


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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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)

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(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), *Patelloida 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).

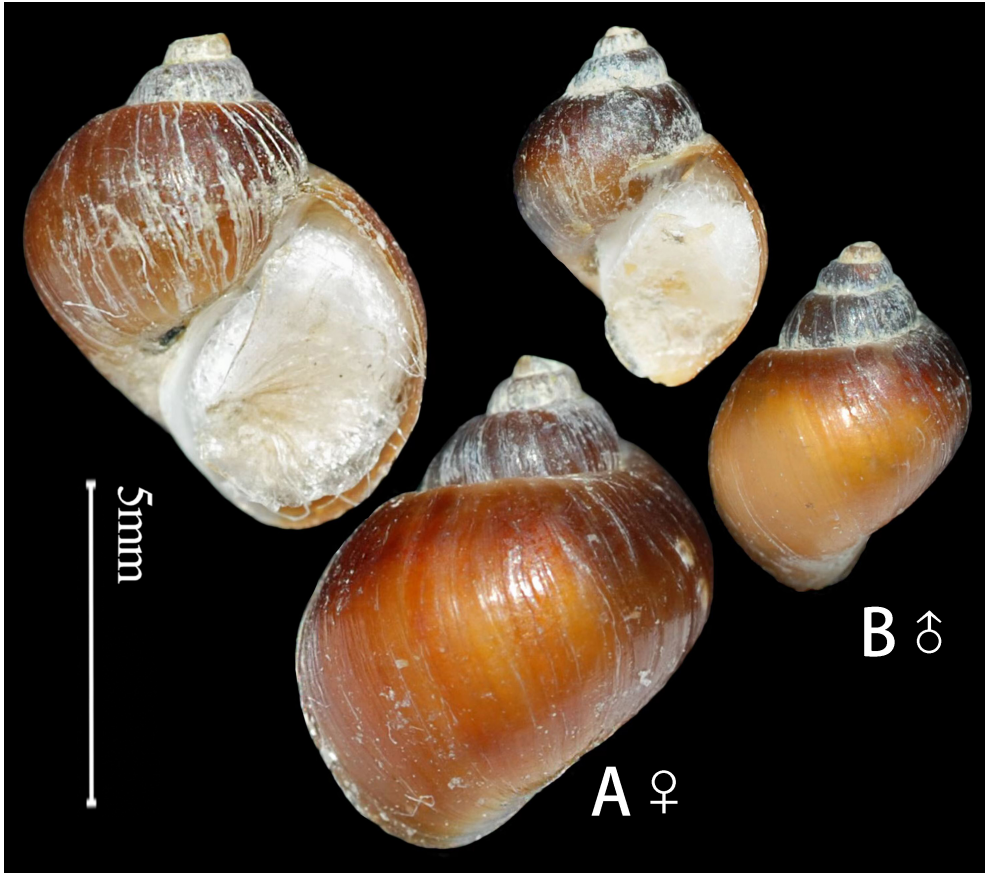


Figure 2. Shells of *Alexania inazawai*. **A.** the female shell; **B.** the male shell.

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-spired 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.

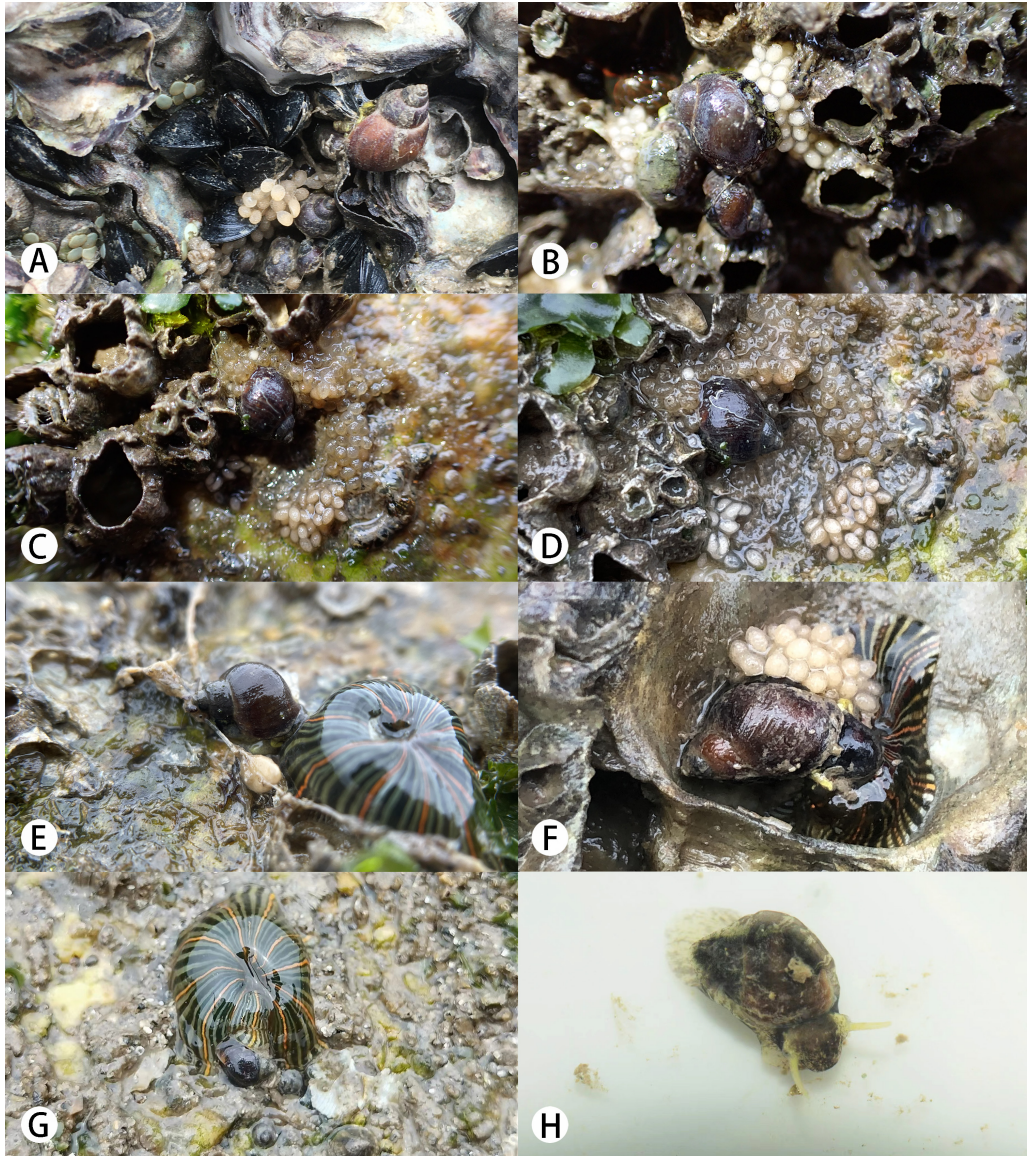


Figure 4. *Alexania inazawai* in life. **A.** Huangcuo, 5 July 2022. **B–C.** Huangcuo, 22 June 2022. **D–F.** Xiajinwan, 17 February 2023. **G–H.** Zengshan, 22 May 2022. Photos: Dan-Dan Zhong (A–F), Li-Wen Lin (G–H).

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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矾海葵的记述

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摘 要

稻泽亚梯螺 *Alexania inazawai* (Kuroda, 1943) 是一种专一以纵条矾海葵 *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