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A new species of *Ebala* J.E. Gray, 1847 from southeastern China, with notes on *Murchisonella densistriata* (Nomura, 1936) (Gastropoda: Heterobranchia: Murchisonellidae)

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Abstract. A new species of *Ebala* J.E. Gray, 1847, collected from sandy sediment of Xiamen, Fujian, China, is described. Conchological comparisons are made between *Ebala yuzan* sp. nov. and congener species, as well as with species in the closely related genus *Murchisonella* Mörch, 1875. The new species is characterized by a heterostrophic protoconch, dense spiral ribs, and an aciform shape. The monotypic species *Murchisonella densistriata* (Nomura, 1936) is superficially similar to the new species in sculpture and outline. Some notes on the type material of this species are made.

Key words. Taxonomy, Xiamen, Fujian, marine gastropods, morphology

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Introduction

Based on shell characters including cylindrical shape, smooth or fine sculpture, hyperstrophic protoconch with slightly sunk nucleus, as well as a unique anatomical feature, the complicated dental structure named jaw apparatus, Warén (1994) moved *Ebala* J.E. Gray, 1847 and the closely related genera *Murchisonella* Mörch, 1875 and *Henrya* Bartsch, 1947 from Pyramidellidae J.E. Gray, 1840 to a new family Ebalidae Warén, 1994.

Ebalidae was subsequently synonymized with Murchisonellidae T.L. Casey, 1904 but recognized at the subfamilial level as Ebalinae, which contains the sole extant genus *Ebala* (Schander *et al.* 1999; Bouchet & Rocroi 2005). The separation of Murchisonellidae and Pyramidellidae is also supported by molecular phylogenetic studies, which show that these families do not form a sister-group relationship (Dinapoli & Klussmann-Kolb 2010; Dinapoli *et al.* 2010).

Ebala and other murchisonellid genera share some conchological and anatomical commonalities, but *Ebala* is distinguished by the hyperstrophic protoconch consisting of sinistral and almost planispiral whorls nearly perpendicular to the teleoconch. *Murchisonella*, *Henrya*, and *Pseudoaclisina* have a protoconch comprising a sinistral embryonic shell covered by the larval shell, which is nearly parallel to the teleoconch (Bandel 2005; Peñas & Rolán 2013). *Koloonella* has a planispiral, perpendicular protoconch but differs from *Ebala* in having a smooth shell surface and lacking a jaw apparatus. Some *Ebala* species with smooth shells and *Koloonella* are conchologically indistinct (Warén 1994; Robba 2013).

Recent *Ebala* species are mainly distributed in the Mediterranean Sea, eastern Atlantic Ocean, Red Sea, northern Indian Ocean, and western to northwestern Pacific Ocean (Saurin 1962; Warén 1994; Bandel 2005). Five species have been described from Japan: *E. pagodula* (Yokoyama, 1927), *E. scintillans* A. Adams, 1861, *E. vestalis* A. Adams, 1860, *E. virginea* A. Adams, 1860, and *E. diaphana* A. Adams, 1861. Peñas & Rolán (2016) transferred *E. diaphana* to *Ebalina* Thiele, 1929, becoming *Ebalina diaphana* (A. Adams, 1861). Thus far, no *Ebala* have been documentary recorded from China.

In this paper, *Ebala yuzan* sp. nov. is described as new to science. It is the first murchisonellid recorded from China. Some remarks are also made on a similar species, *Murchisonella densistriata* (Nomura, 1936).

Materials and Methods

Empty shells of the new species were collected from sandy sediment transported by wave action near the high-water line at Xiajinwan, Siming District, Xiamen City, Fujian Province, China. Small brushes with warm water and alcohol were used to clean the surface of the shells. The holotype and paratype 1 of *Ebala yuzan* were photographed using a Nikon D80 camera with Laowa 60 mm F2.8 Macro 2:1 lens, and paratype 3 was photographed using a Mitutoyo M Plan APO 10×/20× objective with a Raynox DCR150 tube lens. Photomicrographs of a non-type specimen of *E. yuzan* was taken using a Phenom scanning electron microscope (SEM) in College of Ocean and Earth Sciences, Xiamen University.

Photographs of *Murchisonella densistriata* (NSMT-Mo SHM07016) were received from K. Hasegawa (National Museum of Nature and Science, Tsukuba, Japan). Images of *Ebala scintillans*, *E. vestalis*, *E. virginea*, and *E. diaphana* used for comparison were received from C. Rowley (Museums Victoria, Melbourne, Australia) or via the Museums Victoria website (https://collections.museumsvictoria.com.au).

Type materials of the new species have been deposited in the Marine Biological Museum (MBM), Chinese Academy of Sciences (Qingdao, China). Three paratypes have been retained in the authors' private collections. Other museum collections consulted: Museums Victoria Collections (Melbourne, Australia; MVC) and National Science Museum (Tokyo, Japan), now National Museum of Nature and Science (Tokyo and Tsukuba, Japan; NSMT).

Systematics

Superfamily Murchisonelloidea T.L. Casey, 1904

Family Murchisonellidae T.L. Casey, 1904

Genus *Ebala* J.E. Gray, 1847

Type species. *Turbo nitidissimus* Montagu, 1803, by monotypy.

***Ebala yuzan* sp. nov.**

Figures 1, 2A, B

Murchisonella cf. *densistriata* (Nomura, 1936)—Lin & Rolán 2024: 23, fig. 12D.

ZooBank identifier. urn:lsid:zoobank.org:act:08EB80C9-DAF0-4A7C-B8D1-FE91E629C8B7

Type locality. In sandy sediment near the high-water line at Xiajinwan [厦金湾], Siming District [思明区], Xiamen City [厦门市], Fujian Province, China, leg. Li-Wen Lin, 2022.

Type material. Holotype: MBM 287951. Paratypes: MBM 287614 (1 spec.); MBM 287615 (1 spec.); Yang Shao collection, Beijing (1 spec.); Li-Wen Lin collection, Xiamen (2 spec.). All with same data as the holotype.

Non-type material. A damaged, non-type specimen has been deposited in Xiamen University and was used for scanning electron microscopy; it has the same data as the holotype.

Shell measurements. Height = 4.19 mm, width = 0.89 mm (holotype); height = 3.74–5.15 mm, width = 0.81–1.01mm (paratypes).

Diagnosis. Shell of medium size for the genus, aciform; protoconch sinistral, heterostrophic with hyperstrophic whorls and a slightly sunk nucleus, nearly perpendicular to teleoconch; final whorl with 36–40 fine spiral ribs.

Description. Shell of medium size for the genus, translucent, white, elongate-turreted. Protoconch approximately 1¾ whorls, sinistral, globose, with slightly inclined nucleus, distinct from remaining whorls. Protoconch heterostrophic with hyperstrophic whorls and a slightly sunk nucleus, nearly perpendicular to teleoconch. Teleoconch whorls numerous, 10½ in the holotype and 11 in the largest specimen, convex in outline, and some specimens with the last 4–5 whorls slightly angular at middle. Suture marked; subsutural region wide, with a weak spiral cord forming an indistinct shoulder. All whorls increase evenly, including final whorl. Aperture elliptical; lower part of aperture extends outwards at an angle to termination of columella. Outer lip rounded, thin, fragile. Inner lip reflected toward umbilical area, completely covering umbilicus. Parietal region with thin callus; columella thick, with a slight flexure.

Shell surface finely sculptured, with *ca* 36–40 fine spiral ribs on final whorl, intersected by finer, sparser axial growth lines to form a shallow cancellate pattern. Interspaces between some adjacent stronger spiral ribs have a weaker spiral rib.

Soft parts unknown. From the residual dried tissues inside the shells, we infer that animals have a black mantle, which is similar to many other murchisonellid species.

Etymology. Yuzan is the Chinese Pinyin word for jade hairpins, in reference to the aciform shell shape.

Distribution. Known only from the type locality.

Remarks. The sculpture of *Ebala yuzan* is most similar to that of *Murchisonella densistriata*, consisting of fine spiral grooves, sparse growth lines and a weak spiral cord in the subsutural region, but the strength of the axial and spiral sculpture is almost equivalent for *M. densistriata*. Crucially,

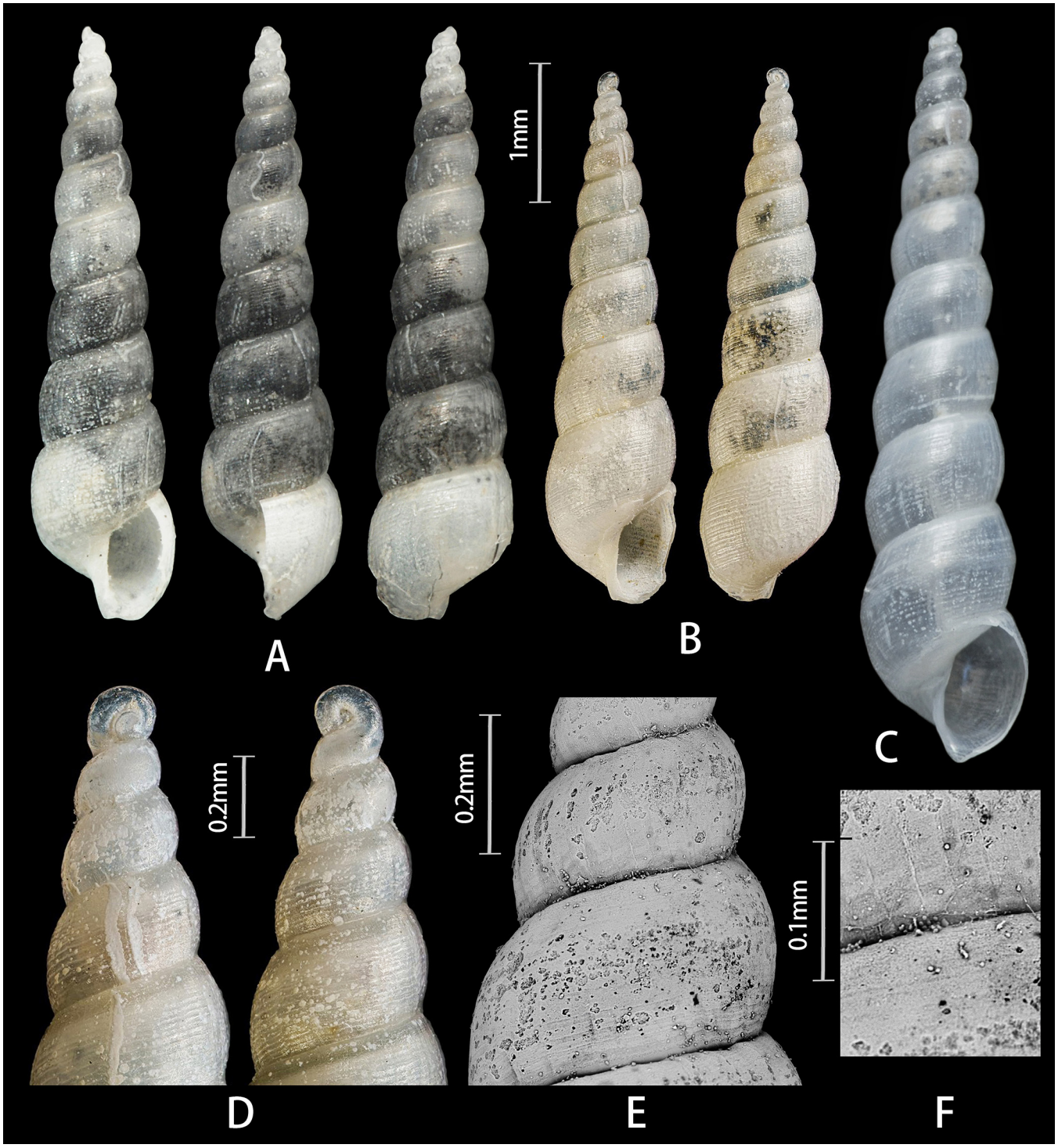

Figure 1. *Ebala yuzan* n. sp. **A**, holotype, MBM 287951. **B**, paratype 3, SY. **C**, paratype 1, MBM 287614. **D**, details of the protoconch of paratype 3. **E**, **F**, SEM photomicrographs of a non-type specimen for details of the sculpture. Photographs: Li-Wen Lin (A, C), Yang Shao (B, D), and Yuan-Zheng Meng (E, F).

M. densistriata has an immersed protoconch, which is the key characteristic of *Murchisonella*.

Three *Ebala* species from seas around Japan, *E. scintillans*, *E. vestalis*, and *E. virginea*, all have smooth shells. *Ebalina diaphana*, which is also smooth, is similar in outline to *E. yuzan*, but *E. diaphana* has a prominent, rather than slightly

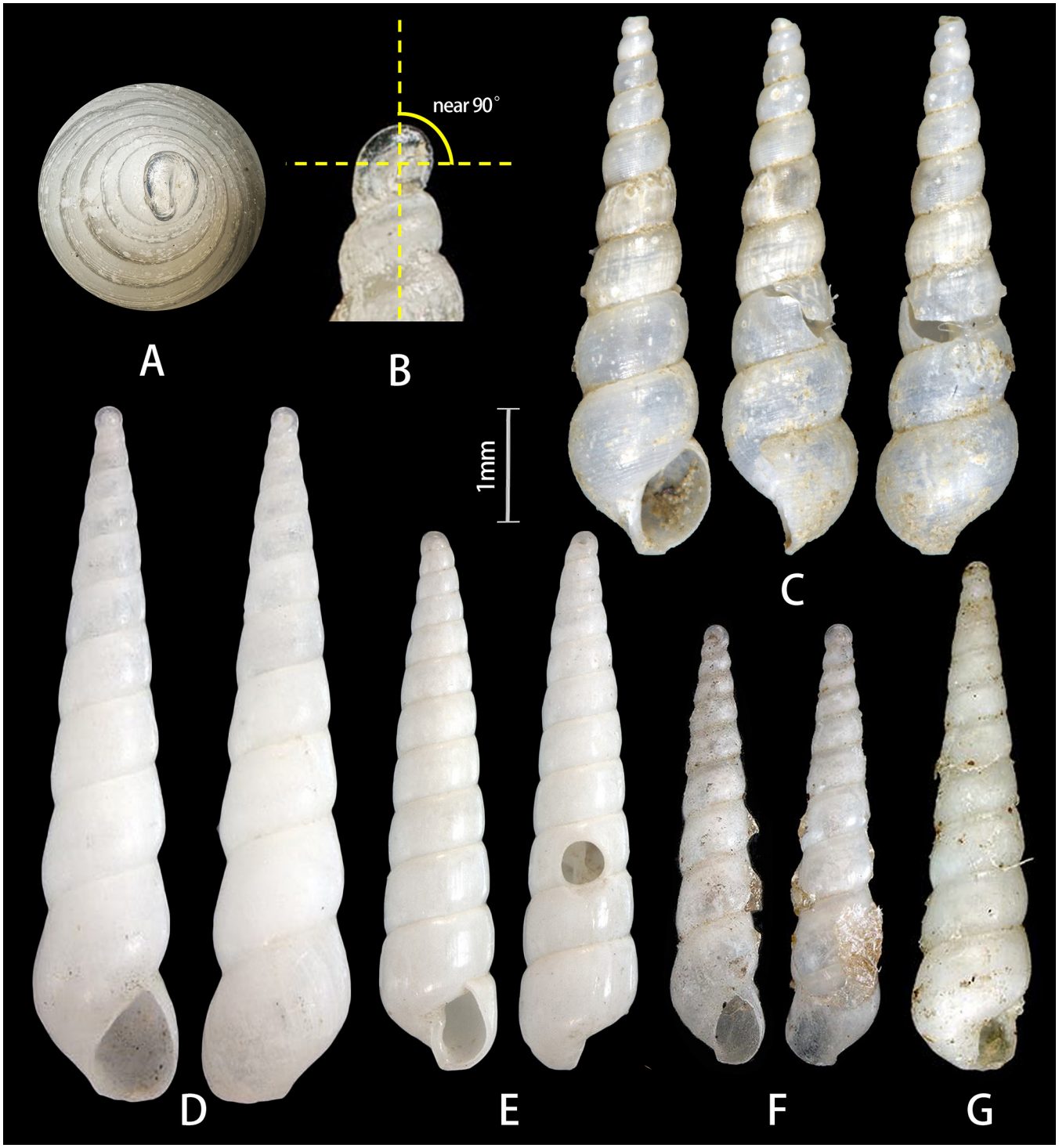

Figure 2. Species of *Ebala* (A, B, D, E, G), *Ebalina* (F), and *Murchisonella* (C). **A**, **B**, details of the heterostrophic protoconch of *Ebala yuzan* n. sp. (paratype 3, SY), not to scale. **C**, *Murchisonella densistriata* (Nomura, 1936) (holotype, NSMT-Mo SHM07016). **D**, *Ebala vestalis* A. Adams, 1861 (syntype, MVC F31511). **E**, *Ebala virginea* A. Adams, 1860 (syntype, MVC F31470). **F**, *Ebalina diaphana* (A. Adams, 1861) (syntype, MVC F31503). **G**, *Ebala scintillaris* A. Adams, 1861 (syntype, MVC F31504). Photos: Yang Shao (A, B), Kazunori Hasegawa (C, © National Museum of Nature and Science, Tsukuba), David Staples and Chris Rowley (D–G, © Museums Victoria).

inclined protoconch nucleus, which accounts for its generic placement in *Ebalina* (Peñas & Rolán, 2016). Another Japanese species, *Ebala pagodula*, has dense spiral ribs on the teleoconch, but the ribs are finer than in *E. yuzan*. Moreover, *E. pagodula* is smaller, *ca* 2 mm, and the outline of the whorls is more convex. Some Atlantic and Mediterranean species, such as *E. nitidissima* (Montagu, 1803) and *E. pointeli* (de Folin, 1868), also have dense spiral ribs but the protoconch makes a lower angle to the teleoconch, and adult shells are apparently smaller than *E. yuzan*.

Genus *Murchisonella* Mörch, 1875

Type species. *Murchisonia spectrum* Mörch, 1875, by monotypy.

***Murchisonella densistriata* (Nomura, 1936)**

Figure 2C

Cingulina (*Careliopsis*) *densistriata* Nomura 1936: 48, pl. 6, fig. 45a, b.

Type material. Holotype: NSMT-Mo SHM07016, Shiogama Bay, Miyagi Prefecture, Japan.

Shell height. 4.8 mm (holotype).

Remarks. *Murchisonella densistriata* was described based on a single specimen collected in Shiogama Bay, Japan (Nomura 1936), and no other specimens have been recorded since. The holotype was originally deposited in the Saito Ho-on Kai Museum of Natural History with collection number 7016, but in 2006 it was transferred to the National Museum of Nature and Science, Tokyo (together with all other collections of natural science in the Saito Ho-on Kai Museum; Matsuura et al. 2009). This specimen is now stored at the Department of Zoology of the National Museum of Nature and Science, Tsukuba with a new collection number, NSMT-Mo SHM07016.

Originally, the holotype was an intact specimen as figured by Hori (2000: 730), but it was broken in the middle and repaired before it left the Saito Ho-on Kai Museum (K. Hasegawa pers. comm.). This may explain the size differences reported in the literature: height 4.8 mm (Hori 2000) and 4.6 mm (Higo *et al*. 2001).

Peñas & Rolán (2013: pl. 16 fig. 3a, b) figured a specimen from the Philippines as *M.* cf. *densistriata*, but this specimen has distinct shouldered whorls. Moreover, the axial ribs of this specimen are strong whereas invisible in the holotype of *M. densistriata*, which indicates it belongs to another species.

Discussion

The species-rich family Murchisonellidae contains species with aciform, translucent-white shells. Most specimens of murchisonellids have been collected from shell grit washed ashore, or from deep water sediments, and living individuals have seldom been seen. As a result, most taxonomic studies are based only on shell morphology, whilst research on anatomy and molecular analysis is rare (Warén 2013; Peñas & Rolán 2013). Knowledge on murchisonellids of China is poor, and *Ebala yuzan* is the first species of this family reported from China. Meanwhile, fieldwork in Chinese sea areas conducted in recent years by other researchers have yielded some other murchisonellid species, among which a few have been collected alive (Zhong D.-D. pers. comm.). A systematic study of this group from Chinese waters and comparisons with species from nearby areas will be forthcoming.

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