浦	Xiang'an	翔安区

### Taxonomy

#### Family Littorinidae

Genus *Littoraria* Gray, 1833  
拟滨螺属

**Type species.** *Littorina pulchra* G. B. Sowerby I, 1832, by monotypy.

*Littoraria melanostoma* (Gray, 1839)

黑口拟滨螺

(Figures 2 A–C, E, F)

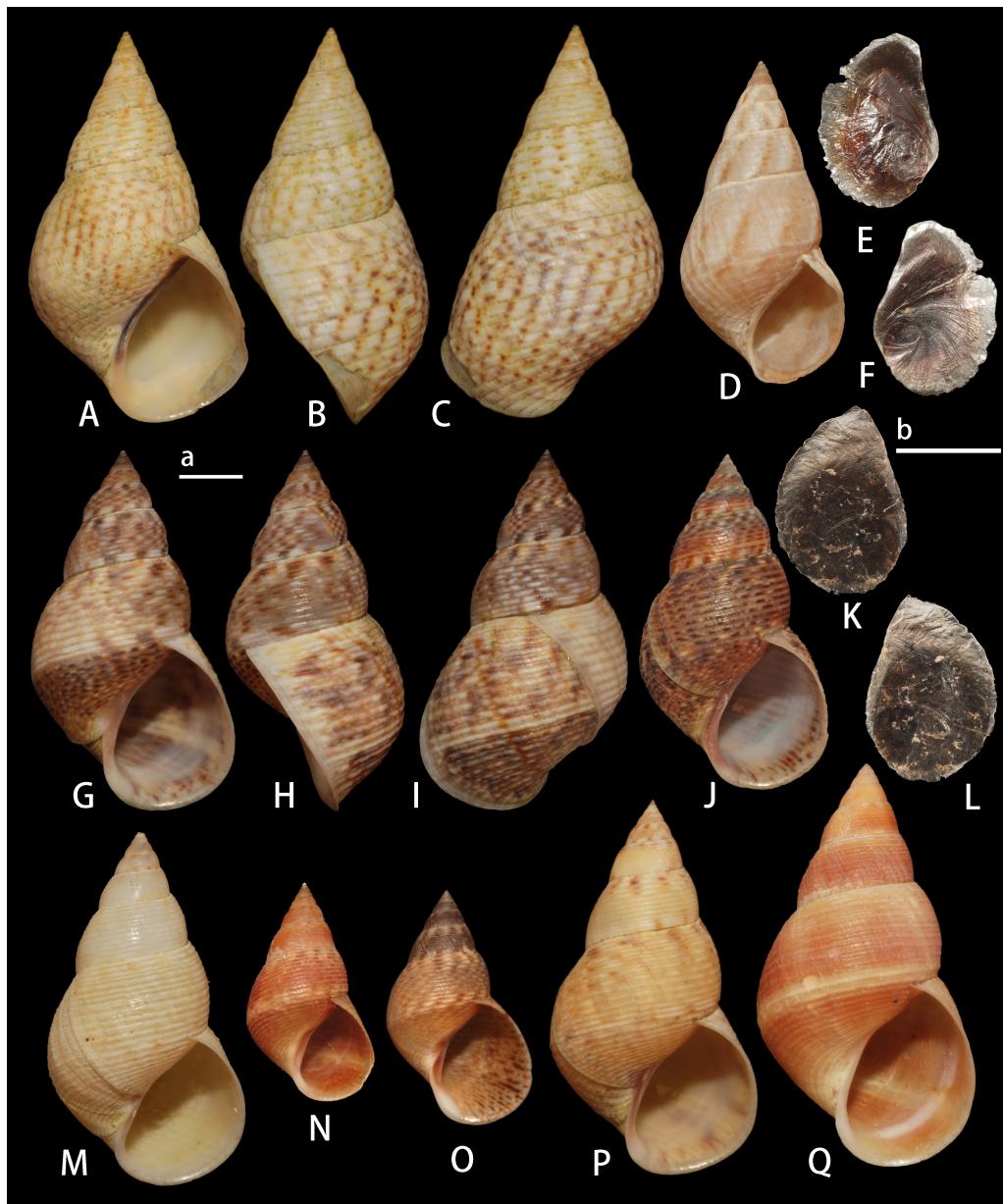
*Littorina melanostoma* Gray, 1839: 140; Yen, 1933: 94.*Littoraria melanostoma* – Reid, 2001: 127; Zhang & Li, 2008: 470; Liu *et al.*, 2023: 14, figs in text.**Material examined.** Specimens from Site 9 (LLWC).**Field observations.** Living individuals were observed in Sites 9, 11, 12 and 13.**Description.** Adult size range 17.5–24.1 mm height. Shell yellow to yellow green, spire tall, solid, with almost straight profiles to the spire and almost flat whorls, slightly angled at the periphery. Aperture relatively large and quadrangular, varices absent. Sculpture consisting of 15–17 flat spiral ribs on the last whorl. Colour pattern consisting of brown dots aligned to form narrow axial series. Parietal callus dark purplish brown. Operculum horny, brown, semiovate, paucispiral.**Type locality.** “Indian Ocean”**Distribution.** Eastern and Southern Asia (China: Fujian and its southern regions including sea areas around Taiwan).**Habitat.** In mangroves and usually on leaves near the top of mangroves. Seldom on artificial constructions like piers and breakwaters.**Remarks.** *Littoraria melanostoma* is easily recognised in this genus by the colour of the shell and columella. The congeneric species *Littoraria flammea* (Philippi, 1847) from Jiangsu (Fig. 2D) which is to the north of the distribution areas of *L. melanostoma* is morphologically similar but has a thin shell with weak varices and brown banding. Intermediate specimens were also found in Zhejiang, which locates between Jiangsu and Fujian. Molecular analysis showed that *L. melanostoma* from South China and *L. flammea* had a rather closed relationship and could be a cline of the same species (Dong *et al.*, 2015). However, there are still no molecular data on *L. melanostoma* from the Indian Ocean, so it remains uncertain whether “*L. melanostoma*” from China is the same species as *L. melanostoma* from the Indian Ocean (Dong *et al.*, 2015).*Littoraria ardouiniana* (Heude, 1885)

斑肋拟滨螺

(Figures 2 G–Q)

*Leptopoma ardouinianum* Heude, 1885: 95, plate 25, figs 8–8a.*Littoraria ardouiniana* – Reid, 2001: 125; Zhang, 2008: 52, figs in text; Zhang & Li, 2008: 470.*Littoraria pallescens* – Liu *et al.*, 2023: 17, figs in text. **Misidentification.****Material examined.** Specimens from Sites 9 and 13 (LLWC).**Field observations.** Living individuals were observed in Sites 9, 11, 13 and 12.

**Description.** Adult size range 12.9–22.7 mm height. Shell colour variable from yellow, brown, orange to white, spire tall, solid, with almost straight profile to the spire and almost flat whorls, highly angled at the periphery. Aperture relatively large and oval, showing exterior patterns. Varices very strong. Sculpture consisting of around 22 flat spiral ribs on the last whorl. Colour pattern variable, sometimes absent, and sometimes consisting of brown dashes aligned to form axial patterns with dashes between. Columella narrow and white. Operculum horny, light brown, semiovate, paucispiral.



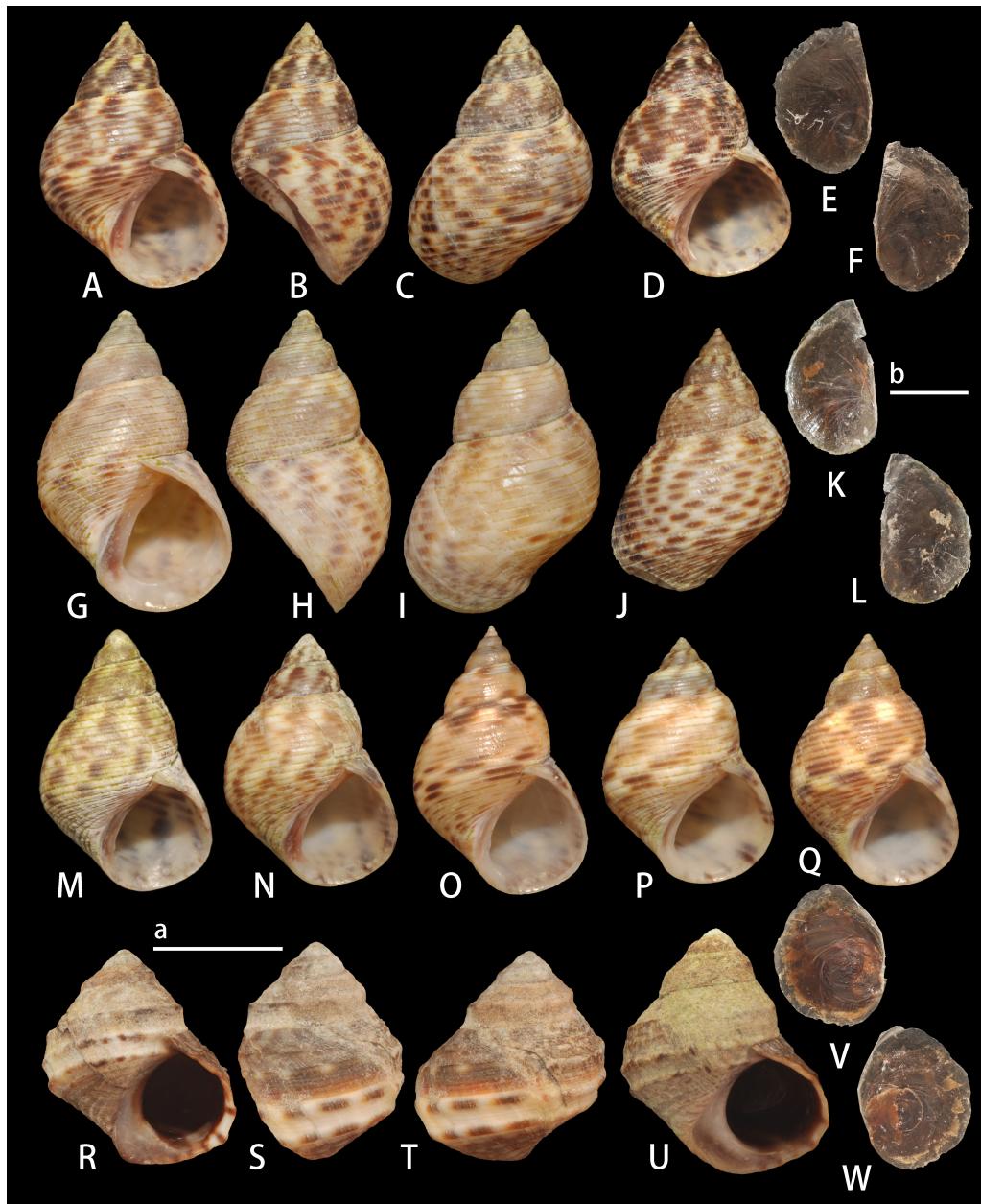
**Figure 2.** Specimens of *Littoraria*. **A–C, E–F.** *Littoraria melanostoma* from Haicangwan Park. **D.** *Littoraria flammea* from Rudong, Jiangsu Province. **G–L.** *Littoraria ardouiniana* from Haicangwan Park. **M–Q.** *Littoraria ardouiniana* from Qianwu. Photos: Li-Wen Lin. Scale bar: a = 5 mm, refers to A–D, G–J, M–Q; b = 5 mm, refers to E–F, K–L.

**Type locality.** “A-long, Tonkin” [Ha Long Bay, Vietnam].

**Distribution.** East and Southeast Asia (China: Fujian and its southern regions including sea areas around Taiwan).

**Habitat.** In mangroves and usually on leaves near the top of mangroves, also common on artificial constructions like piers and breakwaters.

**Remarks.** The population of *Littoraria ardouiniana* (Heude, 1885) from Xiamen is



**Figure 3.** Specimens of *Littoraria* and *Littorina*. **A–F.** *Littoraria articulata* from Haicangwan Park. **G–Q.** *Littoraria sinensis* from Haicangwan Park. **R–W.** *Littorina brevicula* from Hulishan Fortress. Photos: Li-Wen Lin. Scale bar: a = 5 mm, refers to A–D, G–J, M–Q, R–U; b = 2 mm, refers to E–F, K–L, V–W.

sometimes confused with *Littoraria pallescens* (R. A. Philippi, 1846) which is sympatric in South China. Generally, there are less but stronger ribs on shells of *L. pallescens* compared with shells of *L. ardouiniana*. *L. pallescens* was proved to be from Southern China (Hainan and Taiwan) with evidence of anatomical and molecular studies, and *L. ardouiniana* was recorded in Guangxi in the south and some areas in Fujian in the north (Reid, 2001; Chen *et al.*, 2024).

***Littoraria sinensis* (R. A. Philippi, 1847)**

中华拟滨螺

(Figures 3 G–Q)

*Littorina sinensis* R. A. Philippi, 1847: 16.

*Littorina scabra* – Yen, 1933: 92. Misidentification.

*Littorina (Littorinopsis) scabra* – Qi *et al.*, 1989: 29, pl. 5, fig. 4; **Misidentification**.

*Littoraria sinensis* – Reid, 2001: 125, fig. 38–52, 56–64, 68; Lin & Rolán, 2024: 11, fig. 10I.

*Littorina intermedia* – Zhang *et al.* 2008: 46, fig. 51. **Misidentification**.

**Material examined.** Specimens from Site 9 (LLWC).

**Field observations.** Living individuals were observed in all Sites.

**Description.** Adult size range 9.5–11.6 mm height. Shell cream with patterns of brown dashes on ribs and with whitish dashes between. Degree of axial alignment of dashes variable from tessellated pattern to short stripes. Spire high-turbinate, whorls rounded, 7–9 primary spiral ribs on spire whorls, suture impressed, periphery of the last whorl not angulated. Mature lip not flared, aperture cream with exterior patterns. Columella concave, purple brown. Operculum horny, brown, semiovate, paucispiral.

**Type locality.** China.

**Distribution.** East Asia (China: sea areas from Bohai Sea to Hong Kong; Japan).

**Habitat.** Various intertidal environments including reefs from the lowest to the highest water line, mangroves and artificial constructions like piers and breakwaters.

**Remarks.** Except its sympatric species *L. articulata*, *L. sinensis* is conchologically similar to *Littorina scabra* (Linnaeus, 1758) and *Littoraria intermedia* (R. A. Philippi, 1846) from South and Southeast China (Taiwan, Guangdong and Hainan). *L. scabra* has a larger adult shell with strong spiral ribs and sometimes with a carina on the last whorl, and its sympatric species *L. intermedia* has a taller spire and less inflated whorls (Reid, 2001; Reid, 1986 a; Ohgaki, 1992). *L. scabra* and *L. intermedia* has not been recorded in Xiamen or other areas of Fujian Province yet.

***Littoraria articulata* (R. A. Philippi, 1846)**

斑节拟滨螺

(Figures 3 A–F)

*Littorina intermedia* var. *articulata* R. A. Philippi, 1846: 141.

*Littorina intermedia* – Yen, 1933: 93.

*Littoraria articulata* – Reid, 2001: 134, fig. 53–55, 65–68.

**Material examined.** Specimens from Site 9 (LLWC).

**Field observations.** Living individuals were observed in all Sites.

**Description.** Adult size range 9.8–12.2 mm height. Shell very similar to *L. sinensis*, but darker, with distinct dashes well aligned into axial strips. Spire shorter, whorls flatter, spiral grooves finer. Columella longer, straighter, dark brown. Subadult shells with almost smooth surface (Figure 6 C). Operculum horny, brown, semiovate, paucispiral.

**Type locality.** Swan Point, Australia.

**Distribution.** South of East Asia, South and Southeast Asia, North Australia (China: Fujian and its southern regions).

**Habitat.** Various intertidal environments including reefs from the lowest to the highest water line, mangroves and artificial constructions like piers and breakwaters.

**Remarks.** *Littoraria articulata* is difficult to distinguish from its sympatric species *Littoraria sinensis* (R. A. Philippi, 1847) in Xiamen merely through shells. Generally, *L. articulata* has a more globose shell with flatter whorls and spiral grooves up to one quarter rib width, compared with shells of *L. sinensis* with a taller spire, slightly rounded whorls and grooves up to half to one time rib width. The length of penial filaments of these two species is distinctly different (Reid, 2001). The patterns of shells and morphology of apertures were also concluded in Reid, 2001 but these features become ambiguous when a large number of specimens from Xiamen are inspected.

Genus *Littorina* A. Féruccac, 1822  
滨螺属

**Type species.** *Turbo littoreus* Linnaeus, 1758, type by monotypy.

*Littoraria brevicula* (Gray, 1839)  
短滨螺  
(Figures 3 R–W)

*Turbo breviculus* R. A. Philippi, 1844: 166.

*Littorina brevicula* – Yen, 1933: 91; Qi et al., 1989: 28, fig. 27; Li et al., 1994: 44; Zhang, 2008: 51, text-figures; Zhang & Li, 2008: 470; Zhang et al. 2008: 45, fig. 50.

**Material examined.** Specimens from Site 3 (LLWC).

**Field observations.** Only observed in Sites 3.

**Description.** Adult size range 8.2–11.9 mm height. Shell biconical, dark brown to dirty white. Pattern sometimes absent, sometimes with whitish and brown spots. Shell with 3–5 strong spiral ribs. Surface of adult shells always eroded. Columella white, narrow, with pointed end. Operculum horny, brown, ovate, paucispiral.

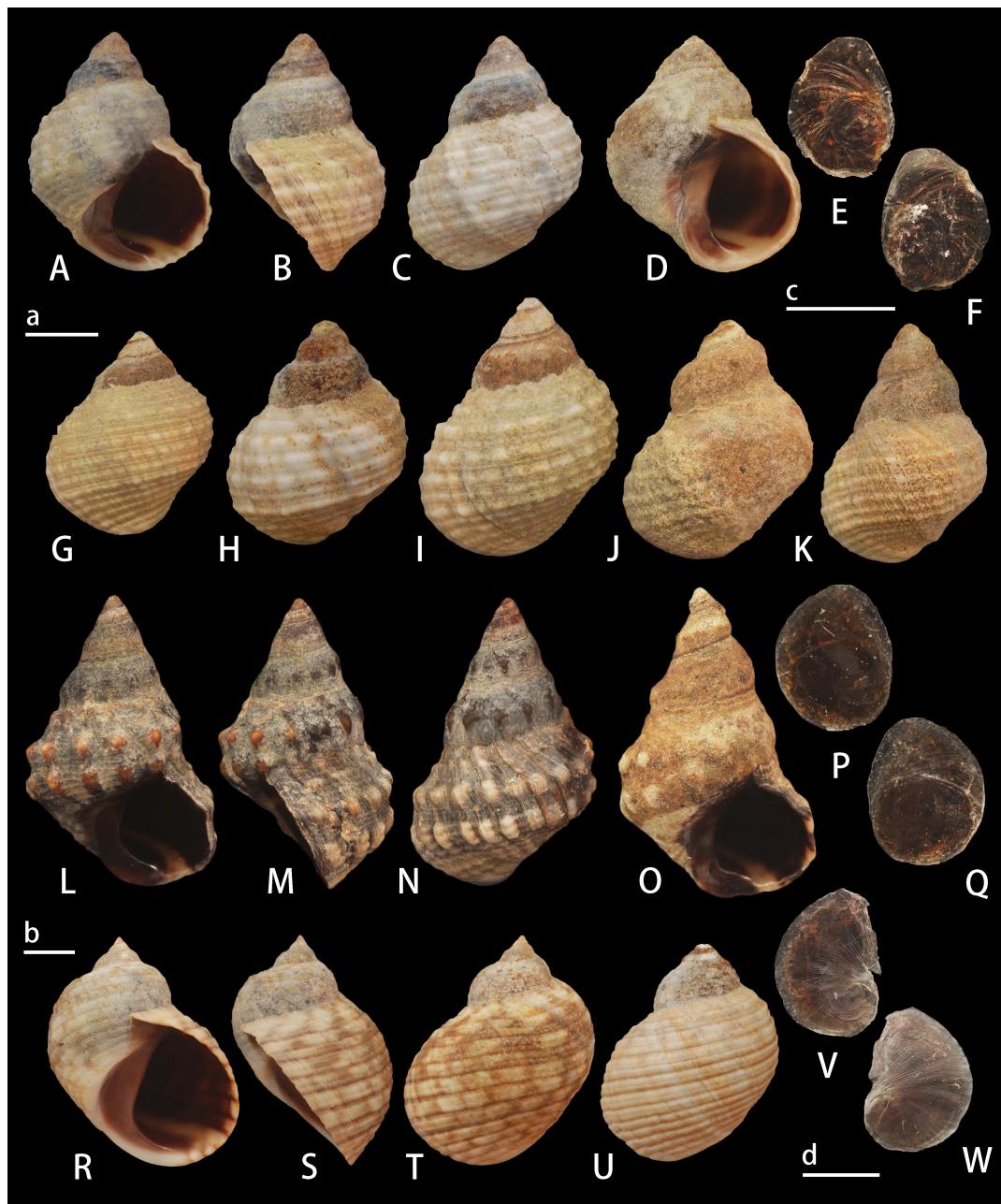
**Type locality.** estuary of Yang-tze River, China.

**Distribution.** East Asia. This is the most widespread periwinkle species in China, whose distribution is from Bohai Sea in the north to the South China Sea in the south.

**Habitat.** On reefs, and only found on granite walls near the highest water line in Xiamen.

**Remarks.** *Littorina brevicula* is very common in intertidal zones of Bohai Sea and the

Yellow Sea, becoming the dominant molluscan species in many areas. However, the population is far less prosperous in Southeast and South China. In Xiamen, *L. brevicula* is always observed to dwell with *Echinolittorina malaccana* (Philippi, 1847) and *Echinolittorina radiata* (Souleyet, 1852), but the density is lower than these two species.



**Figure 4.** Specimens of *Echinolittorina*. **A–K.** *Echinolittorina radiata* from Hulishan Fortress. **L–Q.** *Echinolittorina malaccana* from Hulishan Fortress. **R–W.** *Echinolittorina vidua* from Dongshan Island, Zhangzhou, Fujian Province. Photos: Li-Wen Lin. Scale bar: a = 2 mm, refers to A–D, G–K, L–O; b = 2 mm, refers to R–U; c = 2 mm, refers to E–F, P–Q; d = 2 mm, refers to V–W.

Genus ***Echinolittorina*** Habe, 1956  
棘滨螺属

**Type species.** *Litorina tuberculata* Menke, 1828, by original designation.

***Echinolittorina malaccana* (Philippi, 1847)**  
马六甲棘滨螺  
(Fig. 4 L–Q)

*Litorina malaccana* R. A. Philippi, 1847: vol.3: 15 (51).

*Nodilittorina pyramidalis pyramidalis* – Li *et al.*, 1994: 44. **Misidentification.**

*Nodilittorina pyramidalis* – Zhang & Li, 2008: 471; Zhang, 2008: 53, text-figures; Liu *et al.*, 2023: 19, text-figures. **Misidentification.**

*Echinolittorina malaccana* – Reid, 2007: 55, figs. 26C–D, 27–29.

**Material examined.** Specimens from Site 3 (LLWC).

**Field observations.** Living individuals were observed in Sites 2, 3, 5, 9, 10, 11, 12 and 13.

**Description.** Adult size range 5.9–9.3 mm height. Shell conical to high-conical, black to dark brown, paler at suture and on base; spire whorls almost flat to lightly rounded, suture not distinct; spire profile straight to slightly convex; periphery of the last whorl rounded; base profile slightly convex. Columella dark brown, short, concave, hollowed but not flared at base, anterior lip rounded; aperture dark brown with pale band at base. Sculpture of the last whorl with 2 rows of rounded nodules, white to cream, at periphery and shoulder, entire surface with 12–26 narrow spiral threads and microstriae, peripheral nodules crossed by 2–3 major threads; basal threads (below peripheral nodules) 3–8, often bearing small nodules. Operculum horny, brown, ovate, paucispiral.

**Type locality.** Penang, Malaysia.

**Distribution.** South of East Asia, South and Southeast Asia (China: Zhejiang and its southern regions including sea areas around Taiwan).

**Habitat.** Preferring the reefs near the highest water line and artificial constructions like piers and breakwaters. Seldom in mangroves.

**Remarks.** The population of *E. malaccana* from China has been misidentified as *Nodilittorina pyramidalis* (Quoy & Gaimard, 1833) for a long time (e.g. Li *et al.*, 1994; Zhang, 2008; Liu *et al.*, 2023). These two species are similar in shell morphology but can be distinguished through anatomical features and molecular phylogeny. *Nodilittorina pyramidalis*, whose type locality is in Jervis Bay, New South Wales, was proved to be restricted to Southeastern Australia (Reid, 2004). Other species from East to South Asia, Northern Australia and South Pacific Islands with similar nodulose shells confused with *N. pyramidalis* were also treated as separate species, such as *Echinolittorina austrotrochoides* Reid, 2007 mainly from Northern Australia and Papua New Guinea, *Echinolittorina pascua* (Rosewater, 1970) from Easter and Pitcairn Islands and *Echinolittorina cecillei* (Philippi, 1851) mainly from Japan (Reid, 2004; Reid, 2007).

***Echinolittorina radiata* (Souleyet, 1852)**

小棘滨螺

(Fig. 4 A–K)

*Littorina radiata* Souleyet, 1852: 561, pl. 31, figs 46–47.*Nodilittorina millegrana* – Li *et al.*, 1994: 44; Zhang & Li, 2008: 471. **Misidentification.***Nodilittorina exigua* – Qi *et al.*, 1989: 30, fig. 28; Zhang, 2008: 52, text-figure; Zhang & Li, 2008: 471; Zhang *et al.* 2008: 47, fig. 52. **Misidentification.***Echinolittorina radiata* – Liu *et al.*, 2023: 495, figs in text.*Echinolittorina millegrana* – Liu *et al.*, 2023: 496, figs in text. **Misidentification.***Echinolittorina radiata* – Reid, 2007: 17, fig. 4, 5, 6A–B, 7.**Material examined.** Specimens from Site 3 (LLWC).**Field observations.** Living individuals were observed in Sites 2, 3, 5, 9, 10, 11, 12 and 13.**Description.** Adult size range 6.1–8.9 mm height. Shell dirty white, fawn or blue-grey, spire whorls rounded, suture distinct, spire profile straight. Sculpture on the last whorl with 5–8 granulose ribs with granular not aligned in axial series, and brown marks between granules on ribs. Surface always eroded. Aperture brown inside with a pale band at base. Columella concave and brown. Operculum horny, brown, ovate, paucispiral.**Type locality.** Touranne, Cochinchine [Da Nang, Vietnam].**Distribution.** East Asia and sea areas around Vietnam (China: sea areas from the Yellow Sea to the South China Sea).**Habitat.** Preferring the reefs near the highest water line and artificial constructions like piers and breakwaters. Seldom in mangroves.**Remarks.** *Echinolittorina radiata* is sometimes confused with its sympatric species, *Echinolittorina vidua* (A. Gould, 1859), in Xiamen. This species has a higher spire, coarser granulate ribs, brown columella and lip, dirty white shell sometimes with indistinct brown patterns. Some Chinese essays confused this species with *Echinolittorina millegrana* (R. A. Philippi, 1848), which only distributes in Red Sea, Arabia to mouth of Persian Gulf (Reid, 2007). According to surveys from 2020 to 2024, *E. radiata* is very common in rocky environments near the highest water line in Xiamen.***Echinolittorina vidua* (A. Gould, 1859)**

变化棘滨螺

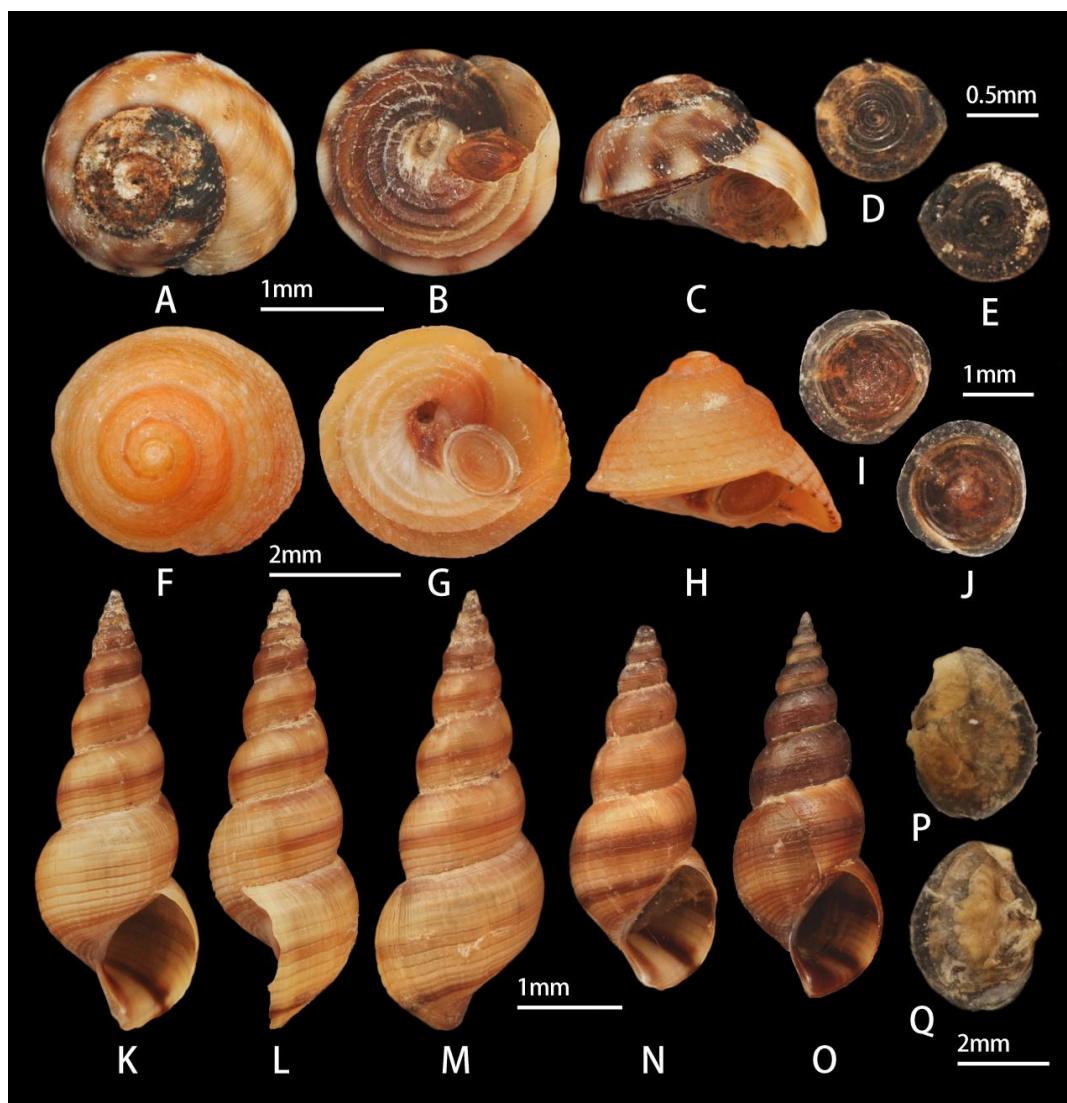
(Fig. 4 R–W)

*Littorina vidua* A. Gould, 1859: 138.*Littorina chaoi* Yen, 1936: 3–4; Yen, 1937: fig. 2, 2a, b.*Echinolittorina vidua* – Reid, 2007: 111, figs 55E–F, 59–61.**Material examined.** Specimens from Dongshan Island, Zhangzhou, Fujian Province, China. (LLWC)**Field observations.** Living individuals were recorded in Sites 3 by Reid (2007), not observed by the authors.**Description.** Adult size range 9.2–10.8 mm height. Shell turbinate to slightly patulous,

usually white, cream or pale grey ground colour with pattern of fine brown tessellation on ribs, sometimes forming axial flames, grooves brown; spire whorls rounded, suture distinct; spire profile usually concave at apex; apex often black; periphery of the last whorl rounded, sometimes slightly shouldered. Aperture dark brown inside with pale band at base Columella is purple-brown, but anterior edge and inner lip white, long, straight, wide, hollowed and slightly pinched at base. Sculpture of last whorl with about 13–16 major spiral ribs; larger ribs usually finely granulose. Operculum horny, brown, semiovate, paucispiral.

**Type locality.** O-shima, Amami Islands, Japan.

**Distribution.** Central Indo-West Pacific (China: Fujian and its southern regions including

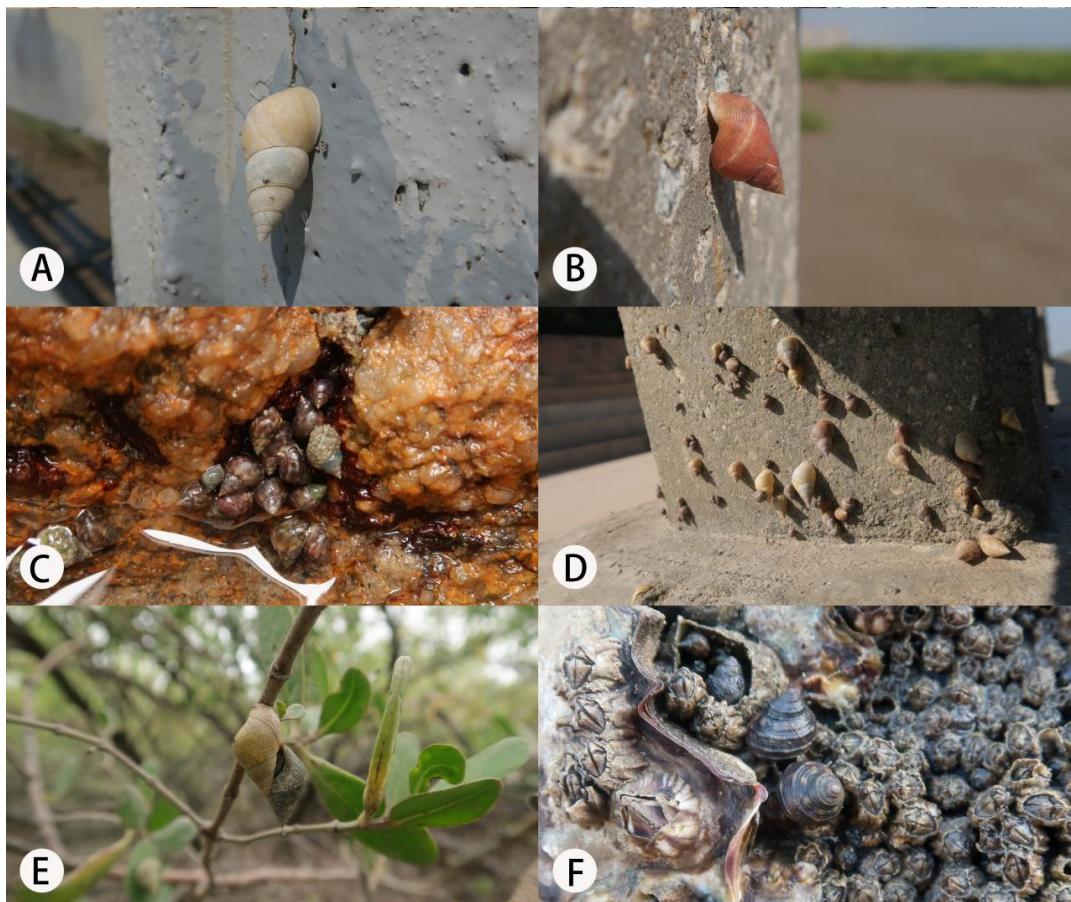


**Figure 5.** Specimens of *Peasiella* and *Mainwaringia*. **A–E.** *Peasiella habei* from Hulishan Fortress. **F–J.** *Peasiella roepstorffiana* from Dadonghai, Sanya, Hainan Province. **K–Q.** *Mainwaringia leithii* from Xiatanwei. Photos: Li-Wen Lin. Scale bar: a = 1 mm, refers to A–C; b = 0.5 mm, refers to D–E; c = 2 mm, refers to F–H; d = 1 mm, refers to I–J; e = 1 mm, refers to K–O; f = 0.5 mm, refers to P–Q.

sea areas around Taiwan).

**Habitat.** On reefs and artificial constructions like piers and breakwaters.

**Remarks.** *Echinolittorina vidua* is sympatric with *Echinolittorina radiata* (Souleyet, 1852) and *Echinolittorina malaccana* (Philippi, 1847) in Xiamen. Reid (2007) recorded this species from Hulishan Fortress (Pao Tai) in Xiamen without figures, and Reid summarised the characters of *E. vidua* from East Asia by having finer and more numerous ribs, brown tessellated pattern and white anterior and inner lips. Several surveys in Hulishan Fortress by the authors yielded a great number of "*E. radiata*" specimens, some of which partly match those characters of *E. vidua* but transitional forms to *E. radiata* are also seen. So, we treat all these specimens as *E. radiata* and recent developments of the population of *E. vidua* in Xiamen remains unknown. The population found in Dongshan Island in Zhangzhou to the south of Xiamen is typical with characters of East Asian *E. vidua*.



**Figure 6.** Living periwinckles from Xiamen. **A, B.** *Littoraria ardouiniana* on artificial seawalls, Qianwu, 25 July, 2024. **C.** *Echinolittorina* spp. and *Littoraria* spp. in gaps of granites, Baicheng, 21 May, 2022. **D.** *Littoraria* spp. on stone pillars of the railing along a seawall, Qianwu, 25 July, 2024. **E.** *Littoraria melanostoma* in mangroves, of the railing along a seawall, Xiatanwei, 30 April, 2022. **F.** *Littorina brevicula* on reefs with barnacles, Yazhou Haiwan, 18 February, 2023. Photos: Yuan-Zheng Meng.

Genus ***Peasiella*** G. Nevill, 1885  
豆滨螺属

Type species *Trochus tantillus* A. Gould, 1849, type by original designation

***Peasiella habei* Reid & Mak, 1998**  
波部豆滨螺  
(Fig. 5 A–E)

*Peasiella habei* – Reid & Mak, 1998; Li *et al.*, 2021: 762, fig. 1 (a, b, c, g); Lin & Rolán, 2024: 11, fig. 14. F.

**Material examined.** Specimens from Site 3 (LLWC).

**Field observations.** Living individuals were observed in Site 2 and 3, empty shells were found in sand sediment near the high-water line along the coast in Site 7.

**Description.** Adult size range 1.8–3.0 mm diameter. Shell fawn or cream, conical, whorls rounded with oblique brown stripe, form single rows of 7–12 brown spots at periphery, suture impressed, peripheral keel prominent, base slightly rounded, umbilicus and columella narrow, curved at base, apex usually eroded. Whorls usually smooth, with 6–11 spiral ribs, 3–5 sharp ribs at base. Operculum horny, light brown, round with a spiral growth line.

**Type locality.** Esu Cape, Shirahama, Wakayama Prefecture, Japan.

**Distribution.** East Asia (China: sea areas from Shandong to Hong Kong).

**Habitat.** On reefs and among algae near the lowest water line.

**Remarks.** Black and white stripes on shells of this species is a unique character which is different from the pure-orange shells of *Peasiella roepstorffiana* (G. Nevill, 1885) recorded from Southern China (Guangdong, Hong Kong and Hainan).

Genus ***Mainwaringia*** G. Nevill, 1885  
长滨螺属

Type species *Melania paludomoidea* G. Nevill, 1885, type by original designation

***Mainwaringia leithii* (E. A. Smith, 1876)**  
莱氏长滨螺  
(Fig. 5 K–Q)

*Alaba (Diala) leithii* E. A. Smith, 1876: 539.

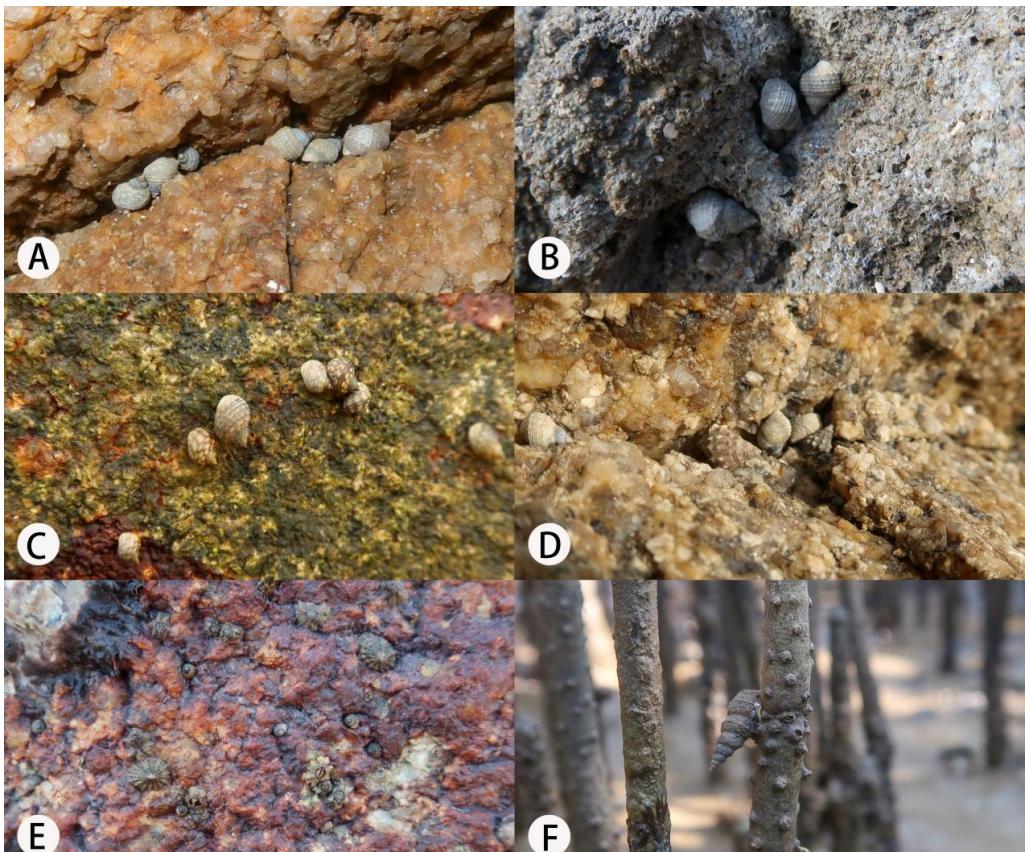
*Mainwaringia leithii* – Reid 1986 b: 226, fig. 1–2; Chen *et al.*, 2021: 1–8, fig. 2; Lin & Rolán, 2024: 11, fig. 12. I.; Xing *et al.*, 2025: 1–9, fig. 1.

*Mainwaringia dantaae* – Liu *et al.*, 2023: 13, text-figure.

**Material examined.** Specimens from Site 12 (LLWC).

**Field observations.** Living individuals were observed in Sites 8, 9, 12 and 13, empty shells were found in sand sediment near the high-water line along the coast in Site 7.

**Description.** Adult size range 6.1–10.1 mm height. Shell pale yellow, with distinct brown



**Figure 7.** Living periwinkles from Xiamen and Zhangzhou. **A.** *Echinolittorina radiata* in gaps of granites, Baicheng, 12 January, 2022. **B.** *Echinolittorina radiata* on cement seawalls, Yazhou Haiwan, 18 February, 2023. **C.** *Echinolittorina vidua* on reefs, Dongshan Island, Zhangzhou, Fujian Province, 11 July, 2024. **D.** *Echinolittorina radiata* and *Echinolittorina malaccana* in gaps of granites, Yazhou Haiwan, 18 February, 2023. **E.** *Peasiella habei* on reefs near the lowest water line, Yazhou Haiwan, 18 February, 2023. **F.** *Mainwaringia leithii* on the trunk of a mangrove, Xiatanwei, 24 February, 2023. Photos: Yuan-Zheng Meng.

spiral bands, with 11-16 fine spiral ribs on the last whorl, thin, sometimes translucent, spire tall, whorls rounded, not angulated. Suture depressed, aperture oval, yellow, lip thin, sharp. Operculum horny, light yellow to transparent, semiovate, paucispiral.

**Type locality.** California, in error, corrected to Bombay Harbour (Tomlin, 1922).

**Distribution.** East, Southeast and South Asia (China: sea areas from Zhejiang to Hong Kong).

**Habitat.** In mangroves and usually on leaves and branches near the bottom of mangroves, also on artificial constructions like piers and breakwaters.

**Remarks.** *Mainwaringia leithii* from India, Malaysia, Vietnam and China have similar distinguishable thin shells with tall spires and brown spiral bands. *Mainwaringia dantaae* Y.-F. Fang, Y.-J. Peng, G.-J. Zhang & J. He, 2012 described from Shenzhen in Southern China has a thoroughly brown to yellow, thick and solid shell different from *M. leithii*. *M. dantaae* illustrated by Liu *et al.* (2023) have banded shells which match the character of *M. leithii*. Xing



**Figure 8.** *Echinolittorina radiata* and *Echinolittorina malaccana* gathered on piers in Hulishan Fortress, 29 December, 2022. Photos: Li-Wen Lin.



**Figure 9.** Transplanted mangroves in Haicangwan Park, with *Mainwaringia leithii* usually hidding on the back of the leaves, 21 August, 2021. Photos: Li-Wen Lin.

et al. (2025) synonymised *M. dantaae* with *M. leithii* through morphological and molecular analyses, while specimens of *M. dantaae* used in this study have a different coloration by having spiral colour bands like *M. leithii*, and are not from the type locality, Shenzhen. More specimens of different coloration are expected to reveal the relationship between the pure colour *M. dantaae* and the banded *M. leithii*.

## Discussion

Littorinids from Xiamen are abundant in intertidal zones including reefs, mangroves and

artificial constructions like piers and breakwaters. Different species has different preference of habitat and the occurrence and density of periwinkle species in each site in Xiamen depend mainly on the environment. Various of reefs such as granites, volcanic rocks and oyster reefs provide littorinids with appropriate habitats. *E. radiata*, *E. malaccana* and *L. brevicula* prefer granites near the highest water line and *P. habei* prefers reefs near the lowest water line. Rehabilitated or transplanted mangroves and artificial constructions especially enriched the diversity of littorinids, where *M. leithii*, *E. radiata*, *E. malaccana* and *L. ardouiniana* appear in flocks.

Geographical location of Xiamen makes it an overlap of periwinkle species from tropical and temperate zones. One example is the sympatry of *L. articulata* and *L. sinensis*. *L. articulata* distributed from South China to North Australia, while *L. sinensis* distributed from Japan to South China. These two morphologically similar species confluences in Xiamen and some areas in Guangdong and Hong Kong.

A review on shells and habitats of littorinids from Xiamen is proposed and the taxonomic information is updated according to others' research on molecular analysis and anatomy of specimens from adjacent areas. Molecular analysis and anatomy of littorinids from Xiamen is expected in future studies to solve more taxonomic problems.

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# 厦门滨螺科软体动物区系及其分布初报

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## 摘要

滨螺科 (Littorinidae) 物种在全球的潮间带及潮下带海域有着极为丰富的多样性，且许多滨螺种类和红树林环境有着密切联系。近年来，在包含形态学、分子生物学和生态学的综合性研究的影响下，西太平洋海域滨螺的分类发生了诸多变化。本文中作者报道了 10 个来自厦门的滨螺物种，检视并拍摄了它们的贝壳标本照片与生活状态照片，并对它们的栖息环境进行探讨。考虑到过往国内的文献资料对许多滨螺的鉴定信息都已过时，作者结合当前最新的研究成果，对这些滨螺物种的分类名称进行更新。

**关键词：**形态学，分类学，潮间带，红树林，中国，福建。



## Three new rock-dwelling species of *Cathaica* Möllendorff, 1884 from the Taihang Mountains, northern China (Stylommatophora: Camaenidae)

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**Abstract.** Species of *Cathaica* are widespread in the temperate montane regions of China, exhibiting high diversity and a broad spectrum of shell morphologies that reflect adaptation to heterogeneous environments. Here we describe three new *Cathaica* species from the Taihang Mountains of Henan and Hebei, China: *Cathaica sculptilis* Wang, Chen, He & Zhang, sp. nov., *C. zhangcunxiangi* Wang, Chen, He & Zhang, sp. nov., and *C. wangjiaxunae* Wang, Chen, He & Zhang, sp. nov. Two of these, *C. sculptilis* sp. nov. and *C. wangjiaxunae* sp. nov., share shell features with *C. multicostata* G. Zhang, 2023. Integrative morphological and molecular analyses support recognition of all three new species. The genital anatomical information of *C. mengi* is also provided for the first time.

**Key words.** Comparative morphology, molecular phylogeny, new species, northern China, rocky habitats

## Introduction

*Cathaica* Möllendorff, 1884 is a specious genus in Camaenidae, with 53 species found in China (MolluscaBase, 2025). A subgenera system of *Cathaica* was proposed by Andreae (1900) and adapted by many authors (e.g., Gude, 1902; Thiele, 1931; Zilch, 1960; Richardson, 1983; Schileyko, 2004), namely *Cathaica* (s.str.), *Cathaica* (*Pliocathaica*) Andreae, 1900, *Cathaica* (*Xerocathaica*) Andreae, 1900, and *Cathaica* (*Campylocathaica*) Andreae, 1900. However, *Cathaica* is no longer considered monophyletic based on recent works, and the status of the subgenera also remains uncertain, as the type species of each requires a comprehensive study to confirm its placement (Wu *et al.*, 2023; Wu & Zhang, 2024). Two recurrent problems were produced by previous research relying solely on shell morphology: the unrelated species have been included in *Cathaica*, as with *Bradybaena brevispira* (H. Adams, 1870) (Wu & Zhang, 2024); and distinct species with similar shells have been treated as conspecific, as in *Cathaica pyrrhozona* (R. A. Philippi, 1845) and *C. fasciola* (Draparnaud, 1801), which were separated only recently through anatomical and

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phylogenetic evidence (Suzuki, 1939; Chen & Zhang, 2004; Wu, 2004; Zhang & Wade, 2023). These issues underscore the need for integrative evidence beyond shells.

Here we combine shell morphology, reproductive anatomy, and molecular phylogenetics to describe three new species of *Cathaica* from the Taihang Mountains of northern China, namely *C. sculptilis* sp. nov., *C. zhangcunxiangi* sp. nov., and *C. wangjiaxunae* sp. nov. All three exhibit a prominent keel, with *C. sculptilis* sp. nov. and *C. wangjiaxunae* sp. nov. also possess fine ribs. Among described congeners, only *C. multicostata* G. Zhang, 2023 and *C. mengi* Yen, 1935 present a distinct keel with strong ribs (Yen, 1939; Zhang *et al.*, 2020b; Zhang & Wade, 2023). To clarify relationships, we surveyed the type localities and adjacent areas of *C. multicostata* and *C. mengi* and provide additional conchological and anatomical information for *C. mengi*.

## Materials and methods

### *Materials and morphological examination*

All specimens were collected in the Taihang Mountains (Hebei, Henan, Shanxi) and Taishan Mountain (Shandong) in the years 2023 and 2024. Specimens were preserved in 95% ethanol and were deposited in the Mollusc collection of the Museum of Hebei University, Baoding, China (HBUMM), Yu-Xuan Huan private collection (HYX), Zhi-Yao Wang private collection (WZY) and Quan-Yu Zhang private collection (ZQY). Photographs were taken with a SOPTOP SZX12 stereomicroscope and a OD500F camera (Sunny Optical Technology, China).

### *DNA extraction, PCR amplification, and phylogenetic analyses*

Total genomic DNA was isolated from a small piece of tissue taken from the foot of each ethanol-preserved specimen using a TreliefTM Animal Genomic DNA kit (Tsingke®). Partial sequences of *16S* rDNA were amplified using the universal primer set 16Sar and 16Sbr (Palumbi *et al.*, 1991). Partial sequences of *COI* were amplified using LCO1490 and HCO2198 (Folmer *et al.*, 1994). A partial fragment of the *ITS2* gene was amplified using the primer pair *LSU-1* and *LSU-3* (Wade & Mordan, 2000). Both ends of the sequences were obtained by automated sequencing on an Applied Biosystems 3730 platform at Sangon Biotech Co. Ltd. (Shanghai, China). Eighteen specimens representing eight species (based on *COI*, *16S* and *ITS2* data) were used in this study (Table 1). Sequences were aligned using MAFFT v. 7.505 based on the L-INS-i method (Katoh & Toh, 2008). Pairwise distances between species were calculated using MEGA X (Kumar *et al.*, 2018). Aligned sequences were concatenated in PhyloSuite v.2.3 (Zhang *et al.*, 2020a). The best substitution model was selected using the corrected Bayesian Information Criterion (BIC) in ModelFinder v.2.2.0 (Kalyaanamoorthy *et al.*, 2017). For Bayesian analysis, two runs were performed simultaneously with four Markov chains starting from a random tree. Bayesian inference and maximum likelihood analysis were performed using MrBayes v.3.2.7 (Ronquist *et al.*, 2012) and IQ-TREE v.2.2 (Minh *et al.*, 2013), respectively, with reference to the selected model of sequence evolution. Bayesian posterior probabilities (BPPs) of nodes were determined using Metropolis-coupled Markov chains (one cold chain) for 2,000,000 generations, sampled every 1,000 generations. The first 25% of sampled trees were discarded as burn-in when the standard deviation of split frequencies from the two runs was less than 0.01; the remaining trees were then used to create a 50% majority-rule consensus tree and to estimate BPPs. Node support for the maximum likelihood analysis was determined using 1000 rapid bootstrap (BS) replicates.

**TABLE 1.** Vouchers, localities, and GenBank accession numbers for all samples used in phylogenetic analysis of this study.

Species	Voucher number	COI	16S	ITS2	Location
<i>Cathaica mengi</i>	HBUMM10083a	PV446475	PV446368	PV446359	Yuncheng City, Yongji City, Shanxi Province, China
<i>Cathaica mengi</i>	HBUMM10083b	PV446476	PV446369	PV446360	Yuncheng City, Yongji City, Shanxi Province, China
<i>Cathaica mengi</i>	HBUMM10083c	PV446370	PV446371	PV446361	Yuncheng City, Yongji City, Shanxi Province, China
<i>Cathaica multicostata</i>	WZY20240424A/1	PV446477	PV446371	PX453178	Zaozhuang City, Shandong Province, China
<i>Cathaica multicostata</i>	WZY20240424A/2	PV446478	PV446372	PV446363	Gongyi City, Zhengzhou City, Henan Province, China
<i>Cathaica sculptilis</i> sp. nov.	HBUMM10084	PV446479	PV446373	PV446364	Gongyi City, Zhengzhou City, Henan Province, China
<i>Cathaica sculptilis</i> sp. nov.	HBUMM10085a	PV446480	PV446374	PV446364	Gongyi City, Zhengzhou City, Henan Province, China
<i>Cathaica zhangcunxiangji</i> sp. nov.	HBUMM10086	PV446473	PV446366	Huixian City, Xinxiang City, Henan Province, China	
<i>Cathaica zhangcunxiangji</i> sp. nov.	HBUMM10087a	PV446474	PV446367	PV446358	Huixian City, Xinxiang City, Henan Province, China
<i>Cathaica wangjiaxunae</i> sp. nov.	HBUMM10088	PV446471	see Appendix 1	PV446357	Wuan City, Handan City, Hebei Province, China
<i>Cathaica wangjiaxunae</i> sp. nov.	HBUMM10089a	PV446472	PV446365	PX453179	Wuan City, Handan City, Hebei Province, China
<i>Cathaica</i> sp1	WZY20240422A/1	N/A	N/A	N/A	Wuan City, Handan City, Hebei Province, China
<i>Cathaica</i> sp1	WZY20240422A/2	N/A	N/A	N/A	Wuan City, Handan City, Hebei Province, China
<i>Cathaica</i> sp1	WZY20240422A/3	N/A	N/A	N/A	Wuan City, Handan City, Hebei Province, China
<i>Cathaica</i> sp2	HYX20240714A/1	N/A	N/A	N/A	Zibo City, Shandong Province, China
<i>Cathaica</i> sp2	HYX20240714A/2	N/A	N/A	N/A	Zibo City, Shandong Province, China
<i>Pseudiberus tectumsinense</i>		PV391143	PV391021	Liantaishan Mout, Jinan City, Shandong Province, China	
<i>Ponsadenia duplocincta</i>	MN369704	PP668898		N/A	

**TABLE 2.** Genetic differentiation of *COI* by means of *p* distances.

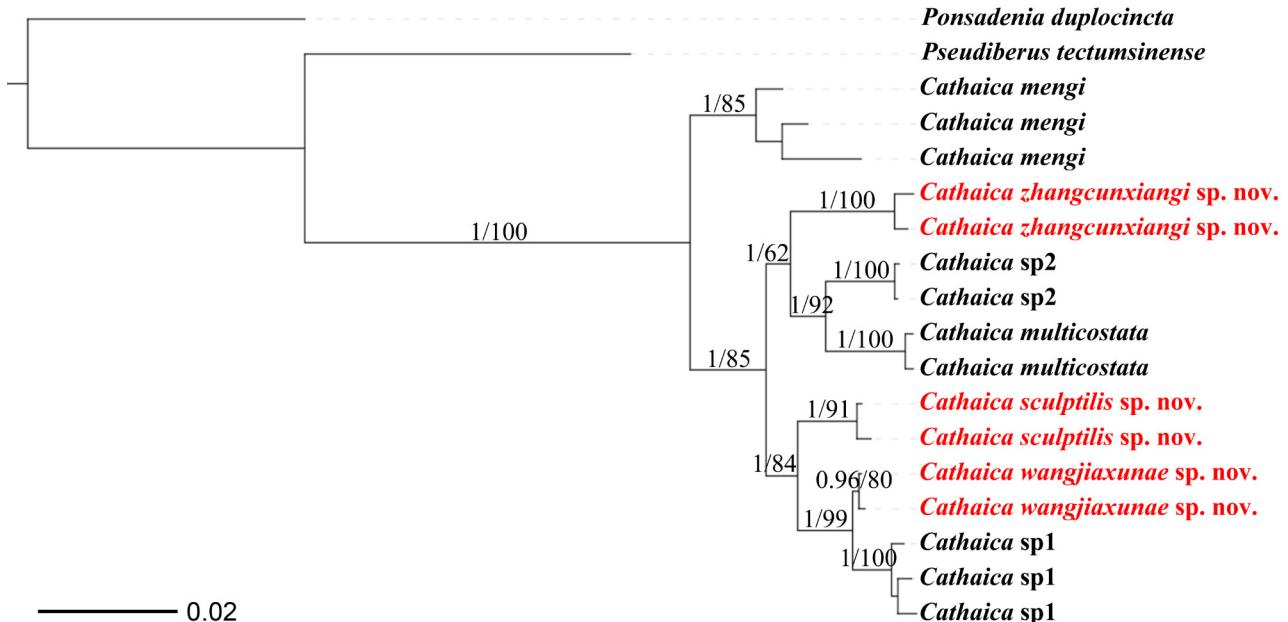
ID	Species	1	2	3	4	5	6	7	8
1	<i>Cathaica</i> sp1								
2	<i>Cathaica wangjiaxunae</i> sp. nov.	0.46–0.92							
3	<i>Cathaica zhangcunxiangi</i> sp. nov.	5.86–6.93	5.39–6.33						
4	<i>Cathaica mengi</i>	8.17–8.78	8.01–8.47	8.47–9.55					
5	<i>Cathaica</i> sp2	6.63–7.55	6.63–6.78	5.7–5.86	7.55–7.86				
6	<i>Cathaica multicostata</i>	6.47–7.24	6.16–6.47	6.16–6.78	8.47–8.94	4.93–5.08			
7	<i>Cathaica sculptilis</i> sp. nov.	4.62–5.39	4.16–4.78	5.86–6.63	7.4–7.7	6.78–6.93	6.01–6.32		
8	<i>Pseudiberus tectumsinense</i>	17.41	16.95–17.1	17.87	17.26–17.41	18.34	18.34–18.49	16.95	
9	<i>Ponsadenia duplocincta</i>	18.06–18.23	18.06–18.23	18.58–18.75	17.19	17.88	18.92–19.1	17.36–17.71	14.24

### Colour scheme for anatomical illustrations

To present the reproductive anatomy more clearly, we use a simple, consistent colour scheme in the line drawings that minimises confusion from overlapping structures. In genital overviews, the mucous glands are blue, the bursa copulatrix and its duct are red, and all remaining parts are yellow. In detailed dissected views, blue again denotes the mucous glands; red marks the opening of the proximal accessory sac, the entrances of the mucous glands, and the penial opening; yellow indicates the remaining structures.

### Abbreviations

At, atrium; BC, bursa copulatrix; BCD, bursa copulatrix duct; DS, dart sac; Dt, love dart; DtC, love-dart chamber, the chamber secreting and containing the love dart; FO, free oviduct; MG, mucous glands; MGE, entrance(s) of mucous glands; P, penis; PAS, proximal accessory sac, a blind sac on



**FIGURE 1.** Bayesian inference (BI) tree for the *Cathaica* species. Values (BPP/BS) at nodes represent Bayesian posterior probabilities and Bootstrap values.

proximal dart sac and opening into dart sac chamber or elsewhere; PE, entrance of penis; PO, opening of proximal accessory sac; PR, penial-retractor muscle; PS, penis sheath; SD, dart-sac septum, a fleshy septum between the atrial opening and the opening of the DtC; VD, vas deferens. Directions used in descriptions of genitalia: proximal, towards the genital atrium; distal, away from the genital atrium; left and right side of dart sac (see Wu *et al.*, 2023: fig. 1A).

## Results

The alignments of the *COI*, *16S* and *ITS2* sequences are 649, 359 and 891 base pairs, respectively. The HKY+I+F model was selected as the best-fit model of nucleotide substitution based on the BIC criterion. *Ponsadenia duplocincta* (Martens, 1879) was used as the outgroup to root the phylogenetic tree. Both Bayesian Inference (BI) and Maximum Likelihood (ML) methods produced identical topologies (Fig. 1). Three new species are supported: *Cathaica zhangcunxiangi* sp. nov. (BPP=1, BS=100), *C. sculptilis* sp. nov. (BPP=1, BS=91) and *C. wangjiaxunae* sp. nov. (BPP=0.96, BS=80). The species *Cathaica zhangcunxiangi* sp. nov., *C. sp2*, *C. multicostata*, *C. sculptilis* sp. nov., *C. wangjiaxunae* sp. nov. and *C. sp1* are nested in a monophyletic group with good support (BPP=1, BS=85), and form a sister lineage to the *C. mengi* (BPP=1, BS=100). *Cathaica* sp2 is the sister lineage of *C. multicostata* (BPP=1, BS=92). *C. wangjiaxunae* sp. nov. and *C. sp2* form a sister groups in the tree (BPP=1, BS=99), with *C. sculptilis* sp. nov. falling outside of this grouping (BPP=1, BS=84). The genetic distances among *Cathaica* species based on *COI* sequences range from 4.16% to 9.55% (Table 2).



**FIGURE 2.** Shell of *Cathaica multicostata*. **A.** WZY20240424A/1. **B.** WZY20240424A/2. **C.** WZY20240424A/3.

## Systematics

Family **Camaenidae** Pilsbry, 1895

Subfamily **Bradybaeninae** Pilsbry, 1934 (1898)

Genus ***Cathaica*** Möllendorff, 1884

**Type species.** *Helix pyrrhozona* Philippi, 1845, by original designation.

### ***Cathaica multicostata* G. Zhang, 2023**

多肋华蜗牛

(Fig. 2)

*Cathaica multicostata* G. Zhang in Zhang & Wade, 2023: 573, figs 1, 3E, 4D, 5, 6.

**Type locality.** “Baodu, Zaozhuang, Shandong; 34.984°N, 117.721°E, 520 m a.s.l.”

**Material examined.** WZY20240424A (10 specimens). Mount Baodugu [抱犊崮], Zaozhuang City, Shandong Province, China, 34°59'N, 117°43'E, 500 m above sea level, leg. Zhi-Yao Wang, 24 April 2024. *Measurements* ( $n = 3$ ): Shell width: 16.6–17.7 mm; shell height: 6–6.7 mm.

### ***Cathaica mengi* Yen, 1935**

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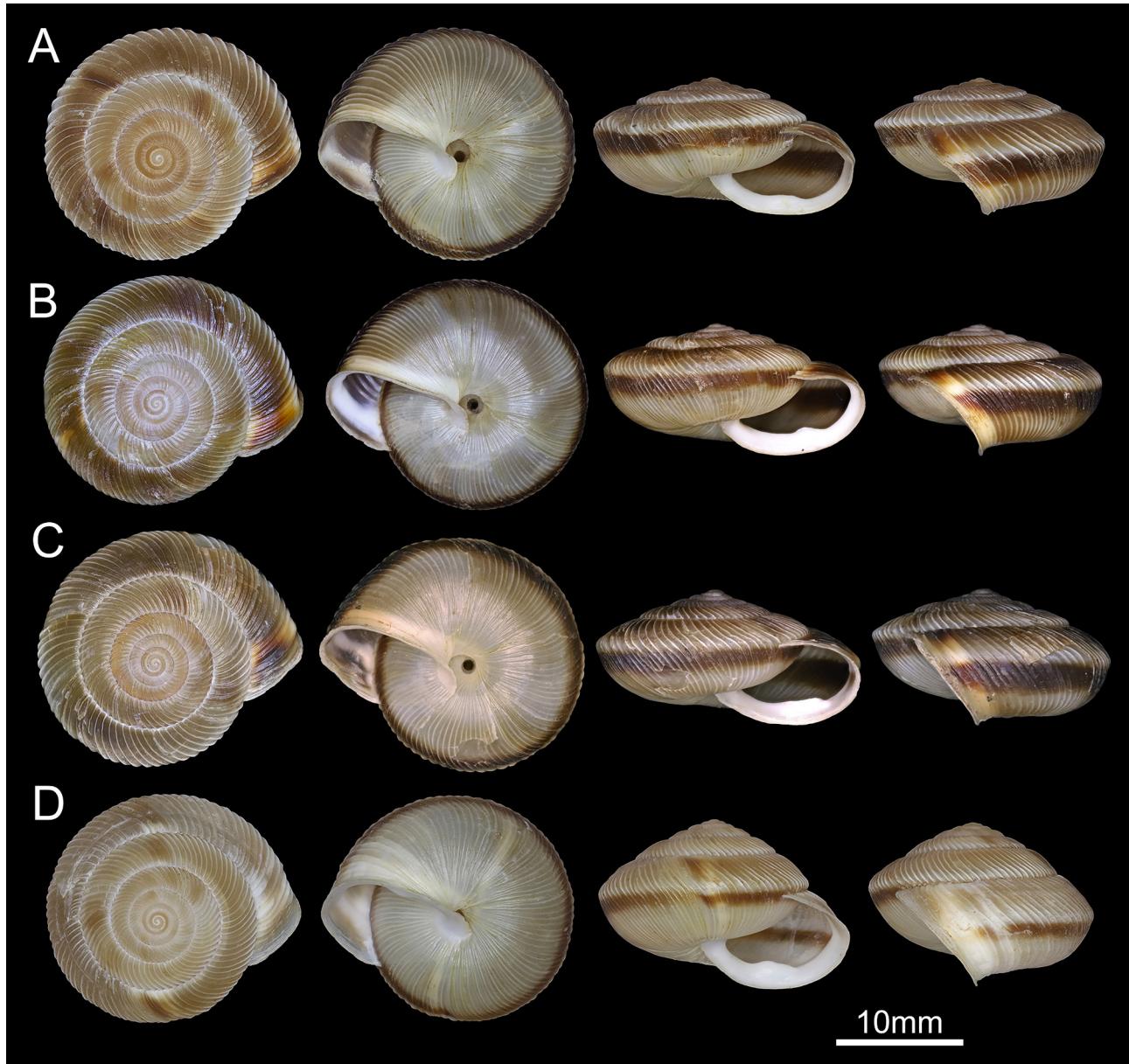
(Figs 3, 4, 12A, 14D–F)

*Cathaica mengi* Yen 1935: 35, pl. 2, figs 12–12b; Zhang *et al.*, 2020b: 62, figs 5A–C.

**Type locality.** “In the mountain near Yu-hsiang Hsien, Shansi”

**Material examined.** HBUUMM10083 (5 specimens), Yuxiang County [虞乡镇], Yongji City [永济市], Yuncheng City [运城市], Shanxi Province, China; 34°50'N, 110°38'E, 400–1000 m above sea level, leg. Shi-Yang Feng, Quan-Yu Zhang and Yue-Ming He, 24 April 2024; WZY20250621A (3 specimens), same location as above, leg. Zhi-Yao Wang, 21 June 2024; HYX20250905A (2 specimens), Shifosicun [石佛寺村], Yuxiang County, Yuncheng City, Yongji City, Shanxi Province, China, 34°49'N, 110°35'E, 500 m above sea level, leg. Yu-Xuan Huan, 5 September 2024.

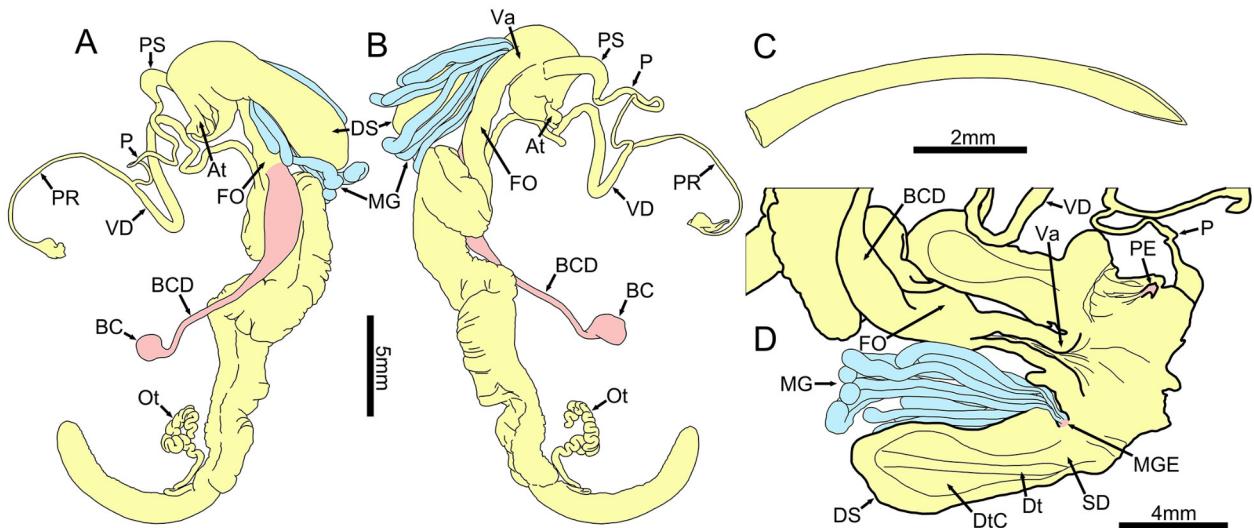
**Redescription.** *Shell* (Fig. 3) slightly depressed to conoid, thin, dextral. Spire conoid, elevated. Whorls slightly convex. Suture superficial, slightly deeper on the last whorl. Umbilicus a slit to narrow; transition from shell to umbilicus gradual. Columella oblique; columellar lip slightly expanded, slightly or almost completely covering umbilicus. Protoconch radially and densely granulate (Fig. 11A). Spiral furrows absent. Shell surface with low ribs, approximately 60–100 on body whorl, forming crenulations at periphery. Growth lines between ribs indistinct. Young shell carinate. Adult shell smooth; last whorl carinate at periphery, with base convex. Aperture roundedly quadrate, slightly expanded below, oblique, with a well-developed basal tooth. Peristome sometimes weakly sinuate, not continuous, thick. Parietal callus thin and indistinct. Shell glossy. Protoconch and conchial whorls show no obvious color difference, apically light brown to cream yellow. Ventral surface milk white, with a dark brown peripheral band under keel. *Measurements*: High altitude



**FIGURE 3.** Shell of *Cathaica mengi*. **A.** HBUMM10083a. **B.** HBUMM10083b. **C.** HBUMM10083c. **D.** HBUMM10083d.

population ( $n = 3$ ): Shell width: 17.6–18.4 mm; shell height: 9.4–9.4 mm. Low altitude population ( $n = 3$ ): Shell width: 17.2–18.9 mm; shell height: 10.6–11.7 mm.

*Genitalia* (Fig. 4). Membranous sac surrounding terminal genitalia absent. Penial sheath approximately 1/3 penis length. Penis slender, simple outside. Flagellum absent. Vas deferens thickened near penial-retractor muscle, thickened portion accounts for about 2/5 of vas deferens. Mucous glands containing 10–15 tubules, similar in length to dart sac, inflated, straight and usually unbranched, if branched, then only simply so. Each tubule with a distinct peduncle, not attached to vagina by connective tissue, opening into dart-sac chamber. Proximal part of dart sac neither elongate nor forming a neck-like structure. Dart sac containing a single dart, curved and possessing chaeta, cross-section fusiform, surface covered with dense villi except at the distal end, approximately 8 mm in length. Proximal accessory sac absent. Vagina entering atrium. *Measurements* (average of three individuals): DS: 9.1 mm in length, 2.4 mm in width; MG: 6.0–9.0 mm; PS+P: 14.8 mm; VD: 19.3



**FIGURE 4.** Genitalia of *Cathaica mengi*. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus.

mm; PR: 10.6 mm; Va: 6.1 mm; FO: 1.1 mm; BC+BCD: 14.0 mm.

**Distribution.** China: Shanxi.

**Ecology.** *Cathaica mengi* occurs across a wide elevational gradient, from lowland farmland at the mountain base to exposed rocky habitats at higher elevations. (Fig. 14A–C).

**Remarks.** *Cathaica mengi* can be readily distinguished from other *Cathaica* species by its carinate periphery and densely spaced, low ribs. Among all *Cathaica* examined to date, *C. mengi* is the only species known to lack a proximal accessory sac. The species shows ecological adaptability. Foothill populations of *C. mengi* tend to have a higher spire (Fig. 3D), whereas populations on rocky cliffs have a lower spire with sparser, more sharply defined ribs (Fig. 3A–C). This pattern indicates a strong environmental influence on shell form, and a lower spire is likely advantageous in exposed rocky habitats.

***Cathaica sculptilis* Z.-Y. Wang, Y.-M. He, H. Chen & Q.-Y. Zhang, sp. nov.**

雕刻华蜗牛

(Figs 5, 6, 12B, 16)

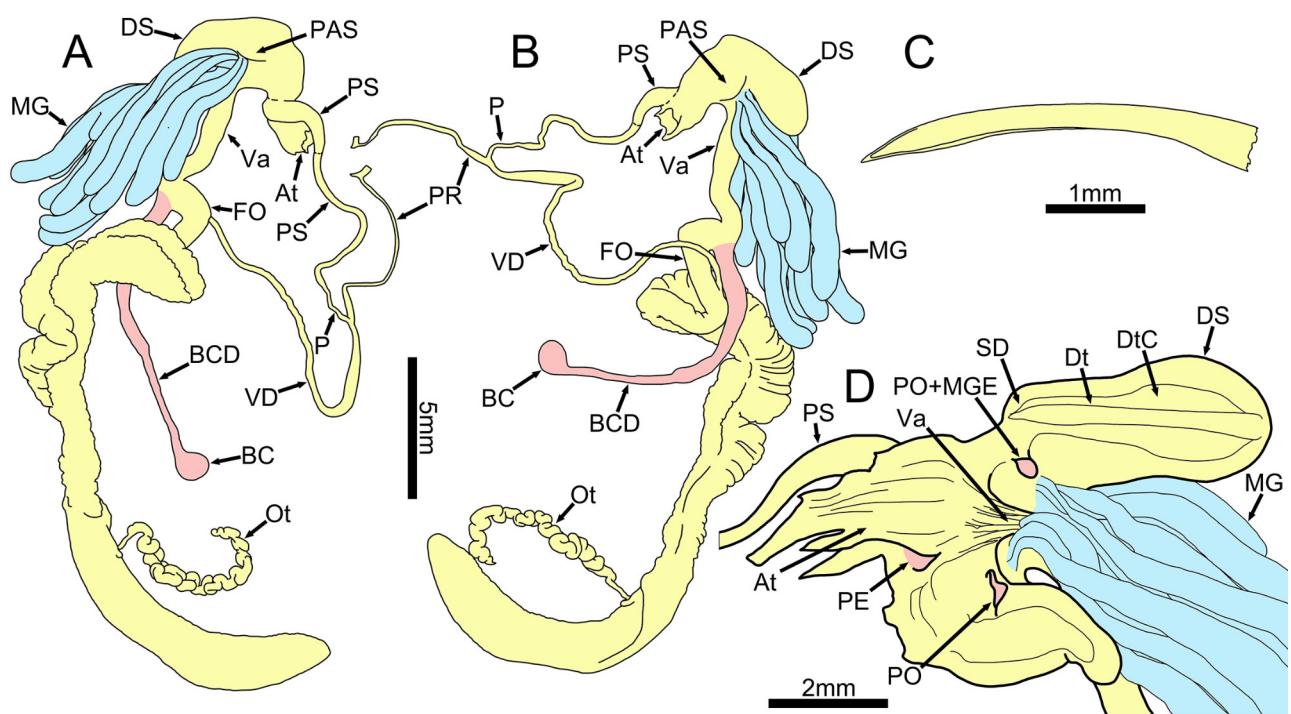
**Type materials.** Holotype. HBUMM10084, Qinglongshan Mount [青龙山], Dayugou County [大峪沟镇], Gongyi City [巩义市], Zhengzhou City [郑州市], Henan Province, China, 34°40'N, 113°04'E, 500 m above sea level, leg. Zhi-Yao Wang, 17 September 2023. Paratypes. HBUMM10085 (9 specimens), WZY20230917A (5 specimens), same data as holotype; ZQY20230126A (5 specimens), same location as holotype, leg. Quan-Yu Zhang, 26 January 2023.

**Etymology.** This new species is named for its prominent ribs and remarkable surface sculpture.

**Description.** *Shell* (Fig. 5) low-conic, thin, dextral; spire conoid. Whorls convex. Suture superficial. Umbilicus narrow, with a gradual transition from the shell base. Columella oblique; columellar lip dilated, partially covering umbilicus. Protoconch radially granulate (Fig. 11B). Spiral furrows densely distributed on spire. Body whorl clearly deflexed behind aperture. Shell surface bearing 60–70 strong ribs, each rib thickened and protruding at keel, forming crenulations at periphery. Growth lines between ribs indistinct. Both young and adult shells smooth. Young shell



**FIGURE 5.** Shell of *Cathaica sculptilis* sp. nov. A. HBUMM10084, holotype. B. HBUMM10085a, paratype. C. HBUMM10085b, paratype.



**FIGURE 6.** Genitalia of *Cathaica sculptilis* sp. nov. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus.

carinate. Adult body whorl sharply carinate above the periphery, basally convex. Aperture peach-shaped quadrate, oblique, slightly expanded, with a very low, broad basal tooth near columella. 1-2 strongly, ring-like thickenings present within aperture present, disconnected from peristome. Peristome thick, not continuous, somewhat sinuate. Parietal callus thin and indistinct. Shell glossy and dull red, with the color slightly lighter around the umbilicus, peripheral bands absent. *Measurements* ( $n = 5$ ): Shell width: 17.4–18.6 mm; shell height: 8.5–9.8 mm.

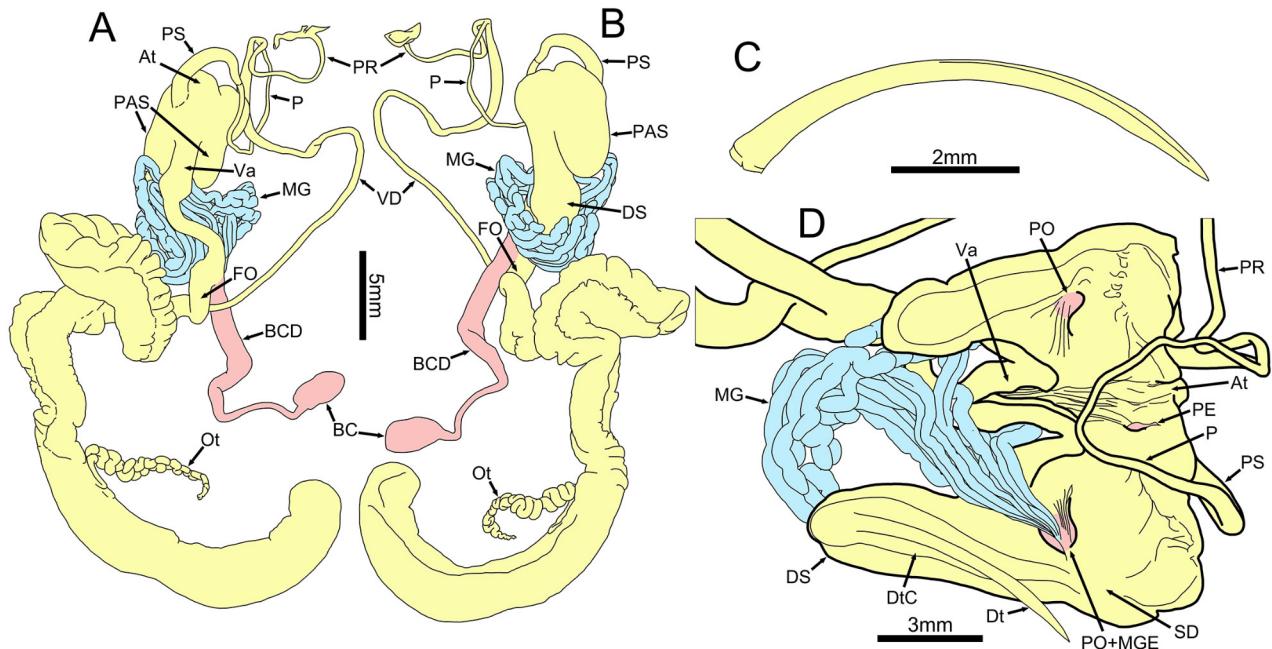
**Genitalia** (Fig. 6). Membranous sac surrounding terminal genitalia absent. Penial sheath approximately 1/4 penis length. Penis slender and externally simple. Flagellum absent. Vas deferens thickened near penial-retractor muscle, thickened portion accounts for about a quarter of vas deferens. Mucous glands containing 10–15 tubules, approximately three times length of dart sac, glands inflated, uncurved and usually unbranched, if branched then only slightly, each with a distinct peduncle; not attached to vagina by connective tissue, opening into dart-sac chamber. Vaginal region between dart sac and atrium short, about equal in length to dart sac. Proximal part of dart sac neither elongate nor forming a neck-structure. Dart sac containing one piece of dart, curved and possess chaeta, basal cross-section ovate, distal cross-section fusiform, surface covered with dense villi except at the distal end, approximately 6 mm in length. Two very small proximal accessory sacs are located on left and right sides of dart sac, each with an opening that leads into dart-sac chamber near insertion of mucous glands. Vagina entering atrium. *Measurements* (average of 10 individuals): DS: 6.5 mm in length, 2.0 mm in width; MG: 3.9–6.3 mm; PS+P: 12.3 mm; VD: 13.6 mm; PR: 6.4 mm; Va: 4.5 mm; FO: 1.9 mm; BC+BCD: 9.4 mm.

**Distribution.** China: Henan. This new species is known only from the type locality.

**Ecology.** *Cathaica sculptilis* sp. nov. lives on the limestone canyon walls with direct sunlight



**FIGURE 7.** Shell of *Cathaica zhangcunxiangi* sp. nov. **A.** HBUMM10086, holotype. **B.** ZQY-20230629/1, paratype. **C.** ZQY20230629/2, paratype.



**FIGURE 8.** Genitalia of *Cathaica zhangcunxiangi* sp. nov. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus.

(Fig. 16).

**Remarks.** The shell of *Cathaica sculptilis* sp. nov. is readily distinguished from most congeners by the combination of a sharp peripheral keel and strong axial ribs. It most closely resembles *C. multicostata* and *C. wangjiaxunae* sp. nov., but differs in having a dull reddish shell, an oblique aperture, and a very low, broad basal tooth. *Cathaica sculptilis* sp. nov. can also be distinguished from other species by the inflated, uncurved mucous glands and the presence of two very small proximal accessory sacs.

***Cathaica zhangcunxiangi* Z.-Y. Wang, Y.-M. He, H. Chen & Q.-Y. Zhang, sp. nov.**

张氏华蜗牛

(Figs 7, 8, 12C, 17)

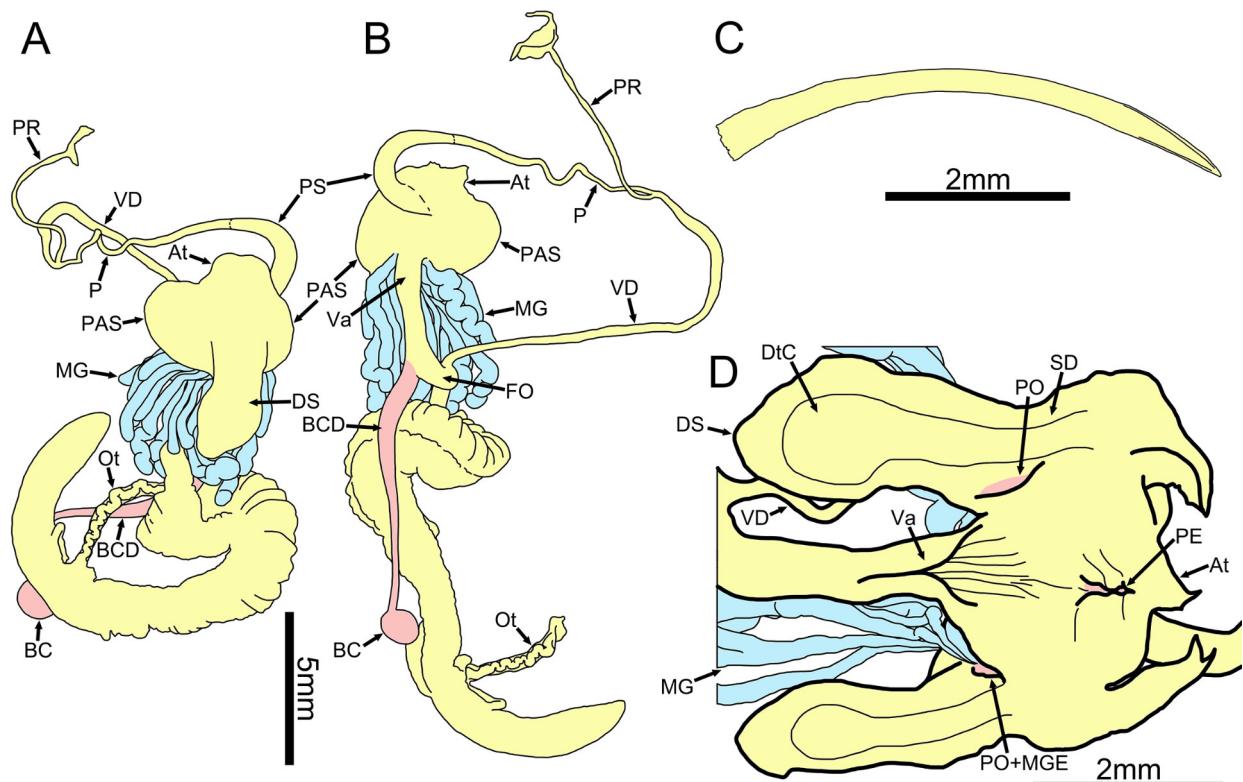
**Type materials.** Holotype. HBUMM10086, Northwest of Huixian City [辉县市], Xinxiang City [新乡市], Henan Province, China, 35°29'N, 113°26'E, 600 m above sea level, leg. Quan-Yu Zhang and Zhi-Yao Wang, 26 April 2024. Paratypes. HBUMM10087 (9 specimens), WZY20240426C (5 specimens), same data as holotype, leg. Quan-Yu Zhang and Zhi-Yao Wang, 26 April 2024; ZQY20210629A (5 specimens), same location as holotype, leg. Quan-Yu Zhang, 26 January 2023.

**Etymology.** The new species is named after the father of second author, Cun-Xiang Zhang [张存祥].

**Description.** *Shell* (Fig. 7) discoid, thin, dextral. Spire very low to slightly concave. Whorls flattish. Suture superficial. Umbilicus slightly narrow; shell transition to umbilicus gradual. Columella oblique; columellar lip slightly dilated, never covering umbilicus. Spiral furrows absent. Final part of last whorl usually slightly descending. Shell surface with dense and shallow ribs that do not form clear crenulations at periphery. Growth lines between ribs indistinct. Adult shell smooth, body whorl polymorphic, supra-peripherally sharply carinate, basally convex. Aperture peach-shaped



**FIGURE 9.** Shell of *Cathaica wangjiaxunae* sp. nov. **A.** HBUMM10088, holotype. **B.** HBUMM10089a, paratype. **C.** HBUMM10089b, paratype.



**FIGURE 10.** Genitalia of *Cathaica wangjiaxunae* sp. nov. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus.

quadrate, slightly oblique, slightly expanded below, toothless. Ring-like thickening present within aperture. Peristome thin, somewhat sinuate, not continuous. Parietal callus thin and indistinct. Basal lip narrow. Protoconch radially granulate (Fig. 11C). Young shell smooth and carinate, without scales, angulate at periphery. Shell glossy, apically dirty yellow to chestnut-brown, ventrally white to dark yellow, with a dark brown blurry band at periphery under keel. *Measurements* ( $n = 5$ ): Shell width: 18.6–21.4 mm; shell height: 8.4–11.9 mm.

*Genitalia* (Fig. 8). Membranous sac surrounding terminal genitalia absent. Penial sheath approximately 2/5 penis length. Penis slender and externally simple. Flagellum absent. Vas deferens thickened near penial-retractor muscle. Mucous glands containing 12–15 tubules, complexly branched, longer than dart sac, each with a distinct peduncle, opening into dart-sac chamber. Proximal part of dart sac neither elongate nor forming a neck-like structure. Dart sac containing one piece of love dart. Love dart curved, with basal cross-section ovate, distal cross-section fusiform, surface covered with dense villi except at the distal end, approximately 8 mm in length. Two proximal accessory sacs, equally developed, internally containing numerous parallel septa; both open into dart sac chamber near mucous glands entrance. Vagina entering atrium, proximally expanded. Measurements (average of three individuals): DS: 9.0 mm in length, 2.9 mm in width; MG: 4.5–15.0 mm; PS + P: 17.7 mm; VD: 26.7 mm; PR: 7.9 mm; Va: 10.3 mm; FO: 2.3 mm; BC + BCD: 16.4 mm.

**Distribution.** China: Henan. This new species is known only from the type locality.

**Ecology.** This new species lives on the canyon walls with direct sunlight and nearby water sources (Fig. 17).

**Remarks.** *Cathaica zhangcunxiangi* sp. nov. has a flat apex, a sharp keel, and a narrow basal lip; the ribs are very shallow, yielding a smoother shell. These features readily distinguish it from other species of *Cathaica*. Anatomically, the vagina of *C. zhangcunxiangi* sp. nov. is proximally expanded, similar to that of *C. fohuiensis* G. Zhang, 2023 (see Zhang & Wade, 2023), but it opens into the dart-sac chamber instead. *Cathaica zhangcunxiangi* sp. nov. is somewhat similar to *P. tectumsinense zenonis* and *P. futtereri*; however, the latter two have more conoid shells, distinct periostracal derivatives on the shell surface, and more strongly expanded lips.

### *Cathaica wangjiaxunae* Z.-Y. Wang, Y.-M. He, H. Chen & Q.-Y. Zhang, sp. nov.

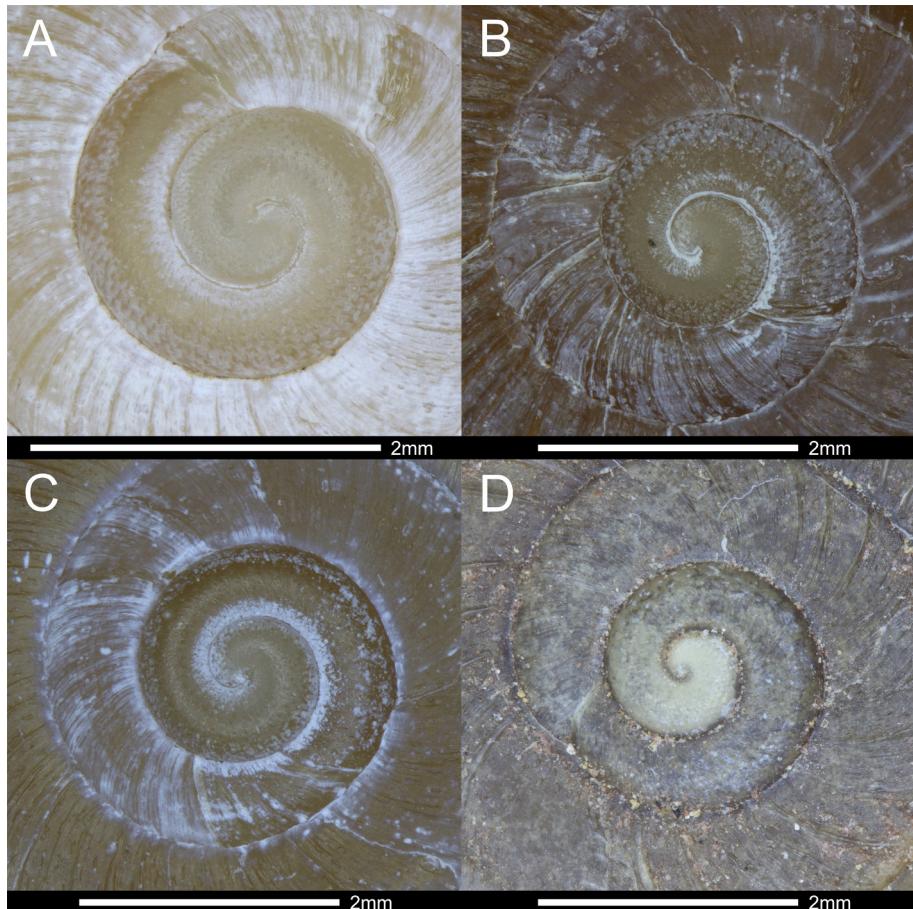
王氏华蜗牛

(Figs 9, 10, 12D, 18)

**Type materials.** Holotype. HBUMM10088, Kunlunyu Village [昆仑峪村], Wuan City [武安市], Handan City [邯郸市], Hebei Province, China, 36°55'N, 113°52'E, 1250 m above sea level, leg. Zhi-Yao Wang, 30 November 2024. Paratypes. HBUMM10089 (4 specimens), WZY20241130A (10 specimens), same data as holotype.

**Etymology.** The new species is named after the mother of first author, Jia-Xun Wang [王佳珣].

**Description.** *Shell* (Fig. 9) shape depressed, thin, dextral, spire low. Whorls flattish. Suture superficial. Umbilicus narrow, with a gradual transition to shell. Columella oblique; columellar lip dilated, slightly covering umbilicus. Protoconch radially granulate (Fig. 11D). Spiral furrows absent. Body whorl straight or slightly descending behind aperture. Shell surface with fine ribs; approximately 40–50 ribs present on the body whorl, forming crenulations at periphery. Growth lines between ribs indistinct. Young shell smooth and carinate. Adult shell smooth, body whorl supra-peripherally sharply carinate and basally convex. Aperture peach-shaped quadrate, slightly expanded below, toothless. Ring-like thickening within aperture present. Peristome thick, somewhat sinuate,



**FIGURE 11.** Protoconchs of *Cathaica* spp. **A.** *Cathaica mengi*. **B.** *Cathaica sculptilis* sp. nov. **C.** *Cathaica zhangcunxiangi* sp. nov. **D.** *Cathaica wangjiaxunae* sp. nov.

not continuous. Parietal callus thin and indistinct. Shell glossy, yellowish, whitish near umbilicus, slightly transparent, pigmented bands absent. Measurements ( $n = 5$ ): Shell width: 16.1–18 mm; shell height: 7–9.1 mm.

*Genitalia* (Fig. 10). Membranous sac surrounding terminal genitalia absent. Penial sheath approximately 1/3 penis length. Penis slender and externally simple. Flagellum absent. Vas deferens slightly thickened near penial-retractor muscle. Mucous glands containing 12–15 single tubules with wavy distal ends, approximately the same length as dart sac, usually not branched, but if branched, then only simply. Each tubule has a distinct peduncle, opening into dart sac chamber. Proximal part of dart sac not forming a neck-like structure. Dart sac containing 1 piece of dart, curved and possess chaeta, basal cross-section ovate, distal cross-section fusiform, surface nearly smooth, with short villi restricted to the middle third, approximately 6 mm in length. Two proximal accessory sacs, on left and right sides of dart sac, unequally developed, right proximal accessory sac more developed. Each sac has an opening, opening into dart-sac chamber near insertion of mucous gland. Vagina entering atrium. Measurements (average of three individuals): DS: 6.2 mm in length, 2.1 mm in width; MG: 2.6–6.5 mm; PS + P: 7.1 mm; VD: 13.5 mm; PR: 6.5 mm; Va: 4.9 mm; FO: 1.6 mm; BC + BCD: 9.5 mm.

**Distribution.** China: Hebei. This new species is known only from the type locality.

**Ecology.** This new species lives on the limestone or sandstone canyon walls (Fig. 18).

**Remarks.** *Cathaica wangjiaxunae* sp. nov. most closely resembles *C. multicostata* and *C. sculptilis* sp. nov., but it differs from *C. multicostata* by its narrow umbilicus, and from *C. sculptilis*



**FIGURE 12.** Shell of *Cathaica* spp. **A.** *Cathaica* sp1, WZY20240422A/1. **B.** *Cathaica* sp1, WZY20240422A/2. **C.** *Cathaica* sp2, HYX20240714A/1.

sp. nov. by ribs that project along the keel, an (near-)orthocline aperture, and the absence of a basal tooth. It also differs from all the other *Cathaica* species in having mucous glands with undulate distal ends that are usually unbranched, and two proximal accessory sacs of unequal size.

#### *Cathaica* sp1

(Figs 12A–B, 13)

**Material examined.** WZY20240422A (3 specimens), Northwest of Wuan City [武安市], Handan City [邯郸市], Hebei Province, China, leg. Zhi-Yao Wang, 22 April 2024. **Measurements** ( $n = 2$ ): Shell width: 14.5–15.7 mm; shell height: 8.6–8.7 mm.

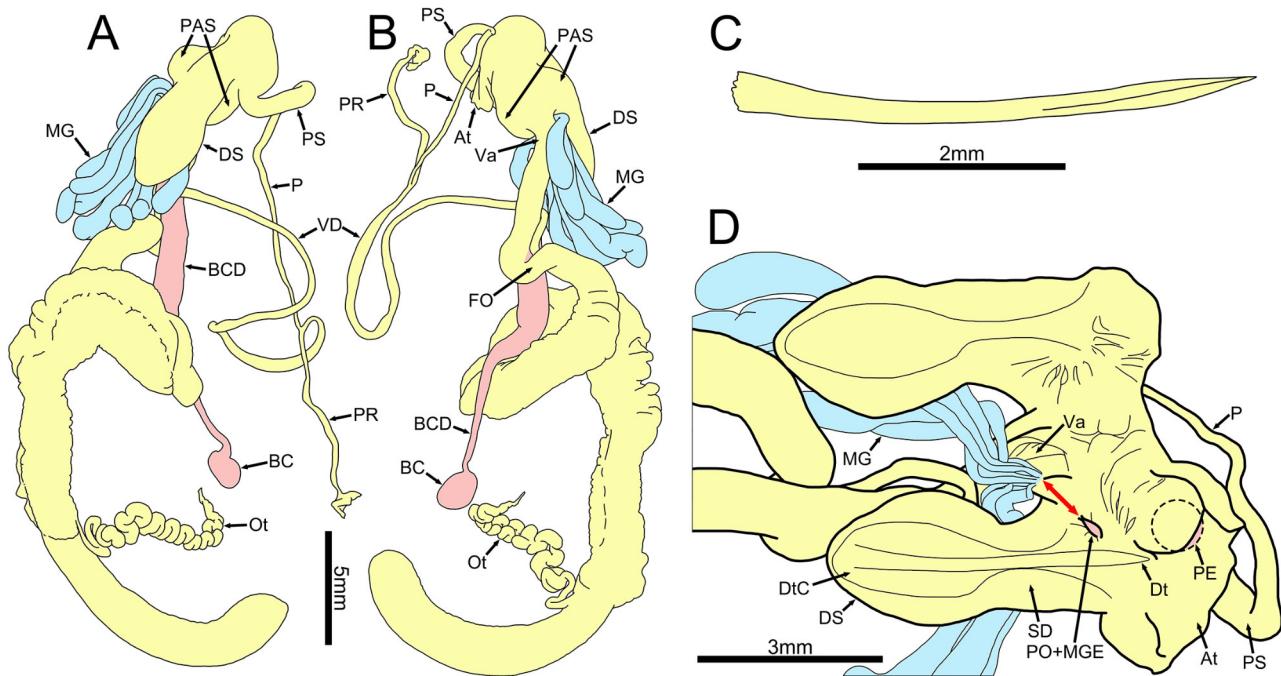
**Remarks.** *Cathaica* sp1 is similar in shell morphology to *C. fasciola* and *C. pyrrhozona*, but it is easily distinguished by its genital anatomy (Fig. 13). It differs from *C. pyrrhozona* by having two equally developed proximal accessory sacs. It also possesses approximately 12 swollen, non-curved mucous glands, which separates it from *C. fasciola*. The position of the dart-sac septum and the entry point of the proximal accessory sacs in *C. sp1* further differs from both *C. fasciola* and *C. pyrrhozona*. Ecologically, *C. sp1* is restricted to sandstone cliffs near mountain summits, whereas *C. fasciola* and *C. pyrrhozona* occur at mountain foothills or in plains.

*Cathaica* sp2

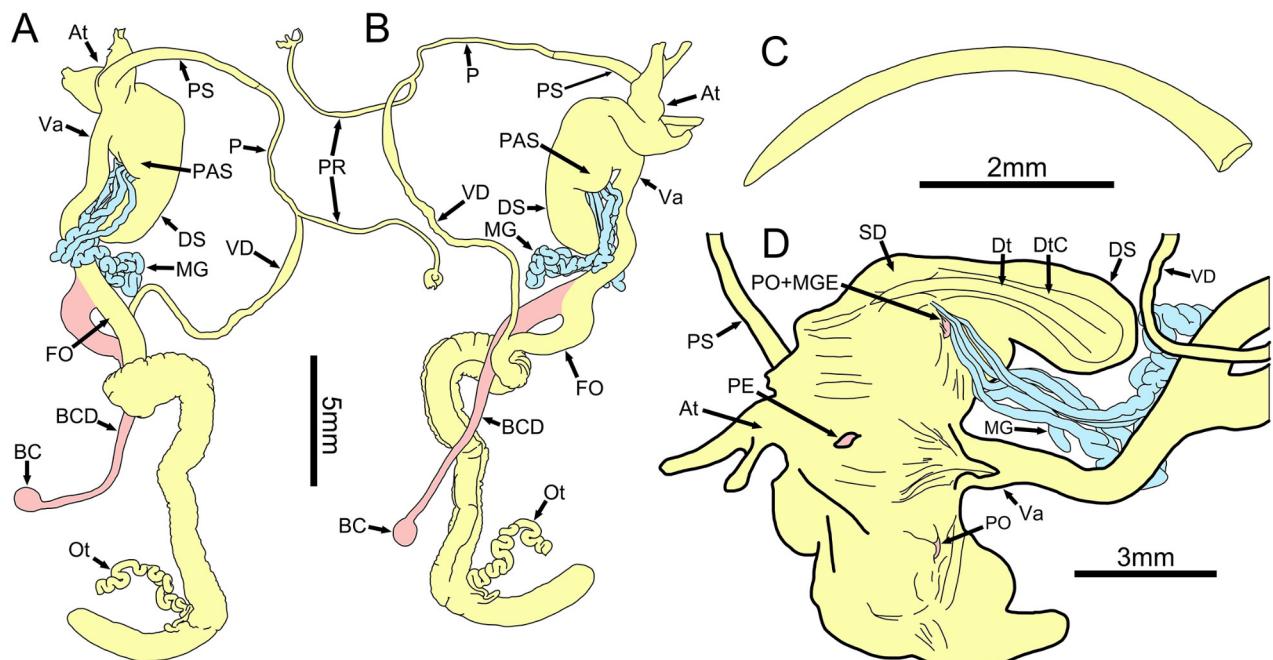
(Figs 12C, 14)

**Material examined.** HYX20240714A (3 specimens), East of Zibo City [淄博市], Shandong Province, China, leg. Huan-Yu Xuan, 14 July 2024. **Measurement** ( $n = 1$ ): Shell width: 17.9 mm; shell height: 10.3 mm.

**Remarks.** The genital anatomy of *C. sp2* closely matches the description of *C. fasciola* provided



**FIGURE 13.** Genitalia of *Cathaica* sp1. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus. The positions indicated by the red arrows were originally connected.



**FIGURE 14.** Genitalia of *Cathaica* sp2. **A–B.** both sides of the genitalia. **C.** love dart. **D.** exposed dart sac apparatus.

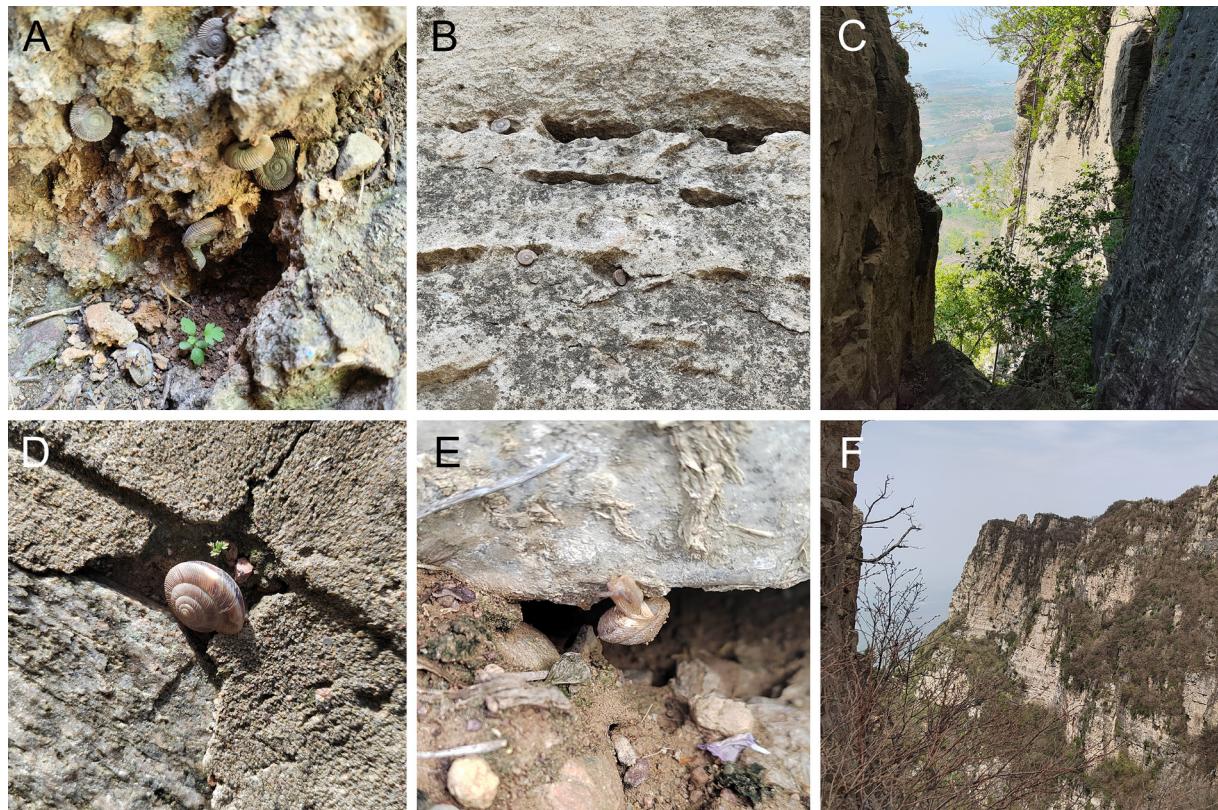


FIGURE 15. Natural habitats of *Cathaica* spp. A–C. *Cathaica multicostata*. D–F. *Cathaica mengi*.

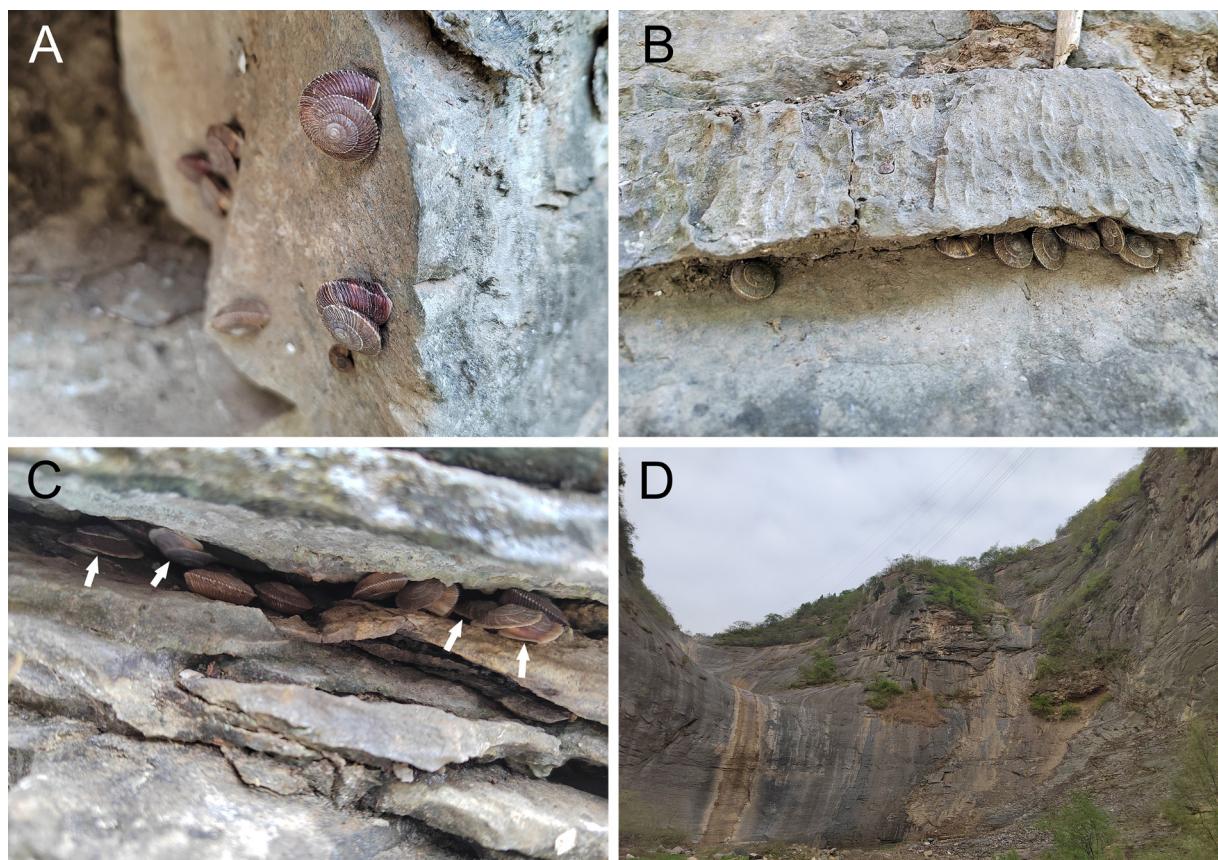
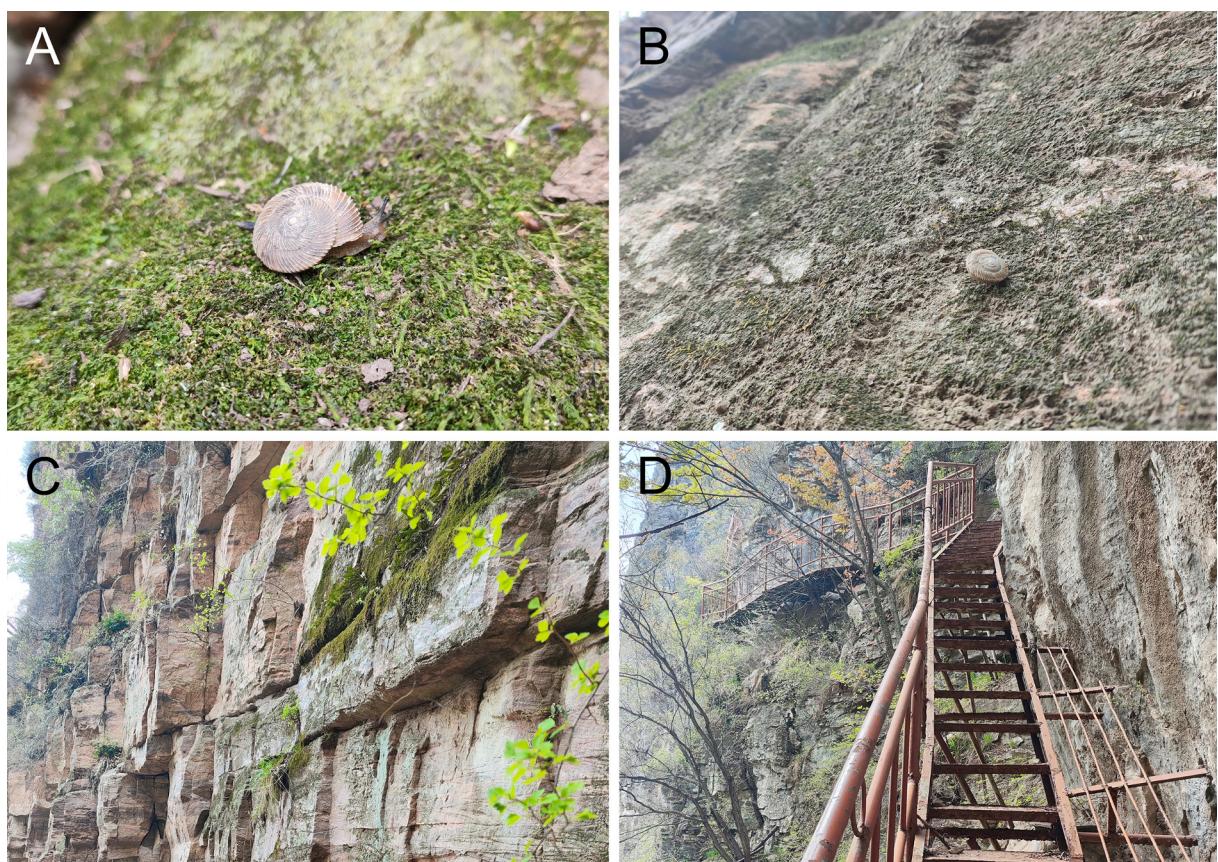


FIGURE 16. Natural habitats of *Cathaica sculptilis* sp. nov. White arrow in C shows the *Pseudiberus shanheicus* Zhang, Liu, Feng & Zhang, 2024 living in the same habitat.



**FIGURE 17.** Natural habitats of *Cathaica zhangcunxiangi* sp. nov.



**FIGURE 18.** Natural habitats of *Cathaica wangjiaxunae* sp. nov.

by Zhang & Wade (2023), but its shell morphology is markedly different. *Cathaica* sp2 shows more strongly developed ribs, a conspicuously expanded lip, no colour bands, and an overall grayish-white appearance. Because reliable molecular data for *C. fasciola* are not yet available, the phylogenetic relationship between *C. sp2* and *C. fasciola* remains unresolved.

### Acknowledgements

Thanks go to Yu-Xuan Huan [郇宇轩] (China Agricultural University) for providing materials for this study and Ms Lisa Angela Orcutt (Beijing) for language polishing. We are grateful to Dr Barna Páll-Gergely (HUN-REN Centre for Agricultural Research) and Prof. Min Wu (Nanjing University) for their constructive comments and suggestions on the manuscript.

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**Appendix 1.****Mitochondrial 16S sequence of *Cathaica wangjiaxunae* sp. nov. (HBUMM10088):**

CTGCTCATGATTATTTAATAGCCGCAGTACCCCTGACTGTGCTAAGGTAGCATAATCAA  
TTGGCTCATGATTGGAGTCTCGTATGAAAGAATTCATGGGGGTTGGCTGTTCATATTA  
ATATTATTAAATTACTTATTAAGTGAAAACTTAAAAATAAAAATAGACGAGAAGACCCCT  
AGAAAATTTAATTAAATTATACCTTTGTTGGGGCGACAAAGTAGCAAATAACCTACTTA  
AGTTTACTTGAATATTATATTATGAATGAATAAATTACTCTAGGGATAACAGCATAATATT  
AAAAGTTGTGACCTCGATGTTGGATTAGGAAAACATACCTAGAAGGTTAAT

# 中国中部太行山脉岩栖性华蜗牛属三新种 (腹足纲: 柄眼目: 坚螺科)

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## 摘要

华蜗牛属 *Cathaica* Möllendorff, 1884 的物种广泛分布于中国温带山地地区, 它们表现出高度的多样性, 并演化出多种形态以适应不同的环境。其中一些物种具有特化的外壳形态以适应特殊的环境, 并且在其分布区及周边区域未发现形态相似的物种。例如, 多肋华蜗牛 *C. multicostata* Zhang, 2023 和孟氏华蜗牛 *C. mengi* Yen, 1939, 具有粗壮的肋和明显突出的龙骨。在本研究中, 我们基于采自太行山区的标本, 描述了华蜗牛属的三个新物种: 雕刻华蜗牛 *C. sculptilis* Wang, Chen, He & Zhang, sp. nov.、张氏华蜗牛 *C. zhangcunxiangi* Wang, Chen, He & Zhang, sp. nov. 和王氏华蜗牛 *C. wangjiaxunae* Wang, Chen, He & Zhang, sp. nov.。这些新种在外壳上相似, 都具有比较低矮的螺塔和突出的龙骨, 但生殖器解剖与分子系统学的分析均支持这些新物种的独立性。同时为了更好地理解这些形态相似的物种之间的亲缘关系, 我们还采集了周边地区的华蜗牛标本, 对它们进行了形态学和分子系统学的研究, 并对孟氏华蜗牛 *C. mengi* 进行了形态重新描述和生殖器补充描述。

关键词: 比较形态学, 分子系统发育, 华北地区, 新物种, 岩石生境

## ***Pseudobuliminus xihuashida*, an additional camaenid new species with detached last whorl from the border of Sichuan and Gansu, China (Gastropoda: Stylommatophora: Camaenidae)**

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**Abstract.** *Pseudobuliminus xihuashida* Z.-G. Chen & Z.-Y. Chen, **n. sp.**, a new species with a detached last whorl, is described from the border of Sichuan and Gansu, China. It can be distinguished from all congeners by the cylindrical shell with last 0.5 to 1 whorl detached, the smooth, initially keeled and gradually rounded teleoconch, and the protoconch with small tubercles.

**Key words.** Land snails, taxonomy, dry-hot river valley, new species, biodiversity

### **Introduction**

The camaenid genus *Pseudobuliminus* Gredler, 1886, characterized by its cylindrical-conical shell, is widely distributed in East Asia (Chen & Zhang, 2004; Hirano *et al.*, 2014). It exhibits considerable species diversity, currently comprising 27 accepted species (MolluscaBase eds, 2025). While some studies have raised doubts about the monophyly of the genus (Hirano *et al.*, 2014; Wu *et al.*, 2023, 2024), no comprehensive systematic revision has been undertaken to date. In this study, we describe a new species of *Pseudobuliminus* with a detached last whorl from the border of Sichuan and Gansu, China.

### **Materials and methods**

The shells were measured with a digital Vernier calliper to the nearest 0.1 mm. Whorls were counted as described by Kerney and Cameron (1979). Photos of the shell were taken using a Canon® 5D Mark IV and modified in Adobe Photoshop® CC 2018. A shell was air-dried in a clean environment and then sputter-coated with gold. It was subsequently imaged using a Thermo Scientific® Quattro Environmental Scanning Electron Microscope. Maps were made in ArcGIS® Pro.

**Abbreviations.** NCUMB: Museum of Biology, Nanchang University (Nanchang, China);

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<http://zoobank.org/urn:lsid:zoobank.org:pub:AF553401-07EA-4990-B12F-5990148C6250>

ZGCC: Collection of Zhong-Guang Chen (Chengdu, China); CZYC: Collection of Zhe-Yu Chen (Wuhan, China); At: atrium; BC: bursa copulatrix; BCD: bursa copulatrix duct; DS: dart sac; Ep: epiphallus; FO: free oviduct; MG: mucous glands; P: penis; PR: penial retractor muscle; Va: vagina; VD: vas deferens.

## Systematics

Family **Camaenidae** Pilsbry, 1895

Subfamily **Bradybaeninae** Pilsbry, 1934 (1898)

Genus ***Pseudobuliminus*** Gredler, 1886

**Type species.** *Helix pseudobuliminus* (Heude, 1882), by absolute tautonomy.

### ***Pseudobuliminus xihuashida* Z.-G. Chen & Z.-Y. Chen, n. sp.**

西华师大假拟锥螺 (Pinyin: xī huá shī dà jiǎ nǐ zhūi luó)

(Figures 1–4)

**Type materials.** *Holotype.* NCUMB JN2503010 (matured shell with genitalia fixed in alcohol separately), Guoyuan Township [郭园乡], Jiuzhaigou County [九寨沟县], Aba Tibetan and Qiang Prefecture [阿坝藏族羌族自治州], Sichuan Province [四川省], China, 104.329876°E, 33.125506°N, leg. Zhong-Guang Chen, July 2021. *Paratypes.* NCUMB JN2503011–JN2503018 (8 matured shells with genitalia fixed in alcohol separately), NCUMB JN2503019–JN2503030 (12 matured shells with genitalia fixed in alcohol together), ZGCC JN1–JN100 (100 dried matured shells with genitalia), CZYC 00306 (6 matured shells with genitalia fixed in alcohol together), other information same as holotype.

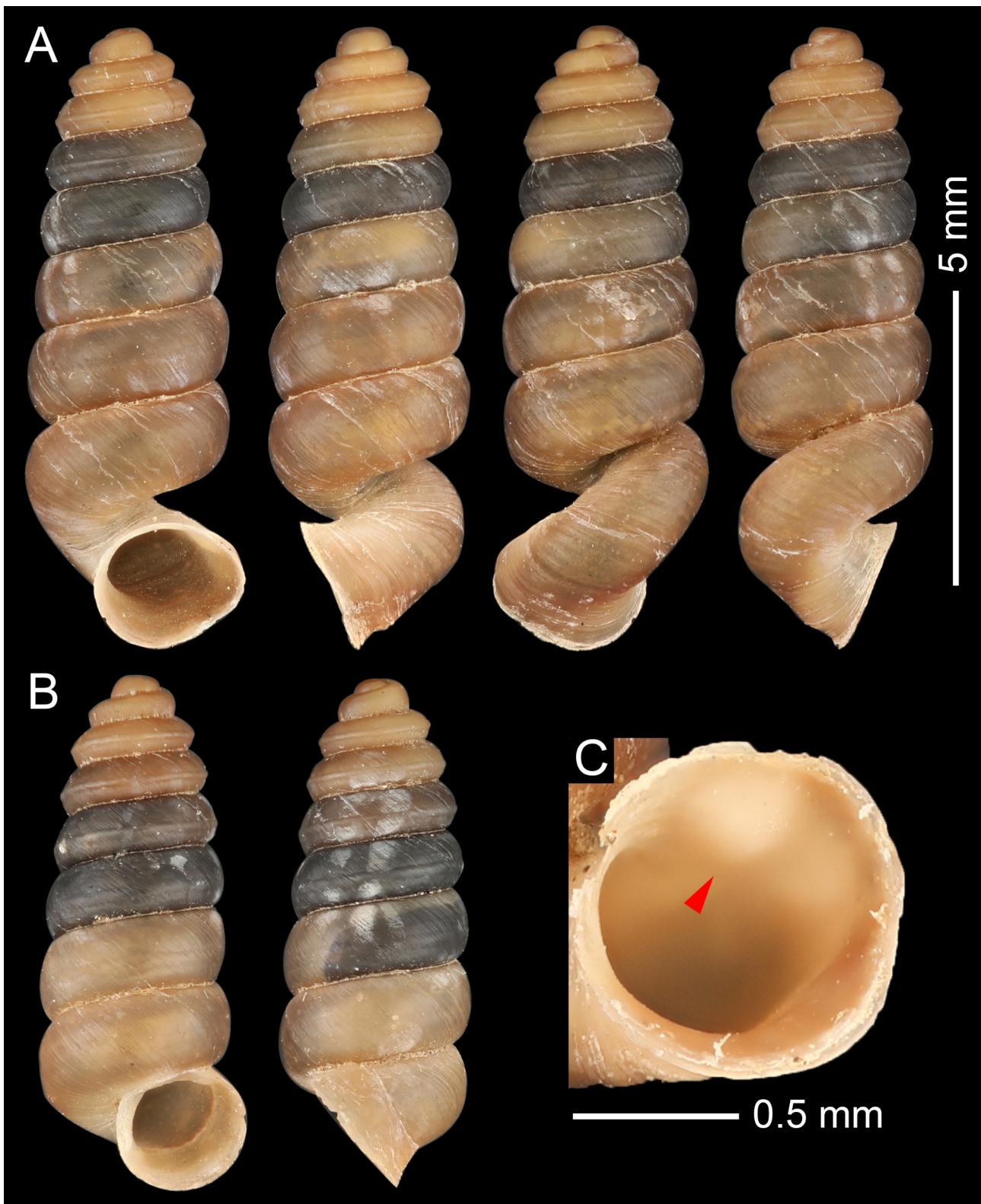
**Diagnosis.** A *Pseudobuliminus* species with cylindrical shell; the last 0.5–1.0 whorl detached; teleoconch smooth, initially keeled and gradually rounded; protoconch with small tubercles.

**Description.** *Shell* (Fig. 1) small, cylindrical with apex blunt; shell most swollen (broadest) at body whorl; dextral; fragile; opaque; sub-glossy to matte; uniform brown; with 8.5–9.5 whorls. Whorls inflated. Protoconch (Fig. 2A–B) with small tubercles, with 1.5–1.75 whorls. Teleoconch smooth, initially keeled and gradually rounded; growth lines distinct. Suture well impressed. The last 0.5–1.0 whorl detached, distance between peristome and penultimate whorl is 0.25–1.0 whorl wide. Aperture in a slightly wavy; rounded; oblique. A mound-like parietal tubercle weakly present. Peristome brown and reflexed; sharp. Umbilicus open, small and deeply cavernous.

*Genitalia* (Fig. 2C). Penis short and thin, externally simple. Epiphallus thick, longer and thicker than penis. Penial retractor muscle short and thin. Flagellum absent. Vas deferens long and thin. Dart sac apparatus large. Mucous gland with one common peduncle, simply branched. Vagina short and thick, slightly shorter than penis. Free oviduct cylindrical, longer and thicker than vagina. Bursa copulatrix large, oblong. Bursa copulatrix duct long and thin, thickened basally.

**Measurements.** Holotype: shell height 10.5 mm, shell width 3.7 mm; aperture height 2.8 mm, aperture width 2.9 mm. Paratypes: shell height 9.3–10.8 mm, shell width 3.6–3.8 mm; aperture height 2.7–2.8 mm, aperture width 2.7–3.0 mm ( $n = 20$ ).

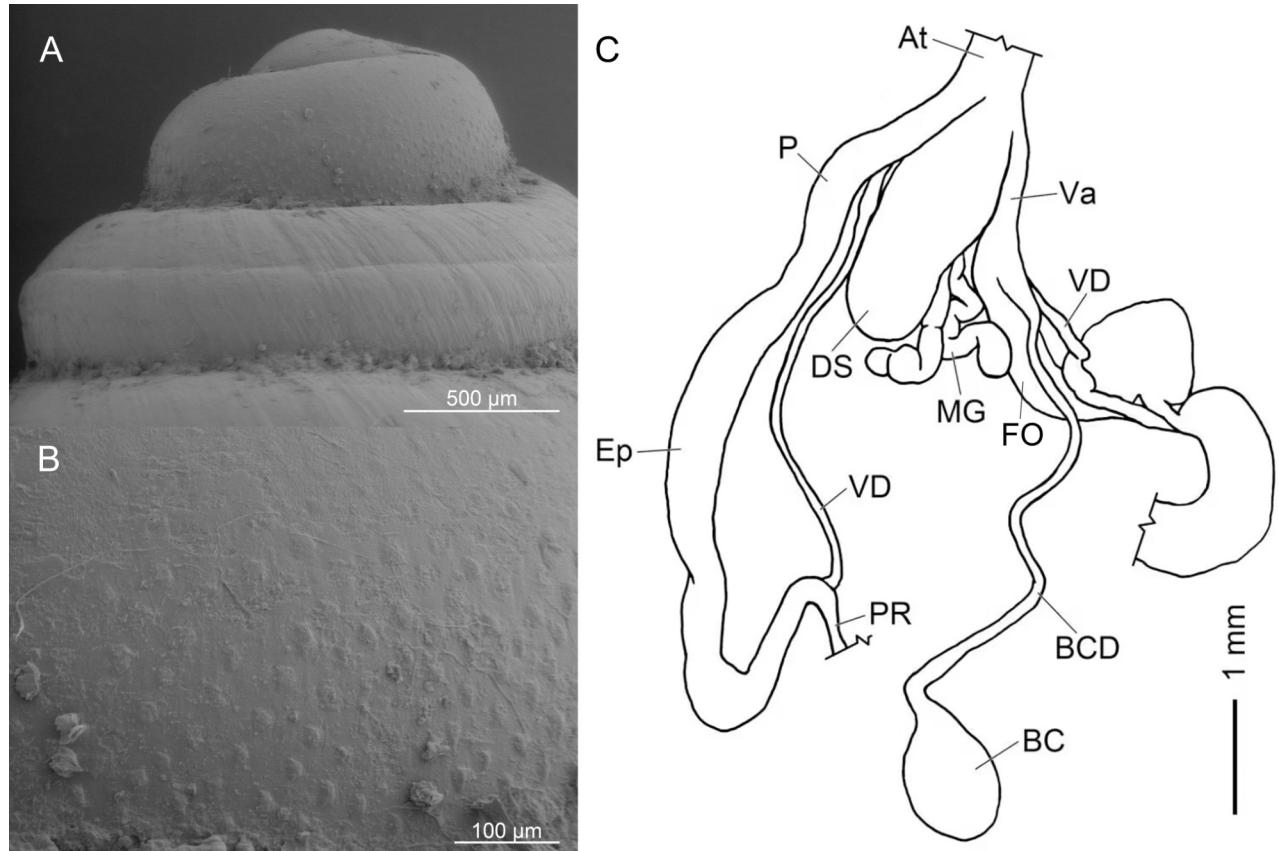
**Variation in specimens.** Among all examined specimens (100+), only a single individual (Fig.



**FIGURE 1.** Shells of *Pseudobuliminus xihuashida* n. sp. **A.** Normal form. **B.** Aperture-attached form. **C.** Aperture details. Arrow shows the parietal tubercle.

1B, CZYC 00306B) possesses an attached body whorl. Given the distinct demarcation visible behind the aperture, such variation may have resulted from rapid post-diapause growth or from injury.

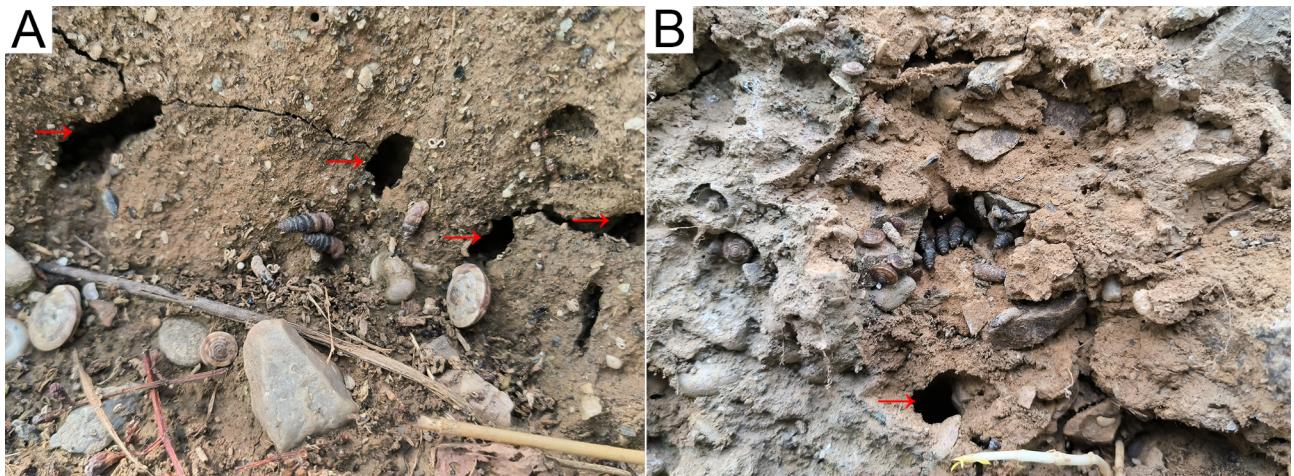
**Etymology.** The specific name is made from the Pinyin form for China West Normal University



**FIGURE 2.** Morphological details of *Pseudobuliminus xihuashida* n. sp. A–B. Protoconch. C. Genitalia.



**FIGURE 3.** Distribution of *Pseudobuliminus xihuashida* n. sp.



**FIGURE 4.** Habitats and living individuals of *Pseudobuliminus xihuashida* n. sp., with arrows showing the burrows. **A.** Individuals emerging from the burrows after rainfall. **B.** Individuals aestivating within the burrows.

[西华师范大学], the alma mater of the first author. Next year will be the 80<sup>th</sup> anniversary of the university's founding and the first author wishes to commemorate this with the species name.

**Distribution and ecology.** Restricted to an area of roughly ten square kilometres from eastern Jiuzhaigou County (Sichuan) to western Wenxian (Gansu) (Fig. 3). During the dry season, individuals are found hibernating in small burrows, which are presumed to be created by other soil animals rather than by this species. During the rainy season, they occur on muddy ground, along with other enids and camaenids (Fig. 4).

**Remarks.** The new species can be easily distinguished from all congeners by the detached last whorl. Among the family, only *Stenogyropsis chorismenostoma* Chen, Huang & Pál-Gergely, 2022, has the detached body whorl (Chen *et al.*, 2022). The new species can be easily distinguished from the former by its rather smooth shell (vs. ribbed).

### Acknowledgements

We thank Meng-Hua Li (Sichuan Agricultural University), Zi-An Qiu (Nanjing), Jin-Sheng Mou (China Agricultural University) and Zi-Zhen Wu (Chengdu) for assistance in collecting specimens. Thanks also go to two anonymous reviewers for their very helpful suggestions to the manuscript. This study was supported by the National Natural Science Foundation of China under Grant No.32360132.

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## 四川与甘肃交界地区发现具游离体螺层坚螺的又一新种： 西华师大假拟锥螺（腹足纲：柄眼目：坚螺科）

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### 摘要

本文描述了产自中国四川与甘肃交界地区的具游离末轮的新种：西华师大假拟锥螺 *Pseudobuliminus xihuashida* Z.-G. Chen & Z.-Y. Chen, n. sp. 该物种可依据以下特征与所有同属种区分：贝壳呈圆柱形，表面光滑，末端0.5至1个壳层游离；螺层初期具弱龙骨，随后逐渐变圆润；胎壳具有细小结节。

关键词：陆生贝类，分类学，干热河谷，新物种，生物多样性



## A new genus and species of gonideine freshwater mussel from Guizhou, China, with notes on a new synonym of *Cosmopseudodon resupinatus* (von Martens, 1902) (Bivalvia: Unionidae: Gonideinae)

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**Abstract.** A new genus and species of gonideine freshwater mussel, *Tenuiunio accuratus* **n. gen. & n. sp.**, is described from the upper Yuanjiang River basin in Guizhou, China. It can be distinguished from all other genera of Gonideini by the irregularly oval and thin shell, and the almost invisible pseudocardinal teeth. The validity of the new genus is further supported by the molecular phylogenetic results based on *COI*, *16S* and *28S* sequences. Additionally, based on molecular phylogenetic results, morphological characteristics, and geographic distribution, we consider *Cosmopseudodon wenshanensis* Wu & Liu, 2024 to be a junior synonym of *C. resupinatus* (von Martens, 1902).

**Key words.** Biodiversity, molecular phylogeny, new taxa, new synonym, taxonomy

## Introduction

The unionid subfamily Gonideinae Ortmann, 1916 exhibit a broad distribution across East and Southeast Asia and harbor considerable diversity (He & Zhuang, 2013; Guo, 2022; Graf & Cummings, 2025; MolluscaBase eds, 2025). In recent years, several new gonideine genera and species have been discovered in China (Dai et al., 2023, 2024; Wu et al., 2024). Tribe Gonideini Ortmann, 1916 is one of the most diverse groups of the subfamily, consist of 15 genera and more than 30 species (Dai et al., 2024; Graf & Cummings, 2025; MolluscaBase eds, 2025). The tribe is distinguished from other tribes of the subfamily by its relatively thin shell, the absence or presence of only vestigial hinge teeth, and a tetragenous brooding type (Dai et al. 2024). Here, we describe a new genus and species of Gonideini from Guizhou, China, and proposal of a new synonym of *Cosmopseudodon resupinatus* (von Martens, 1902).

## Materials and methods

Living specimens were initially frozen at -20°C for 2 hours and subsequently thawed at room temperature for 1 hour to facilitate the extraction of animal parts. After photograph, the animal parts were then fixed in 95% ethanol. Empty shells were cleaned, dried, and preserved at room

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<http://zoobank.org/urn:lsid:zoobank.org:pub:E919A276-E65B-46C2-8396-AEB74C6440FF>

**TABLE 1.** GenBank accession numbers of sequences used in this paper.

Species	COI	16S	28S
<b>UNIONIDAE Rafinesque, 1820</b>			
<b>Gonodeinae Ortmann, 1916</b>			
<b>Gonideini Ortmann, 1916</b>			
<i>Tenuiunio accuratus</i> n. gen. & n. sp. 1	PX724592	PX724523	PX724588
<i>Tenuiunio accuratus</i> n. gen. & n. sp. 2	PX724593	PX724524	PX724589
<i>Guiunio rarus</i> 1	PV368601	PV368859	PV368862
<i>Guiunio rarus</i> 2	PV368602	PV368860	PV368863
<i>Guiunio rarus</i> Chongzuo 1	PX724594	PX724525	PX724590
<i>Guiunio rarus</i> Chongzuo 2	PX724595	PX724526	PX724591
<i>Obovalis omiensis</i>	MT020684	LC223994	MT020830
<i>Ptychorhynchus pfisteri</i>	MG463036	KY067440	MG595564
<i>Parvasolenaia rivularis</i>	MG463100	KX966393	MG595626
<i>Sinosolenaia carinata</i>	MG463087	NC023250	MG595616
<i>Sinosolenaia oleivora</i>	MG463090	NC022701	MG595617
<i>Sinosolenaia iridinea</i>	MG463091	MT477834	MG595618
<i>Sinosolenaia recognita</i>	MG463092	KY561653	MG595619
<i>Leguminaia wheatleyi</i>	MN402614	MN396725	MN396721
<i>Microcondylaea bonellii</i>	KX822652	KT966473	KX822609
<i>Gonidea angulata</i>	MN402615	MN396726	MN396722
<i>Koreosolenaia sitgyensis</i>	MT020682	GQ451859	MT020817
<i>Postolata guangxiensis</i> 1	OP009379	OP020466	OP020470
<i>Postolata guangxiensis</i> 2	OP009380	OP020467	OP020470
<i>Postolata longjiangensis</i> 1	PP786557	PP786405	PP786407
<i>Postolata longjiangensis</i> 2	PP786557	PP786406	PP786407
<i>Pseudopostolata angula</i> 1	PQ189757	PQ201945	PQ201943
<i>Pseudopostolata angula</i> 2	PQ189757	PQ201945	PQ201944
<i>Cosmopseudodon resupinatus</i>	PP079436	PP079964	PP080006
<i>Cosmopseudodon</i> "wenshanensis"	PP079444	PP079972	PP080014
<b>Pseudodontini Frierson, 1927</b>			
<i>Pseudodon mekongi</i>	KX865861	KX865632	KX865733
<i>Pseudodon vondembuschianus</i>	KP795029	KP795052	MZ684028
<i>Pseudodon cambodjensis</i>	KP795028	NC044112	KP795011
<i>Bineurus loeiensis</i>	KX865879	KX865650	KX865750
<i>Bineurus mouhotii</i>	KX865876	KX865647	KX865747
<i>Sundadontina tanintharyiensis</i>	MN275057	MN307248	MN307189
<i>Sundadontina brandti</i>	MN275058	MN307249	MN307190
<i>Pilsbryoconcha exilis</i>	KP795024	NC044124	KP795007
<i>Pilsbryoconcha compressa</i>	KX865875	KX865646	KX865746
<i>Thaiconcha callifera</i>	KX865862	KX865633	KX865734
<i>Thaiconcha munelliptica</i>	MN275063	MN307252	MN307193
<i>Nyeinchanconcha nyeinchani</i>	KP795025	KP795050	KP795008
<b>Lamprotulini Modell, 1942</b>			
<i>Lamprotula caveata</i>	MG462991	NC030336	MG595518
<i>Lamprotula leaii</i>	MN402616	MN396727	MN396723
<i>Potomida littoralis</i>	MN402617	MN396728	MN396724
<i>Pronodularia japanensis</i>	KX822659	AB055625	KX822615
<b>Chamberlainiini Bogan et al., 2017 in Lopes-Lima et al. 2017</b>			
<i>Sinohyriopsis schlegelii</i>	MT020706	EF507846	MT020836
<i>Sinohyriopsis cumingii</i>	MG463086	NC011763	MG595613
<i>Chamberlainia hainesiana</i>	KX822635	NC044110	KX822592

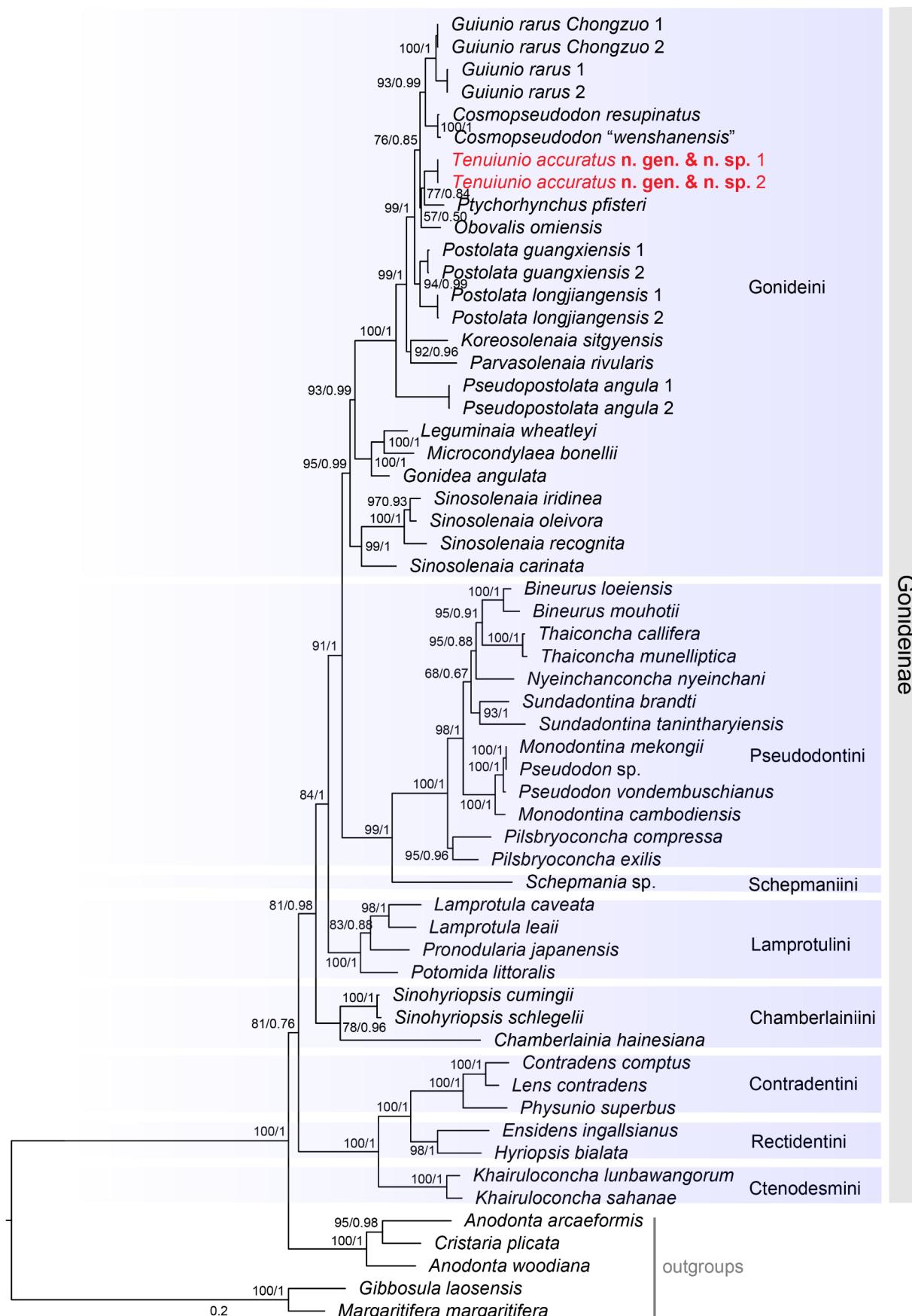
TABLE 1. (Continued)

Species	COI	16S	28S
<b>Rectidentini Modell, 1942</b>			
<i>Hyriopsis bialata</i>	KX051274	MT993644	MT993697
<i>Ensidens ingallsianus</i>	MT993541	MT993687	MT993739
<b>Contradentini Modell, 1942</b>			
<i>Lens contradens</i>	MG581991	MT993693	MT993745
<i>Lens comptus</i>	KX865928	KX865682	KX865799
<i>Physunio superbus</i>	MG582020	MT993689	MT993741
<b>Schepmaniini Lopes-Lima et al., 2021 in Zieritz et al., 2021</b>			
<i>Schepmania</i> sp.	MZ678755	MZ684082	MZ684035
<b>Ctenodesmini Pfeiffer et al., 2021 in Zieritz et al. 2021</b>			
<i>Khairuloconcha lunbawangorum</i>	MN900790	MZ684078	MN902294
<i>Khairuloconcha sahanae</i>	MZ678752	MZ684079	MZ684024
<b>Unioninae Rafinesque, 182</b>			
<i>Anemina arcaeformis</i>	NC026674	NC026674	MG595457
<i>Cristaria plicata</i>	NC012716	NC012716	MG595484
<i>Sinanodonta woodiana</i>	HQ283346	HQ283346	MG595604
<b>MARGARITIFERIDAE Henderson, 1929</b>			
<i>Gibbosula laosensis</i>	JX497731	KC845943	KT343741
<i>Margaritifera margaritifera</i>	KX550089	KX550091	KX550093

temperature. Photographs were taken by Sony® A7C II and edited in Adobe Photoshop® CC 2025. Map was made in ArcGIS® Pro.

Genomic DNA was extracted from muscle tissues preserved in 95% ethanol using a QIAamp DNA Blood Mini kit (Qiagen, Germany). The quality and concentration of the DNA were checked on 1% agarose gel electrophoresis and NanoDrop 2000 (Thermo Scientific, USA). Partial cytochrome c oxidase subunit 1 (CO I), 16S ribosomal RNA (16S) and 28S ribosomal RNA (28S) were amplified and sequenced for molecular phylogenetic analyses. Polymerase chain reaction (PCR) systems, conditions and primer pairs were followed Dai et al., (2024). The CO I sequences were aligned using MEGA v. 6.0 (Tamura et al., 2013), and the 16S and 28S sequences were aligned using MAFFT v. 7 (Katoh et al., 2019) by the Q-INS-i algorithm. The accession numbers of all sequences used in this study are given in Table 1.

Phylogenies reconstructed by the dataset combined three genes using Maximum Likelihood (ML) and Bayesian Inference (BI). Five species of Unioninae Rafinesque, 1820 (Unionidae) and Margaritiferidae Henderson, 1929 were used as the outgroups for rooting the trees. The best-fit model for each gene and gene partition was calculated by PartitionFinder2 v. 1.1 (Lanfear et al., 2017), based on the corrected Akaike Information Criterion (AICc) and using a heuristic search algorithm. The program proposed the division of the concatenated dataset into five partitions, comprising partitions for the 16S and 28S genes and each of the three codon positions of the COI gene. The best-fit model was determined to be GTR+I+G for the first and second codon positions of COI, as well as for 16S and 28S, while GTR+G was selected for the third position of COI. ML analyses were performed in IQ-TREE v. 1.6.12 (Minh et al., 2013) using the Ultrafast bootstrap approach (Minh et al., 2013) with 10,000 iterations. Bayesian inference (BI) analysis was conducted in MrBayes v. 3.2.6 (Ronquist et al., 2012). Four simultaneous runs with four independent Markov Chain Monte Carlo (MCMC) were implemented for 10 million generations, and trees were sampled every 10,000 generations with a burn-in of 25%. The convergence was checked with the average standard deviation of split frequencies <0.01 and the potential scale reduction factor (PSRF) ~ 1. Trees were visualized in



**FIGURE 1.** Maximum Likelihood tree and Bayesian inference tree inferred from *COI*, *16S* and *28S* genes sequences.

FigTree v.1.4.3 (<http://tree.bio.ed.ac.uk/software/figtree/>) and Adobe Illustrator® 2025.

*Abbreviations.* NCUMB: Museum of Biology, Nanchang University (Nanchang, China); ZGCC: Collection of Zhong-Guang Chen (Chengdu, China); MCZ: Museum of Comparative Zoology (Cambridge, USA); SMF: Senckenberg Museum (Frankfurt, Germany); UMMZ: University of Michigan Museum of Zoology (Ann Arbor, USA).

## Results

### Phylogenetic analyses

The sequence dataset consisting of 58 concatenated COI, 16S and 28S sequences from 51 species, including with five outgroup taxa, was employed for phylogenetic analyses (Table 1). The alignments of COI, 16S and 28S genes had a length of 606, 517 and 457 characters, respectively. Within these alignments, 258, 234 and 168 sites were variale, and 237, 200 and 154 sites were parsimony informative. The Bayesian and Maximum Likelihood analyses produced same phylogenies (Fig. 1). The subfamily Gonideinae comprise eight well-supported tribes as the same topology recovered by Dai et al. (2023, 2024). The new genus, along with *Cosmopseudodon* Haas, 1920, is assigned to the tribe Gonideini. The new genus forms a sister group with genus *Ptychorhynchus* Simpson, 1900 with moderate support rate (BS/PP = 77/0.84). *Cosmopseudodon wenshanensis* Wu & Liu, 2024 in Wu et al. (2024) forms a sister group with *C. resupinatus* (BS/PP = 100/1). However, these two species exhibit remarkably low genetic divergence, rendering them nearly indistinguishable.

## Systematics

Family **Unionidae** Rafinesque, 1820

Subfamily **Gonideinae** Ortmann, 1916

Tribe **Gonideini** Ortmann, 1916

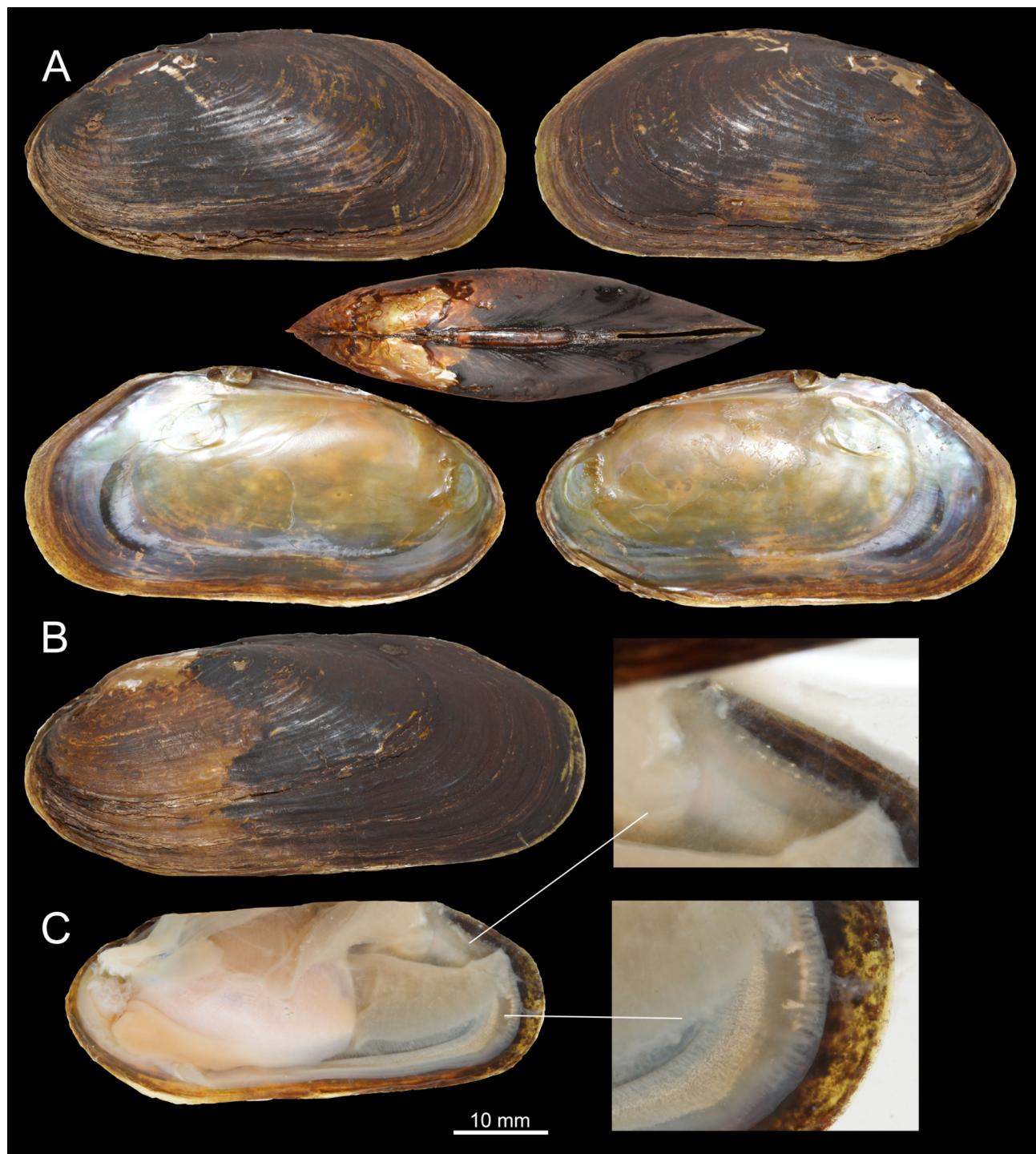
Genus ***Tenuiunio* n. gen.**

薄壳蚌属 (Pinyin: báo ké bàng shǔ)

**Type species.** *Tenuiunio accuratus* n. sp.

**Diagnosis.** The new genus is closely related to the genera *Ptychorhynchus* and *Obovalis* Simpson, 1900, but can be distinguished by the irregularly oval and comparatively thin shell, with a shell thickness comparable to that of *Parvasolenaia rivularis* (Heude, 1877), as well as by the almost invisible pseudocardinal teeth.

**Etymology.** The genus name is formed from the Latin *tenuis*, meaning “thin”, and *Unio*, the type genus of Unionidae. The name refers to the distinctly thin shell of this genus. The gender of the genus is masculine.



**FIGURE 2.** *Tenuiunio accuratus* n. gen. & n. sp. **A.** holotype. **B.** paratype. **C.** animal anatomy of the holotype.

***Tenuiunio accuratus* n. sp.**

严谨薄壳蚌 (Pinyin: yán jǐn báo ké bàng)  
(Figure 2)

**Type materials.** *Holotype*. NCUMB B2601001, Liping County [黎平县], Qiandongnan Miao and Dong Autonomous Prefecture [黔东南苗族侗族自治州], Guizhou Province [贵州省], China, leg. local people, ex. coll. Zhong-Guang Chen, December 2025. *Paratype*. ZGCC/1, other information

same as holotype.

**Diagnosis.** Same as the genus.

**Description.** Shell irregularly oval, medium-sized, very thin, flat, long, sub-glossy, rather smooth, edge semi-transparent. Anterior small, rounded and short; posterior expanded, wide and long. Dorsal margin slightly curved downwards; ventral margin weakly retuse. Umbo lower than the hinge line, located at 1/5 of the dorsal margin, smooth. Periostracum brown with thin growth lines, usually covered by black sediment. Ligament short and weak. Beak cavities shallow, open. Anterior adductor muscle scars irregularly rounded, shallow, smooth; posterior adductor muscle scars long oval, smooth. Pseudocardinal teeth of both shells degenerated, almost invisible. Lateral teeth of both shells short and thin. Nacre light orange to white.

Mantle and aperture margins off-white, papillae on flap margin highly degraded. Gills off-white, inner and outer gills are almost equal in length. Labial palps brown, oval. Visceral mass and foot light orange.

**Measurements.** Holotype: shell length 51.0 mm, height 25.0 mm, width 14.3 mm. Paratype: shell length 59.5 mm, height 25.8 mm, width 15.2 mm.

**Etymology.** The species is named after the Latin *accuratus*, meaning “rigorous”, referring to the need for rigor in taxonomic studies of Chinese freshwater mussels, as insufficiently careful work may lead to the repeated description of junior synonyms.

**Distribution and ecology.** The species is restricted to a small tributary of the Yuanjiang River in Liping (Fig. 3). It inhabits flowing streams with pebble and sandy substrates, where it occurs alongside *Pseudocuneopsis liuovatus* (He & Zhuang, 2013) (Fig. 4). The population size appears to be very small (Yu-Chen Wang, pers. comm.).



**FIGURE 3.** Distribution of *Tenuiunio accuratus* n. gen. & n. sp. Star shows the type locality.



**FIGURE 4.** Habitat of *Tenuiunio accuratus* n. gen. & n. sp. The shells are empty shells. © Yu-Chen Wang.

**Remarks.** The survival of the new species is under severe threat. Under the guise of scientific research, some individuals have reportedly commissioned local collectors to conduct intensive and destructive harvesting across the type locality, followed by the commercial sale of specimens at high prices. In addition to direct overharvesting, the collection methods employed by local collectors have also caused physical damage to the habitat itself. Such combined pressures have very likely exceeded the carrying capacity of the population and have caused a severe impact on the persistence of the species. As a consequence of this overexploitation and habitat disturbance, subsequent field surveys failed to locate any living individuals at the type locality, including a follow-up survey conducted only one month later (Yu-Chen Wang, pers. comm.). Under these circumstances, the authors were compelled to rely on specimens derived from the same distorted source above for the present study. Such practices are strongly condemned here, and we call for their firm rejection, together with an appeal for responsible and ethical shell collecting practices that prioritise species conservation over commercial or personal interests.

Genus *Cosmopseudodon* Haas, 1920

**Type species.** *Pseudodon resupinatus* E. von Martens, 1902, by original designation.

***Cosmopseudodon resupinatus* (von Martens, 1902)**

稀褶饰拟齿蚌 (Pinyin: xī zhě shì nǐ chí bàng)

*Pseudodon resupinatus* von Martens, 1902: 131.

*Pseudodon (Cosmopseudodon) resupinatus* – Haas, 1920: 310.

*Ptychorhynchus resupinatus* – Bolotov *et al.*, 2023.

*Cosmopseudodon resupinatus* – Wu *et al.*, 2024: 11, figs 1, 3a1–a3.

*Cosmopseudodon wenshanensis* – Wu *et al.*, 2024: 11, figs 1, 3b1–b3. **New synonym.**

**Material examined.** Lectotype. MCZ 167671, Than Moi, Tonkin, French Indo China (photo examined). Paratype: MCZ 167672, other information same as lectotype (photo examined). SMF 13785/5, Than-Moi, Tonkin (photo examined). UMMZ 110156/3, Tonkin, French Indo China (photo examined). ZGCC/10, Yongfu County [永福县], Guilin City [桂林市], Guangxi Zhuang Autonomous Region [广西壮族自治区], China, leg. Zhong-Guang Chen & Yu-Ting Dai, March 2023. ZGCC/5, Panlonghe River [盘龙河], Wenshan Zhuang and Miao Autonomous Prefecture [文山壮族苗族自治州], Yunnan Province [云南省], China, leg. local people, ex. Zhong-Guang Chen, May 2023.

**Remarks.** Molecular phylogenetic analyses revealed an extremely limited genetic divergence between *C. resupinatus* and *C. wenshanensis*, with a COI gene distance of merely 1.82% between two geographically distant populations (based on online BLAST results from NCBI). We propose that the morphological distinctions between these two nominal species reflect ecotypic variation rather than interspecific divergence. Specifically, *C. wenshanensis* represents a stream-dwelling ecotype of *C. resupinatus*. Such ecotype-related morphological plasticity is well-documented in freshwater mussels, where numerous Chinese species exhibit pronounced conchological variation across habitats. Examples include *Lamprotula caveata* (Heude, 1877), *Lanceolaria triformis* (Heude, 1877), and *Inversidens rentianensis* Wu & Wu, 2021 in Wu *et al.* (2021) (Z.-G. Chen, unpublished data), among others. Consistently, conspecific individuals from stream environments often display shell morphologies distinct from those inhabiting large rivers. Historically, such ecologically mediated variation has frequently been misinterpreted as evidence for interspecific differentiation (Wu *et al.*, 2020, 2022). Furthermore, the *C. resupinatus* specimens sequenced by Wu *et al.* (2024) originated from the Pearl River basin, while their *C. wenshanensis* specimens were collected from the Red River basin. It is noteworthy that the type locality of *C. resupinatus* is situated within the Red River basin (von Martens, 1902). Thus, the *C. wenshanensis* specimens can be considered a near-topotype of *C. resupinatus*. Additionally, the shell morphology of the lectotype and paratype of *C. resupinatus* (illustrated in Graf & Cummings, 2025) appears intermediate between that of the *C. wenshanensis* and the Pearl River population of *C. resupinatus*. Another set of topotypic specimens of *C. resupinatus* (SMF 13785, illustrated in Graf & Cummings, 2025), collected from Than-Moi, Tonkin (around Hanoi, Vietnam), exhibited virtually no distinguishable morphological differences from *C. wenshanensis*. Based on this combined molecular, morphological, and biogeographic evidence, we treat *C. wenshanensis* as a junior synonym of *C. resupinatus*.

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# 贵州省隆脊蚌亚科一新属新种, 兼论稀褶饰拟齿蚌一新异名 (双壳纲: 蚌科: 隆脊蚌亚科)

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## 摘要

本文描述了产自中国贵州沅江上游的河蚌新属新种: 严谨薄壳蚌 *Tenuiunio accuratus* n. gen. & n. sp.。该属可依据以下特征与所有同族其他属区分: 贝壳薄且为不规则的椭圆形; 拟主齿几乎不可见。其有效性也被基于COI、16S和28S序列的分子系统发育结果所证实。此外, 基于分子系统发育结果、形态学特征和地理分布, 我们将文山饰拟齿蚌 *Cosmopseudodon wenshanensis* Wu & Liu, 2024修订为稀褶饰拟齿蚌 *C. resupinatus* (von Martens, 1902)的次异名。

关键词: 生物多样性, 分子系统发育, 新阶元, 新异名, 分类学

中文题字：吴岷  
封面物种：可爱拟圆口螺（姜日新 摄）

《贝类多样性研究》发行软体动物及其近缘无脊椎动物之原创研究，尤其在分类学、系统发育及相关领域。欢迎如下稿件：修订、描述新分类单元、重描述鲜为人知的分类单元、图示检索表、国家级或省级新记录与生物地理、解剖学报告、动物区系调查和实地野外考察记录。

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# CATHAICA

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