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ORIGINAL ARTICLE

Two new species of hydromedusa (Cnidaria) from the Leizhou Bay, the northern South China Sea

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Abstract Two previously unknown species of hydromedusae, *i.e. Bougainvillia leizhouensis* Xu, Guo & Wang, **sp. nov.** and *Octocannoides tetranema* Xu, Guo & Wang, **sp. nov.** were found in plankton samples collected during oceanographic cruises along the Leizhou Bay of the northern South China Sea. All new species are described and illustrated here. Identification keys to the known species of genera *Bougainvillia* and *Octocannoides*, and the genera of family Octocannoididae are provided, respectively. In addition, the genus name *Pedunculus* Xu, Huang & Guo, 2019 is preoccupied, and *Stylogastria* Xu, Huang & Guo, **nom. nov**. is proposed to replace it. All type specimens are deposited in the College of Ocean and Earth Sciences, Xiamen University.

Key words Hydromedusa, new species, homonym, the South China Sea.

1 Introduction

The Leizhou Bay of the northern South China Sea is located at the west coast of Guangdong Province, which is the key habitats for many economically important fish species and the Indo-Pacific humpback dolphin (*Sousa chinensis*). The taxonomic researches on hydromedusae have been well done in the east coast of Guangdong Province (Xu & Zhang, 1978, 1981; Du *et al*., 2009, 2010, 2012, 2013; Xu *et al*., 2008), while few data for the west coast of Guangdong Province have been published so far (Liu & Ye, 1979; Wang *et al*., 2019).

The present work is to describe two new species of hydromedusa, and propose a replacement name for *Pedunculus* Xu, Huang & Guo, 2019. The keys to known species of genera *Bougainvillia* and *Octocannoides*, and to the genera of family Octocannoididae are also provided, respectively.

2 Materials and methods

Specimens of the new species were collected from the region (21º00'–20º40'N, 110º20'–110º40'E) in the Leizhou Bay of the northern South China Sea during February to November 2018. All planktonic samples were collected using a large-type planktonic net (80 cm diameter, 0.505 mm mesh size) by vertical hauls from the near bottom to the surface. Specimens were preserved in 5% formalin buffered seawater. Samples were identified, and microphotographs were taken using Leica

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M205C dissecting microscopy. The type specimens are deposited in the college of Ocean and Earth Sciences, Xiamen University.

3 Taxonomy

Class Hydrozoa Owen, 1843
Subclass Hydroidolina Collins, 2000
Order Anthoathecata Cornelius, 1992
Suborder Filifera Kühn, 1913

Family Bougainvilliidae Lütken, 1850

Bougainvilleae Lütken, 1850: 29–30.

Bougainvilliidae Allman, 1876: 252; Bouillon *et al*., 2006: 126–127; Schuchert, 2007: 196–198; Xu *et al*., 2014: 200–201; Guo *et al*., 2018: 99; Wang *et al*., 2019: 192.

Diagnosis. Medusa bell-shaped; mouth circular; simple or dichotomously branched oral tentacles distinctly inserted above mouth rim, with nematocyst clusters in end; four radial canals and one circular canal present; marginal tentacles single or clustered by 4, 8, or 16 tentacular bulbs; gonads circled around manubrium, or present in adradial, interradial or perradial position; adaxial ocelli absent or present.

Remarks. For the taxonomic systems and history of this family see Bouillon *et al*. (2006), Schuchert (2007) and Guo *et al*. (2018).

At present time, the family Bougainvilliidae comprise nine medusa genera: *Bougainvillia* Lesson, 1830, *Chiarella* Maas, 1897, *Koellikerina* Kramp, 1939, *Nemopsis* L. Agassiz, 1849, *Nubiella* Bouillon, 1980, *Pachycordyle* Weismann, 1883, *Paranubiella* Xu, Huang & Lin, 2018, *Silhouetta* Millard & Bouillon, 1973, *Thamnostoma* Haeckel, 1879. A key to these genera is provided by Guo *et al*. (2018).

Genus *Bougainvillia* Lesson, 1830

Cyanaea Bougainville Lesson, 1830: 118–119.

Bougainvillia Lesson, 1836: 262; Mayer, 1910: 155; Kramp, 1961: 74; Bouillon *et al*., 2006: 128–131; Schuchert, 2007: 198; Xu *et al*., 2014: 203–204; Guo *et al*., 2018: 99. Type species: *Bougainvillia macloviana* Lesson, 1830.

Diagnosis. Medusa with four perradial marginal bulbs bearing two or more identical tentacles, with or without ocelli; four perradial oral tentacles, usually branched and ending in nematocyst clusters; gonads on manubrium, adradial, interradial or rarely perradial.

Remarks. The genus comprises 29 species (Vannucci & Rees, 1961; Bouillon *et al*., 2006; Schuchert, 2007; Nogueira *et al*., 2013; Xu *et al*., 2014), of which 19 species are known in Chinese seas. These species are widely distributed in all China waters, especially in the East China Sea and the South China Sea. A remarkably large number of medusae was found in the Taiwan Strait and the northern South China Sea by Xu *et al*. (2014).

Bougainvillia is closely related to *Nemopsis*, but the latter has each of four clusters of marginal tentacles with a median pair of club-shaped or capitate tentacles, which are absent in *Bougainvillia*.

***Bougainvillia leizhouensis* Xu, Guo & Wang, sp. nov.** (Figs 1–4)

Material examined. Holotype (AOB-HL 332), a specimen collected from the Leizhou Bay of the northern South China Sea, S8 station (20°40'N, 110°35'E), depth 9.5 m, November 2018, coll. Xuefeng Wang and Liyi Lu.

Diagnosis. Umbrella near bell-shaped, with round dome top, jelly thick, but thinner toward the bell margin; manubrium cylindrical, no gastric peduncle and perradial lobes, about 1/4 height of subumbrella cavity; mouth with 4 proximal simple lips; with 4 perradial oral tentacles, inserted above mouth rim, oral tentacles basal trunk short, divided 3–4 times; eight gonads in adradial pairs on the upper part of the manubrium; bell margin with 4 perradial furrows, 4 perradial tentacular bulbs sunk into a narrow furrow between two marginal lobes, tentacular bulbs broad U-shaped, each with 9–11 tentacles; ocelli adaxial on the tentacular bulbs.

Description. Umbrella 5 mm in height, 4 mm in width; bell-shaped, with round dome top; jelly thick, one-third, or more of bell height at apex, but thinner toward the bell margin; manubrium cylindrical, no gastric peduncle, with a broad base, no

perradial lobes, about 1/4 height of subumbrella cavity; mouth with 4 prominent simple lips; 4 perradial oral tentacles arising above the mouth opening, basal trunk of oral tentacles short, oral tentacles divided 3–4 times, ending with nematocyst knobs; eight gonads in adradial pairs on the upper part of the manubrium, not contacting each other perradially, gonads ellipse-like, with smooth surface; 4 radial canals and a circular canal; in preserved specimen the extension of epaulette-shaped covered the interradial part of bell margin, forming a narrow, perradial notch between two extension of epaulette-shaped, tentacular bulbs located on the notch of bell margin; tentacular bulbs facing downward, broadly U-shaped, each with 9–11 solid long tentacles and corresponding number of ocelli; ocelli adaxial, black, round, on tentacular bulb near base of tentacles; velum moderately broad.

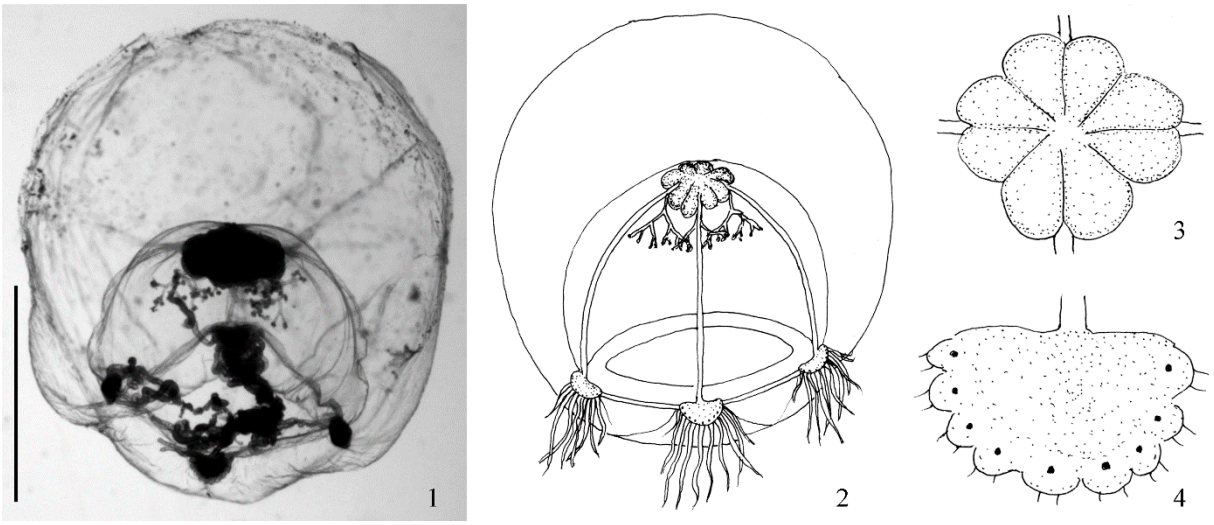
Distribution. The northern South China Sea (Leizhou Bay).

Etymology. The species name is from the Latin *leizhouensis*, meaning Leizhou, refers to the type locality of the new species.

Remarks. This new species has four perradial clusters of identical marginal tentacles, born on four tentacular bulbs; four perradial oral tentacles dichotomously branch, inserted above mouth rim; gonads located on manubrium. These are consistent with the general characters of the genus *Bougainvillia* Lessen, 1830.

At present time, 29 valid species are known in *Bougainvillia* (Vannucci & Rees, 1961; Xu & Huang, 2004a, 2006; Bouillon *et al*., 2006; Xu *et al*., 2006, 2007, 2014; Nogueira *et al*., 2013; Batistić & Garić, 2016). Among them, *B. crassa* Fraser, 1938 and *B. meinertiae* Jäderholm, 1923 are only reported with the hydroid forms, while *B. aberrans* Calder, 1993 and *B. rugosa* Clarke, 1882 are only reported with the newly released medusae.

This new species is similar to *B. vervoorti* Bouillon, 1995, but can be separated by: 1) the new species has the manubrium short cylindrical, without perradial lobes, while *B. vervoorti* has a cruciform manubrium with four large basal perradial lobes; 2) the new species has eight gonads in adradial pairs on the upper part of manubrium, while *B. vervoorti* has four pairs of gonads along the adradial sides of manubrium and extending on the perradial lobes; 3) the new species has four tentacular bulbs sinking into furrows of the bell margin, while *B. vervoorti* has four perradial tentacular bulbs situating on four exumbrellar lobes.



Figures 1–4. *Bougainvillia leizhouensis* Xu, Guo & Wang, **sp. nov.** 1–2. Lateral views. 3. Dorsal view of gonads. 4. Part enlargement of the tentacular bulb. Scale bars = 0.5 mm.

Key to all known species of genus *Bougainvillia* excluding hydroids and newly liberated medusa.

1. Gastric peduncle present, distinct 2
   Gastric peduncle ambiguous or absent 6
2. Without ocelli; gonads perradial present on manubrium, lamella-shaped; oral tentacles divided twice ..... ***B. lamellata* Xu, Huang & Liu, 2006***
   With ocelli 3
3. Ocelli crescent-shaped on tentacles; gonads present on interradial of manubrium wall ..... ***B. superciliaris* (L. Agassiz, 1849)***
   Ocelli present on marginal bulbs; gonads present on perradial outgrowth of manubrium 4
4. Each marginal bulb with two tentacles; oral tentacles divided twice ..... ***B. bitentaculata* Uchida, 1925***
   Each marginal bulb with more than two tentacles 5

5. Each bulb with 4–9 tentacles; oral tentacles with moderately long basal trunk ..... ***B. pyramidata*** **(Forbes & Goodsir, 1851)**
   Each bulb with 30–65 tentacles; oral tentacles with short basal trunk ..... ***B. macloviana*** **(Lesson, 1830)**
6. With medusae budding from manubrium 7
   Without medusae budding from manubrium 10
7. Manubrium flat; basal trunk of oral tentacles absent or short 8
   Manubrium flask-shaped or cylindrical-shaped; basal trunk of oral tentacle long 9
8. Oral tentacles with basal trunk absent ..... ***B. platygaster*** **(Haeckel, 1879)**[*]
   Oral tentacles with basal trunk short and thick, first branches about 1/2 length of oral tentacles ..... ***B. chenyapingae*** **Xu, Huang & Guo, 2007**[*]
9. Manubrium flask-shaped; 8 tentacles present in each marginal bulb; ocelli present on marginal bulbs..... ***B. niobe*** **Mayer, 1894**[*]
   Manubrium cylindrical-shaped; 3 tentacles present in each marginal bulb; without ocelli ..... ***B. frondosa*** **Mayer, 1900**[*]
10. Gonads separated from manubrium (adult males); peduncle shallow; top of subumbrella flat, bell base quadrangular; each bulb with 7–10 tentacles; sexually dimorphic male with gonads ..... ***B. dimorpha*** **Schuchert, 1996**
    Gonads present on manubrium 11
11. Gonads perradial present on manubrium 12
    Gonads interradial or adradial present on manubrium 15
12. Oral tentacles with four clusters, each consist of four main oral tentacles; oral tentacle with basal trunk short, divided 6–7 times ..... ***B. paraplatygaster*** **Xu, Huang & Chen, 1991**[*]
    Oral tentacles without cluster 13
13. Oral tentacles with basal trunk long, about 5/6 length of oral tentacles; 4–6 tentacles present in per bulb ..... ***B. longistyla*** **Xu & Huang, 2004**[*]
    Oral tentacles with basal trunk short, up to half of the length of oral tentacle; more than 6 tentacles present in per bulb 14
14. Each bulb with 50–60 tentacles ..... ***B. multitentaculata*** **Foerster, 1923**
    Each bulb with 7–16 tentacles ..... ***B. pagesi*** **Nogueira, Rodriguez, Mianzan, Haddad & Genzano, 2013**
15. Gonads adradial 16
    Gonads interradial 21
16. Ocelli present on tentacles 17
    Ocelli present on bulbs 18
17. Oral tentacles with long trunk, divided 4–6 times; each bulb with 12–17 tentacles ..... ***B. britannica*** **(Forbes, 1841)**[*]
    Oral tentacles with short trunk, divided 6–8 times; each bulb with 15–20 tentacles ..... ***B. fulva*** **Agassiz & Mayer, 1899**[*]
18. Exumbrella with reticular papillae; oral tentacles with long and thick trunk, divided twice; each bulb with 8–9 tentacles ..... ***B. reticulata*** **Xu & Huang, 2006**[*]
    Exumbrella smooth, without reticular papillae 19
19. Tentacular bulbs long, epaulette-shaped, not shorter than intervals; each bulb with 20–40 tentacles ..... ***B. principis*** **(Steenstrup, 1850)**[*]
    Tentacular bulbs U-shaped 20
20. Manubrium cruciform, with 4 large basal perradial lobes; 4 pairs of gonads along the adradial side of manubrium, extending on the perradial lobes ..... ***B. vervoorti*** **Bouillon, 1995**[*]
    Manubrium short cylindrical, lacking perradial lobes; 8 gonads present in adradial pairs on upper part of manubrium ..... ***B. leizhouensis*** **Xu, Guo & Wang, sp. nov.**[*]
21. Without ocelli 22
    With ocelli 24
22. Tentacular bulbs near crescent-shaped, with a short, papillar-shaped endodermal process extending to radial canals; manubrium quadrangular very flat adnate to subumbrella ..... ***B. papillaris*** **Xu, Huang & Guo, 2014**[*]
    Tentacular bulbs triangular-shaped or hemispherical-shaped 23
23. Basal trunk of oral tentacles long, up to half length of oral tentacle; < 2 mm in height; each bulb with 2–3 tentacles ..... ***B. aurantiaca*** **Bouillon, 1980**[*]
    Basal trunk of oral tentacles short, about 1/5 length of oral tentacle; 3–5 mm in height; each bulb with 3–7 tentacles ..... ***B. muscoides*** **(Sars, 1846)**
24. Ocelli present on tentacles; manubrium long and narrow, about 1/2 height of umbrella cavity; oral tentacle with basal trunk long, divided twice ..... ***B. carolinensis*** **(McCrady, 1859)**[*]
    Ocelli present on bulbs 25
25. Each bulb with up to 60 tentacles; each oral tentacle divided 7 times ..... ***B. involuta*** **Uchida, 1947**
    Each bulb with less than 60 tentacles 26
26. Each oral tentacle divided twice; without apical canal ..... ***B. muscus*** **(Allman, 1863)**[*]
    Each oral tentacle divided up to 3 times; adult medusa with an apical canal ..... ***B. triestina*** **Hartlaub, 1911**

[*]Recorded in Chinese seas.

Order Leptothecata Cornelius, 2000

Family Octocannoididae Bouillon, Boero & Seghers, 1991

Octocannoididae Bouillon, Boero & Seghers, 1991: 399–407; Bouillon *et al*., 2006: 359; Xu *et al*., 2007: 687–688; Xu *et al*., 2014: 631; Xu *et al*., 2019: 144–145, 160–161.

Diagnosis. Manubrium with or without gastric peduncle; mouth with 4 or 8 simple lips; 4 or 8 simple radial canals present; 4 or 8 marginal tentacles and 16–32 short club-shaped tentaculae present, all with black pigmented spots in marginal; without excretory papillae; gonad consisting of two lateral halves; with numerous statocysts; without ocelli.

Remarks. The family Octocannoididae was erected by Bouillon *et al.* (1991) based on *Octocannoides ocellata* Menon, 1932, which had been placed in the families Phialuciidae or Malagazziidae (Kramp, 1961; Bouillon, 1984). Based on the diagnosis of Octocannoididae, Xu *et al*. (2007, 2019) erected another two genera, *i.e. Tetracannoides* and *Pedunculus*, and modified the diagnosis of the family. However, the scientific name "*Pedunculus*" was preoccupied by an insect group (Townes, 1969). Thus, a new name, *Stylogastria* Xu, Huang & Guo, **nom. nov.** is erected to replace *Pedunculus* Xu, Huang & Guo, 2019. And the monotype of the genus was combined as *Stylogastria polycystis* (Xu, Huang & Guo, 2019) **comb. nov.** The scientific name of the genus refers to the gastrostyle on manubrium.

At present time, the family Octocannoididae medusa comprises three genera: *Octocannoides* Menon, 1932, *Tetracannoides* Xu, Huang & Guo, 2007 and *Stylogastria* Xu, Huang & Guo, **nom. nov.**

Key to the genera of Octocannoididae medusa.

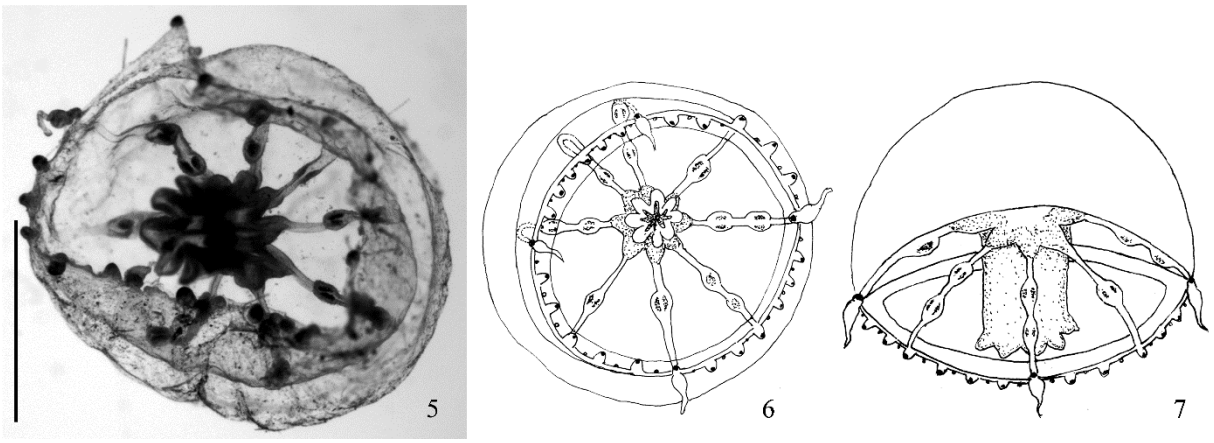
1. Manubrium with gastric peduncle; 8 radial canals, 8 marginal tentacles and 16–24 short club-shaped tentaculae present; 8 gonads developed near base of gastric peduncle ..... ***Stylogastria* Xu, Huang & Guo, nom. nov.**
   Manubrium without gastric peduncle 2
2. With 8 radial canals; manubrium with or without 8 radial lobes; 8 gonads on the radial canals and 8 simple oral lips present ..... ***Octocannoides* Menon, 1932**
   With 4 radial canals; manubrium with 4 radial lobes; 4 gonads present on each side of radial lobe; 4 oral lips short bifurcated, without terminal knob of cnidocysts ..... ***Tetracannoides* Xu, Huang & Guo, 2007**

***Octocannoides tetranema* Xu, Huang & Guo, sp. nov.** (Figs 5–7)

Material examined. Holotype (AOB-HL 333), one specimen collected from the Leizhou Bay of the northern South China Sea, S7 station (20°45'N, 110°35'E), depth 10.4 m, November 2018, coll. Xuefeng Wang and Kun Lin.

Diagnosis. Manubrium broad and long, about 3/4 height of subumbrella cavity; with 8 funnel-shaped radial lobes extending from manubrium wall, 8 oral lips and 8 simple radial canals; 4 marginal tentacles and 24 short club-shaped tentaculae present, all with black pigmented spots in marginal; usually 8–12 elliptic-like gonads present on middle of radial canals, consisting of two lateral halves.

Description. Medusa spherical-like, up to 2 mm height, 3 mm width; dome top round, with very thick jelly, about 1/2 height of bell, thinner toward bell margin; manubrium broad and long, octagon-like in cross section, without gastric peduncle,



Figures 5–7. *Octocannoides tetranema* Xu, Guo & Wang, **sp. nov.** 5–6. Oval views. 7. Lateral view. Scale bars = 0.5 mm.

about 3/4 height of subumbrella cavity; 8 funnel-shaped radial lobes extend from manubrial wall, end connected to radial canals; 8 simple lips present, without short bifurcating; 8 simple radial canals present, with median grooves; 4 marginal tentacles present with base bulbs large, long conical-shaped, without excretory papillae; 24 short club-shaped tentaculae present, without marginal bulbs, all with black pigmented spots in marginal; usually with 8–12 elliptic-like gonads, each consisting of two lateral halves upon middle of radial canal; about 24 closed statocysts present, usually with 1 statocyst located between tentaculae; without ocelli; velum middle broad.

Etymology. The specific name is from the Latin *tetranema*, meaning four tentacles, referring to the medusa with distinct four tentacles.

Distribution. The northern South China Sea (Leizhou Bay).

Remarks. This new species has 8 simple radial canals, 8 simple lips on mouth, 4 marginal tentacles and 24 short club-shaped tentaculae with black pigmented spots present, and gonads consists of two lateral halves; lacks excretory papillae. These are consistent with the general characters of the family Octocannoididae.

The new species resembles *O. ocellata* Menon, 1932, by both manubria without gastric peduncle; having 8 radial canals and 8 simple oral lips; gonads on the middle of radial canals, each consisting of two lateral halves, but can be distinguished from the latter by having 4 marginal tentacles. The genus comprises the following species: *O. ocellata* Menon, 1932 and *O. taeniogonia* Xu & Huang, 2004 (Bouillon *et al.*, 1991; Xu & Huang, 2004b). The new species has elliptical-shaped gonads, located upon the middle of radial canals, which differs from *O. taeniogonia*. These characteristics are listed in the following keys.

Key to medusa of all known species in genus *Octocannoides*.

1. Gonads band-liked, S-shaped, along almost whole length of radial canals; with 3 statocysts between tentacles..... ***O. taeniogonia* Xu & Huang, 2004**
   Gonads oval or elliptical shaped, upon the middle radial canals.....2
2. Umbrella flatter than hemispherical, jelly thick at apex, about 1/5 height of bell; manubrium short and broad, about 1/3 height of subumbrella cavity; radial lobes indistinct; with 8 marginal tentacles and 16–24 club-shaped tentaculae; with 40 statocysts ..... ***O. ocellata* Menon, 1932**
   Umbrella near spherical, jelly thick at apex, about 1/2 of bell height; manubrium long and broad, about 3/4 height of subumbrella cavity; with 8 distinct radial lobes; with 4 marginal tentacles and 24 club-shaped tentaculae; with 24 statocysts..... ***O. tetranema* Xu, Huang & Guo, sp. nov.**

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