

Taxonomic notes on Hydroidomedusae (Cnidaria) from the South China Sea IV: Family Bougainvilliidae (Anthomedusae)

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Abstract

This study reviews all genera and species belonging to the family Bougainvilliidae from the South China Sea. The *Nubiella atentaculata* Xu and Huang, 2004 formerly included in the genus *Nubiella*, now is transferred to a new genus *Paranubiella* and included in the Bougainvilliidae as *Paranubiella atentaculata* (Xu and Huang, 2004) n. comb.. Two new species, *Paranubiella nanhaiensis* Xu, Huang and Guo, sp. nov. and *Nubiella apapillaris* Xu, Huang and Guo, sp. nov. from the South China Sea are described and illustrated in the present paper. In addition, the key to known genera of family Bougainvilliidae and species of genus *Nubiella* are described. Other data are briefly summarized to the list of species presented on the family Bougainvilliidae in the South China Sea. The type species were deposited at the Third Institute of Oceanography, State Oceanic Administration.

Key words: Anthomedusae, Bougainvilliidae, new genus, new species, new combination, South China Sea

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1 Introduction

There are 750 species of hydrozoan recorded in China at the end of 2012 (Xu et al., 2014). Recent collections have provided new materials to update our treatise. The present study treats the family Bougainvilliidae, and it is the fourth publication in a series of taxonomic revisions of Anthomedusae in the South China Sea (Lin et al., 2016; Xu et al., 2016; Wang et al., 2016).

Based on previous reports (Xu and Zhang, 1978; Li and Chen, 1991; Xu and Huang, 1994, 2006; Xu et al., 2008; Du et al., 2012) and recent records of the authors, there are 42 medusa species and 7 genera of Bougainvilliidae in the South China Sea. The purpose of this study is to describe one new genus of medusa, two new species, and one new combination.

2 Materials and methods

The majority of the samples were collected from the South China Sea (4°00'–18°30'N, 109°00'–119°00'E) during June–August 2012. Part of the samples were collected from the southern part of Taiwan Strait in December 1987 and the South China Sea in August 2007. All planktonic samples were collected using a large-type zooplankton net (80 cm diameter, 0.505 mm mesh size) and WP2 zooplankton net (57 cm diameter, 0.202 mm mesh size) by vertical towing from the near bottom to the surface, or from depth 200 m to the surface if the depth of stations is more than 200 m.

Samples were fixed in 5% formaldehyde buffered in seawater, and stored in this solution. Specimens were examined using stereoscopic and light microscopy, and taxonomic identification were undertaken using the literatures, as specified in the references section. All drawings were made from preserved specimens using an attached camera lucida. Microphotographs were taken using either an Axiocam MRe5 (Zeiss) dissecting microscope or a Micaren DC200 camera mounted on a BH-2 Olympus microscope. Type specimens are deposited in the Third Institute of Oceanography, State Oceanic Administration.

3 Taxonomy

List of species presented on the family Bougainvilliidae in the South China Sea (SCS)

(N: northern SCS, M: middle SCS, S: southern SCS)

Class Hydroidomedusa Claus, 1877

Subclass Anthomedusae Haeckel, 1879

Order Filifera Kühn, 1913

Family Bougainvilliidae Lütken, 1850

Genus *Bimeria* Wright, 1859

Bimeria vestita Wright, 1859

N

Genus *Bougainvillia* Lesson, 1830

Bougainvillia aurantiaca Bouillon, 1980

S

Bougainvillia bitentaculata Uchida, 1925

N S

Bougainvillia britannica (Forbes, 1841)

N S

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<i>Bougainvillia chenyapingae</i> Xu, Huang and Guo, 2007	N	S
<i>Bougainvillia frondosa</i> Mayer, 1900		N
<i>Bougainvillia fulva</i> A. Agassiz and Mayer, 1899	N	M
<i>Bougainvillia longistyla</i> Xu and Huang, 2004		N
<i>Bougainvillia muscus</i> (Allman, 1863)	N	S
<i>Bougainvillia niobe</i> Mayer, 1894		N
<i>Bougainvillia papillaris</i> Xu, Huang and Guo, 2014		N
<i>Bougainvillia paraplatygaster</i> Xu, Huang and Chen, 1991		N
<i>Bougainvillia platygaster</i> (Haeckel, 1879)		N
<i>Bougainvillia vervoorti</i> Bouillon, 1995		N
Genus <i>Koellikerina</i> Kramp, 1939		
<i>Koellikerina bouilloni</i> Kawamura and Kubota, 2005	N	
<i>Koellikerina constricta</i> (Menon, 1932)		N
<i>Koellikerina diforficulata</i> Xu and Zhang, 1978		N
<i>Koellikerina fasciculata</i> (Péron and Lesueur, 1809)		N
<i>Koellikerina heteronemalis</i> Xu, Huang and Chen, 1991	N	
<i>Koellikerina multicirrata</i> (Kramp, 1928)		N
<i>Koellikerina octonemalis</i> (Maas, 1905)	N	S
<i>Koellikerina staurogaster</i> Xu and Huang, 2004		N
<i>Koellikerina taiwanensis</i> Xu, Huang and Chen, 1991		N
Genus <i>Nemopsis</i> L. Agassiz, 1849		
<i>Nemopsis bachei</i> L. Agassiz, 1849	N	
Genus <i>Nubiella</i> Bouillon, 1980		
<i>Nubiella alvarinoae</i> (Segura, 1980)	N	S
<i>Nubiella apapillaris</i> Xu, Huang and Wang, sp. nov.	M	
<i>Nubiella claviformis</i> Xu, Huang and Lin, 2009		N
<i>Nubiella crassocanal</i> Xu, Lin and Guo, 2012		N
<i>Nubiella globogona</i> Wang, Guo and Xue, 2012	M	S
<i>Nubiella globosa</i> Lin, Xu and Huang, 2012		S
<i>Nubiella intergona</i> Xu, Huang and Lin, 2009		N
<i>Nubiella macrogastera</i> Xu, Huang and Lin 2009		N
<i>Nubiella macrogona</i> Xu, Huang and Guo, 2009	N	S
<i>Nubiella medusifera</i> Huang, Xu, Lin and Guo, 2012		N
<i>Nubiella oralospinella</i> Xu, Huang and Guo, 2009		N
<i>Nubiella papillaris</i> Xu, Huang and Guo, 2009		N
<i>Nubiella paramitra</i> Xu, Huang and Guo, 2007		N
<i>Nubiella sinica</i> Huang, Xu, Lin and Chen, 2009	N	S
<i>Nubiella tubularia</i> Xu, Huang and Guo, 2007		N
Genus <i>Pachycordyle</i> Weismann, 1883		
<i>Pachycordyle conica</i> Kramp, 1959		N
Genus <i>Paranubiella</i> Xu, Huang and Lin n. gen.		
<i>Paranubiella atentaculata</i> (Xu and Huang, 2004) n. comb.		N
<i>Paranubiella nanhaiensis</i> Xu, Huang and Guo, sp. nov.		S

Family Bougainvilliidae Lütken, 1850

Bougainvilliidae Bouillon et al., 2006: 126–127; Schuchert, 2007: 196–197; Xu et al., 2014: 200–201

Synonyms see Calder, 1988: 12

Diagnosis. Medusa bell-shaped; mouth circular, with simple or dichotomously branched oral tentacles inserted distinctly above mouth rim, ending in nematocyst clusters; four radial canals and circular canal; marginal tentacles solid, either solitary or in clusters, borne on 4, 8, or 16 tentacular bulbs; gonads on manubrium, either forming a continuous ring or in adradial, interradial, or perradial position; adaxial ocelli absent or present.

Remarks. Family Bougainvilliidae medusa included ten genera: *Bougainvillia* Lesson, 1830, *Chiarella* Maas, 1897, *Koellikerina* Kramp, 1939, *Lizzella* Haeckel, 1879, *Lizzia* Forbes, 1846, *Nemopsis* L. Agassiz, 1849, *Nubiella* Bouillon, 1980, *Pachycordyle*

Weismann, 1883, *Silhouetta* Millard and Bouillon, 1973, *Thamnostoma* Haeckel, 1879 (Kramp, 1961; Bouillon and Boero, 2000; Bouillon et al., 2006; Xu et al., 2014).

Lizzella octella Haeckel, 1879, type species of *Lizzella*, is not well characterized and Uchida (1927) referred it to a young *Spirocodon saltator* (Tilesius, 1818) (Family Polyorchidae). The other species included in this genus by Haeckel, *Lizzella hyalina* (Van Beneden, 1866), is a doubtful species (Bouillon et al., 2006). These ambiguities render the genus doubtful and useless, so the genus *Lizzella* Haeckel, 1879 should not be used anymore (Schuchert, 2007).

The genus *Lizzia* Forbes, 1846 was usually included in the family Bougainvilliidae (Russell, 1953) due to the presence of perradial oral tentacles. According to the 16S polygeny and the origin of oral tentacles, *Lizzia* were removed from the Bougainvilliidae to the Rathkeidae (Schuchert, 2007).

As mentioned above, the family Bougainvilliidae (medusa) thus comprises eight previously known genera, excluding *Lizzella* Haeckel, 1879 and *Lizzia* Forbes, 1846. Additionally, the new genus *Paranubiella* is proposed.

Key to medusa genera of the family Bougainvilliidae

1. Without tentacular bulbs, lacking mouth.....
.....*Pachycordyle* Weismann, 1883
- With tentacular bulbs, with mouth.....2
2. 4 tentacular bulbs.....3
- 4 or 8 or more tentacular bulbs.....7
3. Without developed tentacles per bulb.....
.....*Paranubiella* Xu, Huang and Lin, n. gen.
- With developed tentacles per bulb.....4
4. More than one tentacles per bulb.....5
- One tentacle per bulb.....6
5. Besides filiform tentacles also club-shaped or capitate ones
.....*Nemopsis* L. Agassiz, 1849
- All tentacles identical in structure..*Bougainvillia* Lesson, 1830
6. Tentacular bulbs with ocelli.....
.....*Silhouetta* Millard and Bouillon, 1973
- Tentacular bulbs without ocelli.....*Nubiella* Bouillon, 1980
7. 8 tentacular bulbs subdivided by cleft.....*Chiarella* Maas, 1897*
- 8 tentacular bulbs not subdivided by cleft.....8
8. 4 or 8 or more tentacular bulbs with solitary tentacle.....
.....*Thamnostoma* Haeckel, 1879*
- 8 tentacular bulbs with groups of tentacles.....
.....*Koellikerina* Kramp, 1939

* No species recorded in the South China Sea.

Genus *Paranubiella* Xu, Huang and Lin, n. gen.

Type species: *Nubiella atentaculata* Xu and Huang, 2004

Diagnosis. Bougainvilliidae medusae mouth simple, circular, with simple unbranched oral tentacles, inserted well above mouth rim and armed with concentration of nematocysts; umbrella with four marginal bulbs, each without single tentacle; gonads situated on the interradial or perradial region of the manubrium.

Remarks. Type species is *Nubiella atentaculata* Xu and Huang, 2004. Based on having the simple unbranched oral tentacles, Xu and Huang (2004) referred it to the genus *Nubiella*. In most taxonomic characteristics currently used in genus *Nubiella* (Bouillon et al., 2006; Schuchert, 2007), only Bougainvilliidae species with unbranched oral tentacles and 4 solitary marginal tentacles assign to the genus *Nubiella*. But *N. atentaculata* has four marginal bulbs without tentacles. The same character was found in the other species collected from the South China Sea. It

is necessary to transfer it to the new genus *Paranubiella*. The name gives an allusion to its similarity to medusae formerly included in the genus *Nubiella*. The species name will thus become *Paranubiella atentaculata* (Xu and Huang, 2004) n. comb.. It is represented in the southern part of the Taiwan Strait.

***Paranubiella atentaculata* (Xu and Huang, 2004) n. comb. (Fig. 1)**

Nubiella atentaculata Xu and Huang, 2004: 553–554, Figs 3a–c; Xu and Huang, 2005: 86, Figs 3a–c; Tang and Gao, 2008: 302; Xu et al., 2014: 233–334, Figs 89A–C

Material examined. One specimen was collected from the southern part of the Taiwan Strait in December 1987.

Diagnosis. Umbrella bell-shaped, without apical projection; subumbrella cavity with 4 apical interradial conical projection; with 12 simple unbranched oral tentacles; with 4 large, ovaliform gonads on the perradial region of the manubrium; 4 perradial marginal bulbs, differing in size and structures, without a single tentacle.

Description. Umbrella bell-shaped, 2 mm high, 1.5 mm wide; apical jelly slightly thickened, thinning gradually toward umbrella margin; subumbrella cavity spacious, presenting 4 apical interradial conical projections into the apical mesoglea; manubrium elliptic like, about 1/3 the length of subumbrella cavity; mouth simple, without lips, with 12 simple unbranched oral tentacles, inserted well above mouth rim and armed with nematocyst cluster; 4 large, ovaliform gonads on the perradial of manubrium and extending toward interradial scattered numerous, round, granulose sex cell on the gonads; 4 radial canals and ring canal; 4 perradial marginal bulbs, differing in size and structure, of which 2 opposite bulbs are smaller than the others, with a short club-shaped endodermal process, extending slightly upwards from the basal bulbs into radial canal, and with brown pigment; other 2 opposite bulbs elliptic-like, from subumbrella margin clasp the exumbrella margin, all marginal bulbs without single tentacle; no ocelli; velum moderately broad.

Distribution. The southern part of Taiwan Strait, China.

Remarks. This species is based on simple unbranched oral tentacles and 4 marginal bulbs attributed to *Nubiella atentaculata* by Xu and Huang (2004). The arguments why we disagree with this identification are given in the remarks under the genus *Nubiella*. Because of marginal bulbs without tentacle, it does not belong to the genus *Nubiella*. The species is therefore described as type species of new genus *Paranubiella*.

***Paranubiella nanhaiensis* Xu, Huang and Guo, sp. nov. (Fig. 2)**

Material examined. Holotype (TIO 018), the South China Sea, Sta. NNXW12109 (4°13'N, 112°48'E), depth 65–50 m, 4 September 2012, collector Xiang Peng.

Diagnosis. Umbrella near bell-shaped, with a well-developed rounded solid apical projection; subumbrella cavity without apical interradial conical projection; with 4 simple oral tentacles; with 4 large, ovaliform gonads on the interradial region of the manubrium; 4 perradial marginal bulbs, papillary, all of the same size and structures, without developed tentacles.

Description. Umbrella 2.5 mm high (including apical projection), 1.5 mm wide, bell-shaped, with a well developed rounded solid apical projection, jelly uniformly thick excluding top; subumbrella cavity without apical interradial conical projection; manubrium very short, about 1/3 length of bell cavity; mouth simple, circular, with 4 simple oral tentacles, inserted distinctly above mouth rim and armed with nematocyst clusters; with 4 large, ovaliform gonads situated on the interradial region of the manubrium; with 4 radial canals and circular canals; 4 perradial marginal bulbs, papillary, all of the same size and structure, without developed tentacles; without ocelli; velum moderately wide.

Distribution. The South China Sea.

Etymology. From the Latin *nanhaiensis*, meaning Nanhai. The species name refers to the type locality of Nanhai (the South China Sea).

Remarks. This species has simple unbranched oral tentacles;

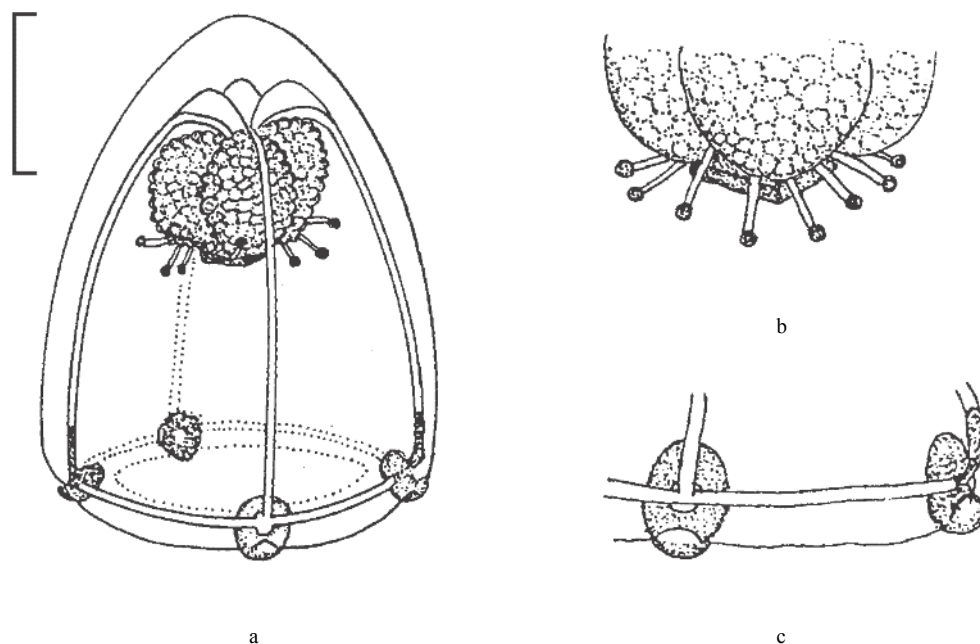


Fig. 1. *Paranubiella atentaculata* (Xu and Huang, 2004) n. comb.. a. Lateral view, b. enlargement of gonad and oral tentacles, and c. detail of marginal bulb. Scale bar: 0.5 mm.

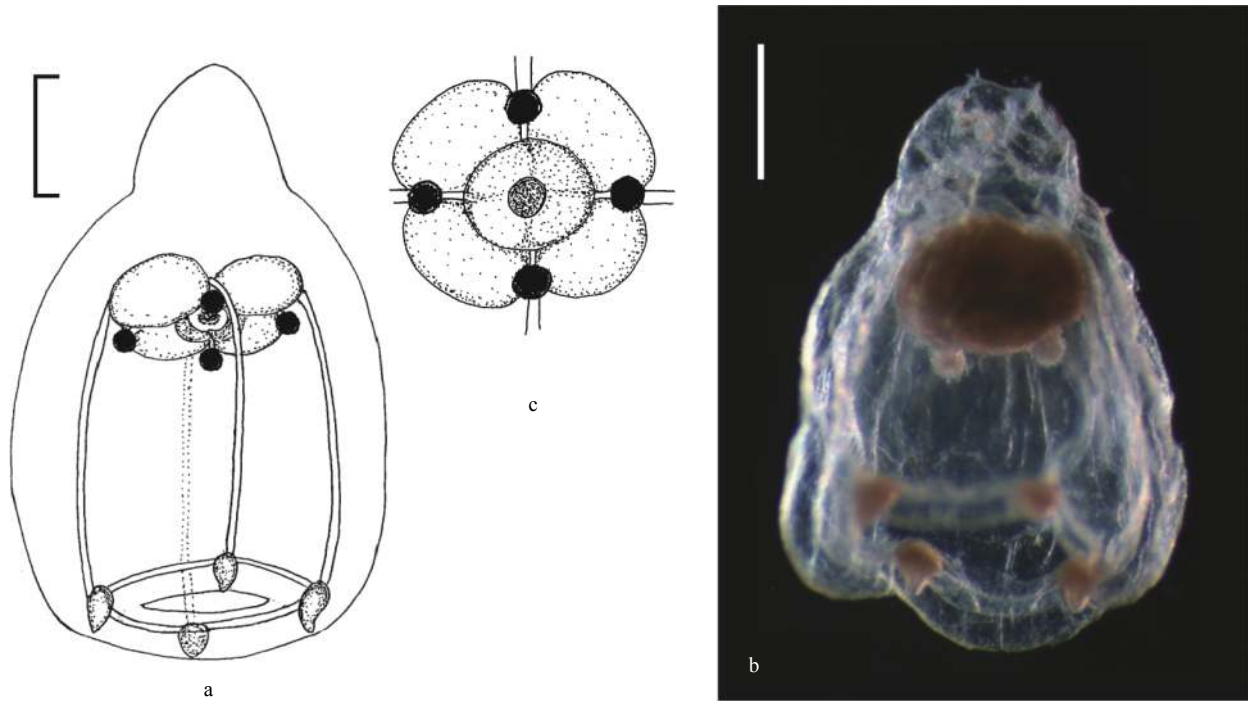


Fig. 2. *Paranubiella nanhaiensis* Xu, Huang and Guo, n. sp.. a and b. Lateral view, and c. oral view of oral tentacles and gonads. Scale bars: 0.5 mm.

with 4 marginal bulbs, without single tentacle. These features place this medusa in the family Bougainvilliidae Lütken, 1850, the genus *Paranubiella* n. gen..

At present time, only one species in the *Paranubiella* is known. This new species differs from the *Paranubiella atentaculata*: (1) the former 4 simple unbranched oral tentacles, inserted well above mouth rim, but latter with 12 simple unbranched oral tentacles; (2) the former 4 large, ovaliform gonads situated on the interradial region of the manubrium, but latter 4 large, ovaliform gonads situated on the perradial region of the manubrium; (3) the former with 4 perradial marginal bulbs, all of the same size and structures, but latter with 4 perradial marginal bulbs, differing in size and structure, of which 2 opposite bulbs have a short club-shaped endodermal process, extending slightly upwards from the basal bulbs into radial canal, other 2 opposite bulbs elliptic-like from subumbrella margin clasp the exumbrella margin.

Key to the known species of genus *Paranubiella*

1. 4 perradial marginal bulbs, differing in size and structure; gonads on the perradial region of manubrium; with 12 unbranched oral tentacles.....*P. atentaculata* (Xu and Huang, 2004) n. comb.
- 4 perradial marginal bulbs, all of the same and structure; gonads on the interradial region of manubrium; with 4 unbranched oral tentacles.....*P. nanhaiensis* Xu, Huang and Guo, n. sp.

Genus *Nubiella* Bouillon, 1980

Nubiella Bouillon, 1980: 315; Bouillon and Boero, 2000: 84; Bouillon et al., 2006: 135; Schuchert, 2007: 238; Xu et al., 2014: 232
Type species: *Nubiella mitra* Bouillon, 1980

Diagnosis. Bougainvilliidae medusae with simple and unbranched oral tentacles; umbrella with 4 marginal bulbs, each

with a single tentacle; without ocelli.

Remarks. Bouillon (1980) established this genus *Nubiella* to accommodate Bougainvilliidae medusae that resemble genus *Silhouetta* Millard and Bouillon, 1973. There are some small differences in their 4 tentacular bulbs with ocelli.

At present time, a total of 16 medusae species (including one new species) in the *Nubiella* is known (Bouillon, 1980; Xu et al., 2014), 15 of which are reported from the South China Sea and Taiwan Strait.

***Nubiella apapillaris* Xu, Huang and Guo, sp. nov. (Fig. 3)**

Material examined. Holotype (TIO 019), the South China Sea, Sta. Y45 (15°46'N, 112°29'E), depth 1 430 m, sampling depth 100–0 m, 28 August 2007, collector Guo Donghui.

Diagnosis. Medusa without apical projection; exumbrella without nematocyst pouches; without gastric peduncle, with 16 unbranched oral tentacles, no oral tube; 4 tentacular bulbs crescent-shaped, without papillar-shaped endodermal process extending up to radial canals.

Description. Umbrella bell-shaped, 1.5 mm high, 1 mm wide, jelly thicker at apex, but thinner toward the bell margin, without apical projection; manubrium very voluminous, cylindrical, about half of the height of bell cavity, no gastric peduncle and oral tube, with a distinct apical chamber; mouth simple, circular, with 16 unbranched capitate oral tentacles attached above mouth rim; 4 perradial marginal bulbs large, nearly crescent-shaped, each with one tentacle, tentacular bulbs without ocelli and black endodermal papilla; gonads encircling manubrium; with 4 narrow radial canals and circular canal; velum narrow.

Distribution. The South China Sea.

Etymology. From the Latin *apapillaris*, meaning a-papilla. The species name refers perradial marginal bulbs without endodermal papilla.

Remarks. The new species has simple unbranched oral

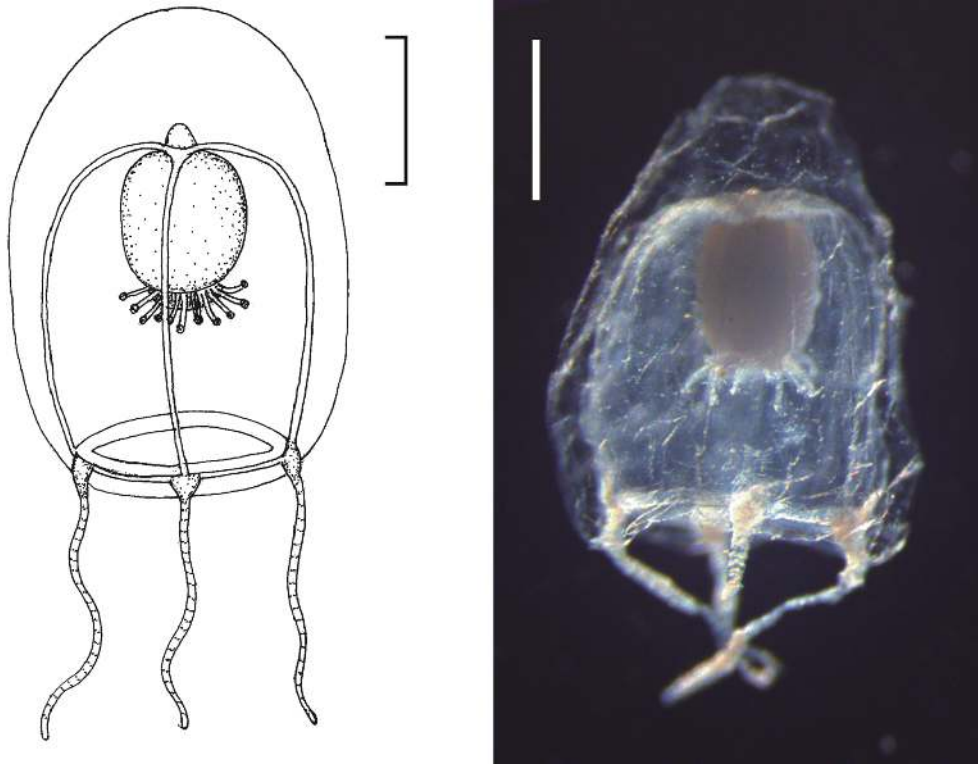


Fig. 3. Lateral view of *Nubiella apapillaris* Xu, Huang and Guo, sp. nov.. Scale bars: 0.5 mm.

tentacles; with 4 marginal bulbs, each with one tentacle, with 4 radial canals. These features place this medusa in the genus *Nubiella* Bouillon, 1980.

At present time, only 16 species in the *Nubiella* is known (Bouillon, 1980; Xu and Huang, 2004; Xu et al., 2007, 2009, 2014; Huang et al., 2012; Wang et al., 2012). This new species can easily be distinguished from the other species of *Nubiella* by medusa without apical projection, without gastric peduncle; gonads encircling manubrium; exumbrella without nematocyst pouches; manubrium without medusa buds and oral tube; but similar to *Nubiella papillaris* Xu, Huang and Guo, 2009, also has apical chamber. The new species differs from the *N. papillaris* by (1) the former with 16 unbranched oral tentacles, but latter with 8 unbranched oral tentacles; and (2) the former tentacular bulbs crescent-shaped, without papillar-shaped endodermal process, but latter tentacular bulbs with a dense mass of black pigment and a short, papillar-shaped endodermal process extending up to radial canals.

Key to the known species of genus *Nubiella*

- 1. With gastric peduncle.....2
- Without gastric peduncle.....6
- 2. Gonads on interradial region of manubrium.....3
- Gonads encircling manubrium.....4
- 3. Gastric peduncle cylindrical-shaped, about 1/2 of the length of manubrium; 4 gonads very large, global-shaped, without medusa buds.....*N. macrogona* Xu, Huang and Guo, 2009
- Gastric peduncle broad-based conical-shaped, about 1/3 of the length of manubrium; gonads with medusa buds, oval-shaped.....*N. alvarinoae* (Segura, 1980)
- 4. Umbrella without apical projection; with 8–16 unbranched oral tentacles; gastric peduncle very long, about 1/2 length of manubrium.....*N. sinica* Huang, Xu, Liu and Chen, 2009

- Umbrella with apical projection; with only 4 unbranched oral tentacles.....5
- 5. Exumbrella without scattered cnidocysts; marginal tentacular bulbs spherical; with medusa buds; tentacular distal half thicker and armed with cnidocysts.....*N. mitra* Bouillon, 1980
- Exumbrella with scattered cnidocysts; marginal tentacular bulbs erect elliptical; without medusa buds; whole tentacles with ring cnidocyst.....*N. paramitra* Xu, Huang and Guo, 2007
- 6. Gonads on interradial or adradial region of manubrium.....7
- Gonads encircling manubrium.....12
- 7. Umbrella with apical chamber; 8 gonads on adradial region of manubrium; mouth rim with numerous cnidocysts; with 14 unbranched oral tentacles.....
-*N. oralospinella* Xu, Huang and Guo, 2009
- Umbrella without apical chamber; 4 large gonads on interradial region of manubrium.....8
- 8. Tentacular bulbs with abaxial cnidophores or club-shaped tentacles.....9
- Tentacular bulbs without abaxial cnidophores or club-shaped tentacles.....10
- 9. Tentacular bulbs with a pair of club-shaped tentacles at medial; manubrium with oral tube.....
-*N. claviformis* Xu, Huang and Lin, 2009
- Tentacular bulbs with abaxial cnidophores extending to exumbrella; manubrium without oral tube.....
-*N. crassocanalis* Huang, Xu, Lin and Guo, 2012
- 10. Umbrella with apical chamber; with 12 unbranched oral tentacles; gonads globular on interradial region of manubrium... ..*N. globogona* Wang, Guo and Xu, 2012
- Umbrella without apical chamber.....11
- 11. Medusa bell-shaped with apical projection; with 8 unbranched oral tentacles.....*N. intergonia* Xu, Huang and Lin, 2009
- Medusa sphere-shaped without apical projection; with 4 unb-

- ranced oral tentacles.....*N. globosa* Lin, Xu and Huang, 2012
12. Exumbrella with nematocyst pouches above tentacular bulbs; manubrium with medusa buds.....
.....*N. medusifera* Huang, Xu, Lin and Guo, 2012
- Exumbrella without nematocyst pouches; manubrium without medusa buds.....13
13. Manubrium without oral tube, and with apical chamber.....14
- Manubrium with oral tube.....15
14. With 8 unbranched oral tentacles; 4 tentacular bulbs with a dense mass of black endodermal process extending up to radial canals.....*N. papillaris* Xu, Huang and Guo, 2009
- With 16 unbranched oral tentacles; 4 tentacular bulbs without endodermal process, nearly crescent-shaped.....
.....*N. apapillaris* Xu, Huang and Guo, sp. nov.
15. Umbrella without apical projection, and with apical chamber; manubrium long and large, elliptical-shaped; oral tube short, about 1/4 of the length of manubrium; with 12 unbranched oral tentacles; tentacular bulbs with a mass of red endodermal pigment at abxial view, oval-like
.....*N. macrogastera* Xu, Huang and Lin, 2009
- Umbrella with apical projection, and without apical chamber; manubrium flask-shaped; oral tube very long, about 1/2 of the length of manubrium; with 8 unbranched oral tentacles; tentacular bulbs without mass of pigment.....
.....*N. tubularia* Xu, Huang and Guo, 2007

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