

## Two new species of the genus *Nassarius* (Gastropoda: Nassariidae) from the South China Sea

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### Abstract

Two species of *Nassarius* Duméril, 1805 from the South China Sea are described and illustrated. The specimens are in the Nassariidae collection of the Marine Biological Museum of Chinese Academy of Sciences, Qingdao. *Nassarius concavus* sp. nov., from the sandy bottom at a depth of 180 m, resembles *Nassarius glabrus* Zhang and Zhang, 2014 in general shell morphology, but differs from the latter in having a smaller, more slender adult shell without axial ribs on the upper teleoconch whorls. *Nassarius nanshaensis* sp. nov., from the Nansha Islands at a depth of 56–147 m, is similar to *Nassarius maxiutongi* Zhang, Zhang and Li, 2019 in the shell sculpture, but differs in having a more slender shell with a higher spire, and fewer cusps on the rachidian tooth (9–11 vs. 13–17).

**Key words:** Gastropoda, *Nassarius*, new species, South China Sea, Nansha Islands

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### 1 Introduction

The family Nassariidae is a relatively diverse group of buccinoid gastropods occurring worldwide, with a wide habitat range encompassing temperate, subtropical and tropical waters, from the intertidal zone to deeper waters (0–1 000 m depth, mostly 0–300 m) (Cernohorsky, 1972, 1984). Some species have even invaded freshwater (Strong et al., 2017 and references therein). In recent years, intensive efforts to understand the evolutionary relationships of the Buccinoidea have resulted in significant advances towards a stable classification of Nassariidae (Galindo et al., 2016); as a part of these efforts, some genera previously included in Buccinidae were transferred to the Nassariidae. Currently, the family Nassariidae includes more than 600 species in at least 23 genera (MolluscaBase, 2020).

In China, species and fauna of Nassariidae have been investigated by various authors (e.g., Zhang, 2009, 2010; Yang, 2010; Zhang and Yang, 2010), with more than 70 species have been recorded. However, the biodiversity of this group is still underestimated. Increased taxonomic efforts over recent years have revealed several undescribed or unrecorded nassariid species in China (Zhang, 2013; Zhang and Zhang, 2014; Zhang and Zhang, 2018; Zhang et al., 2019).

Recently, examination of nassariid specimens preserved at the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS), Qingdao revealed two new species belonging to the genus *Nassarius*. In the present paper, we formally describe and illustrate these two species to increase the taxonomic knowledge of Nassariidae from Chinese waters.

### 2 Materials and methods

Specimens of *Nassarius nanshaensis* sp. nov. were collected

by Agassiz trawl from shallow water (56–147 m) off the Nansha Islands; and the specimens of *Nassarius concavus* sp. nov. were sampled from the South China Sea at a depth of 180 m. Two specimens of *Nassarius nanshaensis* sp. nov., including the holotype, were dissected for examination of radulae. Shells and operculum were observed by a light microscope and radulae by scanning electron microscope (SEM). For SEM, radulae were placed in 10% NaOH for 2 h, washed in distilled water, then laid on a cover slip to air-dry. Finally, the samples were coated with gold and examined under SEM.

The following abbreviations are used in the text: CN, collection number; MBMCAS, Marine Biological Museum of Chinese Academy of Sciences, Qingdao; RN, registration number; St, station; spm(s), specimen(s); coll(s), collector(s).

### 3 Taxonomy

Class Gastropoda Cuvier, 1795

Superfamily Buccinoidea Rafinesque, 1815

Family Nassariidae Iredale, 1916 (1835)

Genus *Nassarius* Duméril, 1805

Type species: *Buccinum arcularia* Linnaeus, 1758, by subsequent designation. Recent, Indo-Pacific Ocean.

*Nassarius concavus* sp. nov. (Figs 1a–e)

*Nassarius* (*Zeuxis*) sp. Li et al., 2010 (Figs 1f, h)

**Material examined:** Holotype, RN: MBM286692 (15.6 mm in length, 7.8 mm in width), South China Sea, off Guangdong Province (20°52'N, 114°53'E), sandy bottom, 180 m, in MBMCAS, Qingdao.

Paratype: 1 spm, RN: MBM286693 (12.0 mm in length, 6.8 mm in width), collected together with the holotype.

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**Fig. 1.** *Nassarius concavus* sp. nov. (a–e) and *Nassarius nanshaensis* sp. nov. (f–n). a–c. Holotype, MBM286692, 15.6 mm; d. Paratype, MBM286693, 12.0 mm; e. Radula, modified from Fig. 2c of Li et al. (2010); f–h. MBM286694, 25.2 mm; i. Operculum; j–k. MBM286695, 24.2 mm; l–n. Radula.

**Description** of the holotype: Shell (Figs 1a–d) thin, semitransparent, of medium size for the genus; last whorl large, 2/3 of the shell length. Protoconch of 3.25 glassy whorls; last 1.25 whorls angulated with a distinct peripheral keel. Transition to teleoconch distinct. Teleoconch of 6 evenly convex whorls. Suture deeply channeled. First teleoconch whorl with weak axial waves, probably due to uneven thickness of material in underlying shell layers or irregular erosion. Subsutural groove on first two teleoconch whorls. Subsequent whorls smooth except for microscopic axial striae. Aperture slightly higher than the spire, outer lip variced, interior with 11–12 moderately long lirae, outer lip anteriorly with 4 indistinct, pointed denticles. Columella arched, upper region with a prominent parietal tooth. Columellar callus thin and narrowly margined. Siphonal canal short with a prominent, U-shaped notch. Anal canal narrow. Shell color whitish to light yellow, with prominent brownish longitudinal streaks.

**Radula:** Central tooth evenly arched, posterior margin with 9 long, sharp-pointed denticles. Lateral teeth with 2 large, sharp-pointed cusps, outer one longer and narrower than the inner one (Fig. 1e).

**Etymology:** The species is named *concavus* in reference to the concave shape of the suture.

**Type locality:** South China Sea, off Guangdong Province, China.

**Distribution and habitat:** Only known from the type locality, South China Sea, off Guangdong Province, where they live on sandy bottom in 180 m depth.

**Remarks:** *Nassarius concavus* sp. nov. was illustrated as *Nassarius (Zeuxis)* sp. by Li et al. (2010) (Figs 1f, h). In that publication, they also mentioned another species, *Nassarius (Zeuxis) algidus* (Reeve, 1853) (Figs 1g, i), which was subsequently described as *Nassarius glabrus* Zhang and Zhang, 2014. The two species are very similar in general shell morphology; however, *Nassarius glabrus* differs from *Nassarius concavus* sp. nov. in having a large, broader shell with well-developed axial ribs on the first 2 to 3 teleoconch whorls. In addition, the molecular analysis based on the sequences of the mtCOI gene confirmed that they represent two different species (Li et al., 2010).

*Nassarius excellens* (Kuroda and Habe, 1961) (Habe, 1961) and *Nassarius tangaroai* Kool, 2006 resemble *Nassarius con-*

*cavus* sp. nov. in shell shape and color pattern, but they can be distinguished from the new species in having axial ribs on earlier teleoconch whorls, a subsutural groove and a non-channeled suture.

*Nassarius concavus* sp. nov. may be confused with *Nassarius kooli* Dekker and Dekkers, 2009 because of the similarity in shell shape and in possession of a deeply channeled suture. *Nassarius kooli* differs from the new species in having prominent axial ribs on earlier teleoconch whorls, a subsutural groove, numerous microscopic spirals and a different color pattern (Dekker and Dekkers, 2009; Zhang and Zhang, 2014).

*Nassarius nanshaensis* sp. nov. (Figs 1f–n)

**Material examined:** Holotype, RN: MBM286694, St: 64 (4°00'N, 112°06'E), CN: SSBV27–15, Nansha Islands, muddy sand, 56 m, 1 August 1988, coll. Ruiqiu Chen, in MBMCAS.

**Paratypes:** 1 spm, RN: MBM286695, CN: SSBV26–33, St: 60 (5°20'N, 112°06'E), Nansha Islands, muddy sand, 127 m, 31 July 1988, coll. Ruiqiu Chen; 5 spms, RN: MBM286696, CN: SSIVB50–11, St: 50 (5°38'N, 109°05'E), Nansha Islands, 147 m, 16 May 1987, coll. Ruiqiu Chen; 2 spms, RN: MBM286697, CN: SSBIV–4, St: 29 (6°00'N, 112°15'E), Nansha Islands, soft mud, 105 m, 11 May 1987, coll. Ruiqiu Chen; 2 spms, RN: MBM286698, CN: SSIVB40–11, St: 49 (5°15'N, 109°45'E), muddy sand, 111 m, 16 May 1987, coll. Ruiqiu Chen; 6 spms, RN: MBM286699, CN: SSB10–6, St: 64 (4°30'N, 110°30'E), Nansha Islands, sand and mud, 100 m, 23 September 1994, colls. Zhican Tang, Xianqiu Ren; 5 spms, RN: MBM286700, CN: SSB12–7, St: 68 (5°00'N, 112°00'E), Nansha Islands, 102 m, 23 September 1994; colls. Zhican Tang, Xianqiu Ren.

**Description** of the holotype: Shell (Figs 1f–h, j and k) thick, solid, of medium size for the genus; spire acute; last whorl large, 2/3 of shell length. Protoconch of 2.5 glassy, slightly angulated whorls with a distinct keel on the middle part, transition to teleoconch distinct. Teleoconch of 6 evenly convex whorls. Suture ledged, slightly channeled. First 4 teleoconch whorls sculptured with weak, wide, flattened spiral cords, numbering 6–7 on the antepenultimate whorl. Each teleoconch whorl with a distinct subsutural spiral groove. Spiral sculpture gradually becoming reduced and absent on penultimate whorl and upper part of the last whorl; shell base with 4–5 deep grooves. Axial ribs thin and

narrowly spaced on upper whorls (24–25 on penultimate whorl), becoming broader on ventral surface of last whorl, reducing on the dorsal surface of last whorl and finally recurring towards the aperture. Aperture as long as spire, outer lip slightly variced, edge sharp, interior with 14 moderately long lirae, outer lip anteriorly with 5–6 small, pointed denticles. Columella arched, upper region with a prominent parietal tooth. Columellar callus well developed and margined. Siphonal canal narrow with a prominent, U-shaped notch. Anal canal narrow. Shell color whitish to yellowish brown, outer lip and columella white, aperture orange-yellowish inside, brownish spiral band vague on spire, visible on dorsal surface of the body whorl.

Operculum (Fig. 1i) ovate, brownish, inner margin smooth, outer margin with 4–5 prominent serrations.

**Radula** (Figs 1l–n): Central tooth evenly arched, posterior margin with 9–11 long, sharp-pointed denticles. Lateral teeth with 2 large, sharp-pointed cusps, outer one longer and narrower than the inner one.

**Variability:** The adult size of the shells varies from about 16.5 mm to 25.2 mm, most 21.0–23.0 mm. The colour varies from creamy white to light brownish, with vague brownish bands. The axial ribs on dorsal surface of the last whorl are weak or absent.

**Etymology:** The new species is named after its type locality, Nansha Islands.

**Type locality:** Nansha Islands, South China Sea, China.

**Distribution and habitat:** To date only known from Nansha Islands, where they live on muddy or sandy bottom at depth range of 56–147 m.

**Measurements:** See Table 1.

**Remarks:** To date, more than 70 species of the genus *Nassarius* have been recorded from Chinese waters. Of these, only two species, *Nassarius multivocus* Kool, 2008 and *Nassarius maxiutongi* Zhang, Zhang and Li, 2019, could be confused with *Nassarius nanshaensis* sp. nov. in terms of the shell size and general shape. However, *Nassarius multivocus* can be separated from the new species on the basis of the presence of sculpture over the whole shell surface (Kool, 2008; Zhang et al., 2019). *Nassarius maxiutongi* has a similar sculpture to *Nassarius nanshaensis* sp. nov., but differs in having a broader shell, thicker axial ribs, and a lower number of cusps on the rachidian tooth (9–11 vs. 13–17).

**Table 1.** Shell dimensions (unit: mm) of holotype and four paratypes of *Nassarius nanshaensis* sp. nov.

	Holotype	Paratype 1	Paratype 2	Paratype 3	Paratype 4
Shell length	25.2	24.2	22.3	21.5	18.5
Shell width	12.3	12.0	11.5	10.8	10.4

#### 4 Discussion

In China, the family Nassariidae was systematically studied by Yang (2010) based on the shell and radula. As a result, a total of 46 species in two genera were recorded. Since that time, extensive taxonomic efforts have revealed many new species and new records from Chinese waters (Zhang, 2009, 2010, 2013; Zhang and Zhang, 2014; Zhang and Zhang, 2018; Zhang et al., 2019). There are at least 100 nassariid species in Chinese waters (authors' unpublished data), a much higher number than previously thought. These findings strongly suggest that the biodiversity of Nassariidae in Chinese waters is still underestimated, and there are more species waiting to be discovered.

Accurate identification and delimitation of species are essential for assessing biodiversity; however, previous descriptions of nassariid species were mainly based on their shells, which sometimes do not provide sufficient morphological information, res-

ulting in taxonomic confusion and, in turn, in an inaccurate estimate of biodiversity. The morphology of the radula is typically considered to be an important feature for gastropod taxonomy. Some authors have emphasized that the radular morphology of Nassariidae can be used as a basis for both genus and species distinctions (Habe, 1964; Adams and Knudsen, 1984), but others noted that radulae seem not to be practical for taxonomy, especially for species delimitation (Troschel, 1867; Cernohorsky, 1984). Yang and Zhang (2011) examined the radulae of 22 nassariid species from China in detail and concluded that radula morphology could be used to distinguish species. In recent years, some molecular studies of Nassariidae have been conducted in China based on mitochondrial and/or nuclear genes (Li et al., 2010; Chen and Zhang, 2012; Zou et al., 2012). Although those molecular studies determined some systematic relationships among species and revealed several cryptic species, many spe-

cies names used were misidentifications that resulted in inconsistent conclusions. In the future, traditional shell-based identification should, where possible, be combined with radular and molecular features to ensure accurate taxonomy and classification of Nassariidae.

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