



Two new species and four new records of the *Sarsia tubulosa* group of *Sarsia* (Cnidaria, Corynidae) from the Bohai Sea of China

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Abstract

Seven species of the *Sarsia tubulosa* group in the *Sarsia* genus from the Bohai Sea of China are described in the present paper. These include two new species, namely *Sarsia bohaiensis* Xu, Wang, & Chen **sp. nov.** and *Sarsia macrogastera* Xu, Chen, & Wang **sp. nov.**, and four new records to China, namely *Sarsia apicula* (Murbach & Shearer, 1902), *Sarsia piriforma* Edwards, 1983, *Sarsia striata* Edwards, 1983 and *Sarsia viridis* Brinckmann-Voss, 1980. In addition, *Sarsia tubulosa* (M. sars, 1835) is a new record to the Bohai Sea of China. A key to all known species of the *Sarsia tubulosa* group is provided. The specimens examined in the study have been deposited at the First Institute of Oceanography, Ministry of Nature Resources.

Key words: Medusae, new species, new record, the Bohai Sea of China

Introduction

The Bohai Sea is a semi-enclosed inner shore, located to the northeast of China and met the Yellow Sea via the Bohai strait in the east. The Bohai sea has an area of 7.7×10^4 km², with an average depth of 18 m, and a maximal depth of 86 m in its western part. The water bodies around the Bohai Sea include the Bohai Bay, Liaodong Bay, and Laizhou Bay, and numerous rivers flow into it, e.g., Huanghe River, Haihe River, Liaohe River, Luanhe River, etc. The water temperature ranges from 0 to 25°C due to the strong influence of the terrestrial climate, the water salinity is below 30 ppt sometimes with the flowoff effect. Thus, there are only a minimal number of medusae species in the Bohai Sea.

Sarsia Lesson, 1843, the largest genus of Family Corynidae, contains 11 valid species (Schuchert, 2001, 2010; Bouillon *et al.*, 2006; Fenchel & Fenchel, 2001; Nawrocki *et al.*, 2010). Based on the gonophores of *Sarsia*, they can be divided into two groups, *Sarsia tubulosa* group and *Sarsia* species with sessile gonophores, wherein hydranths are either released as free medusae or remain as medusoids attached to the hydroid (Schuchert, 2001).

Sarsia species with sessile gonophores contains *S. lovenioid* and *S. medelae* (Gili *et al.*, 2006), characterized by medusoids that remain attached to the hydroid. This paper does not include these two species.

Sarsia tubulosa group is characterized by free medusae that are released from the hydranths. This group is represented by the type species *Sarsia tubulosa*, others are *S. apicula*, *S. bella*, *S. densa*, *S. occulta*, *S. piriforma*, *S. princeps*, *S. striata*, and *S. viridis*. Important characteristics for distinguishing species are given in Table 1. The goal of this paper is to describe the *Sarsia tubulosa* group.

Based on previous reports (Chow & Huang, 1958; Kao *et al.*, 1958; Hsu & Chin, 1962; Xu *et al.*, 2014), five

Sarsia species have been reported in China, but four of these species have since been transferred to other genera (*Sarsia gracilis* Browne, 1902 = *Coryne gracilis* (Browne, 1902), *Sarsia japonica* Nagao, 1962 = *Coryne japonica* (Nagao, 1962), *Sarsia nipponica* Uchida, 1927 = *Coryne nipponica* (Uchida, 1927), *Sarsia producta* Wright, 1858 = *Coryne producta* (Wright, 1858)), while the genus *Sarsia* only with *Sarsia tubulosa* (M. sars, 1835) is known in the northern Yellow Sea (Sheng & Dong, 2018).

In this paper, two new species of the *Sarsia tubulosa* group in the Bohai Sea of China are described, namely *Sarsia bohaiensis* Xu, Wang, & Chen **sp. nov.** and *Sarsia macrogastera* Xu, Chen & Wang **sp. nov.**, and four new records to China are noted, including *Sarsia apicula* (Murbach & Shearer, 1902), *S. piriforma* Edwards, 1983, *S. striata* Edwards, 1983 and *S. viridis* Brinckmann-Voss, 1980. A key for all known species of the *Sarsia tubulosa* group and the two new species is provided.

Materials and methods

We analyzed planktonic medusae in samples collected from 28 stations in the east coastal waters of Qinghuangdao City (39°46'10.00"~39°57'27.00"N, 119°37'38.00"~119°47'22.00"E) in April and July 2020 (Fig. 1). All planktonic samples were collected using vertical tows from near the sea bottom to the surface with a large-type zooplankton net (80 cm net mouth diameter, 0.505 mm mesh size). The samples were preserved in seawater with 5% buffered formalin. The samples were examined using stereoscopic and light microscopy, and taxonomic identifications were undertaken using the literature as reference, as noted throughout the paper and 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 an Olympus microscope. Type specimens were deposited in the First Institute of Oceanography, Ministry of Nature Resources.

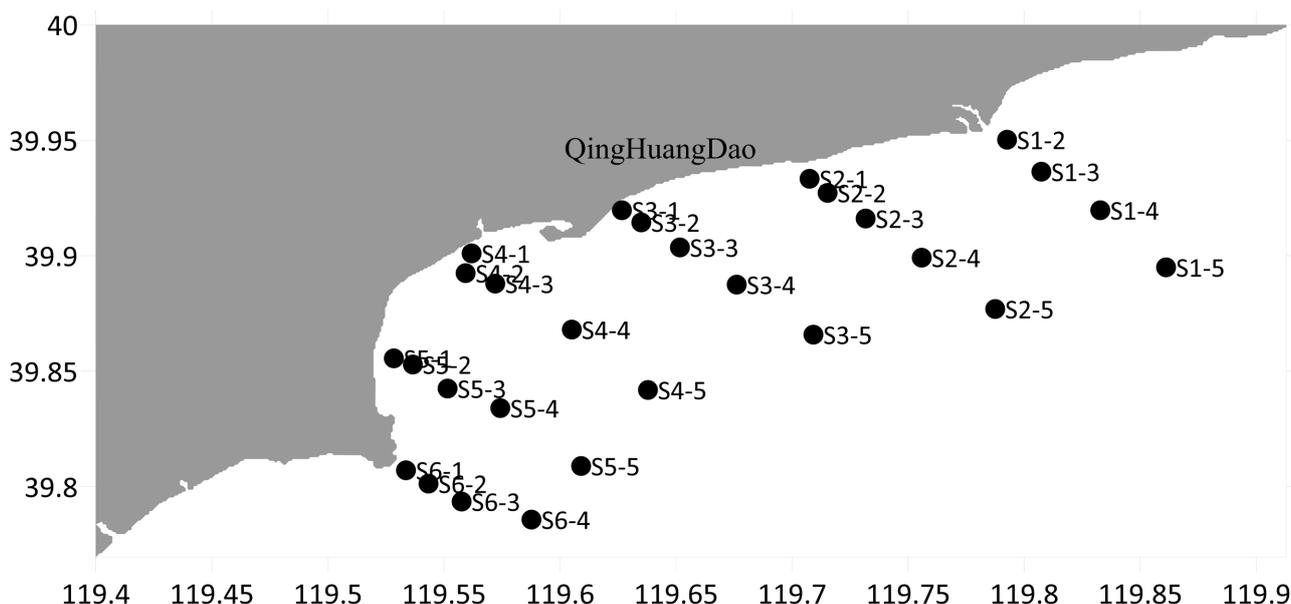


FIG. 1 Map of the study area

Results

Taxonomic account

Class Hydroidomedusa Claus, 1877 emend Bouillon & Boero, 2000

Subclass Anthomedusae Haeckel, 1879

Order Capitata Kühn, 1913

Family Corynidae Johnston, 1836

Genus *Sarsia* Lesson, 1843

Synonyms: *Sthenyo* Dujardin, 1845; *Codonium* Haeckel, 1879; *Sarsiella* Hartlaub, 1907; *Stauridiosarsia* Mayer, 1910; *Syndiction* Agassiz, 1862.

Sarsia Lesson, 1843; Schushert, 2001; Bouillon *et al.*, 2006.

Type species: *Sarsia tubulosa* (M. sars, 1835)

Diagnosis: The genus is diagnosed according to the following characteristics: the manubrium of medusa extends beyond umbrella margin and is divided into a thin, long, serpentine proximal part and a swollen distal part with a wide stomach. Gonad forms a cylinder around only the thin serpentine part of manubrium, leaving the distal stomach free of gonad. Tentacles are unbranched.

Remarks: Members of this genus are easily distinguished from all other genera by the marginal bulbs of the medusa, which lack adaxial cnidocyst pads. Gonads are not interrupted and form an unbroken ring. Manubrium extends beyond umbrella margin, with a thin proximal part.

The *Sarsia tubulosa* group of the genus *Sarsia* comprises 11 valid species (including the new species), of which, two are new species and four are first recorded in the China sea. These six and the *Sarsia tubulosa* (M. sars, 1835) listed below are described in detail in present work.

Sarsia bohaiensis Xu, Wang, & Chen **sp. nov.**

Sarsia macrogastera Xu, Chen, & Wang **sp. nov.**

Sarsia apicula (Murbach & Shearer, 1902), new record to China.

Sarsia piriforma Edwards, 1983, new record to China.

Sarsia striata Edwards, 1983 new record to China.

Sarsia viridis Brinckmann-Voss, 1980, new record to China.

Sarsia tubulosa (M. sars, 1835), new record to the Bohai Sea of China.

Descriptions of new species

Sarsia bohaiensis Xu, Wang, & Chen **sp. nov.** (Fig. 2)

LSIDurn:lsid:zoobank.org:act:7A3A4A88-E7AC-4953-829A-69D6A1D23415

Material examined. Holotype (FIO-HCCS01). One specimen from the Bohai Sea of China, station 2-2(39°55'38.0 0"N,119°42'55.00"E), depth 3.4 m, April 2020, collected by XiaoWang .

Diagnosis: Medusa subumbrella is rounded, without angular pockets. Manubrium is about two times as long as height of bell cavity, with conical apical chamber. The manubrium is divided into a long and thin serpentine part, and a distal swollen stomach with an oral tube. Gonad-free proximal portion of manubrium longer than subumbrella height, with short section covered by gonad, about 1/6 of manubrium. Radial canals enter at tops of gastrodermal chambers of bulbs without passing through mesogloea.

Description. Mature medusa is 3 mm high, with slightly smaller diameter, bell rounded to conical in shape, jelly thicker at apex than side. Interradial exumbrella nematocyst patches are faintly visible. Manubrium contains short, conical apical chamber. The manubrium is about two times as long as height of bell cavity, divided into a long and thin serpentine part and a distal, swollen spindle-shaped stomach, with an oral tube. The manubrium extends beyond the velar opening. Gonads are restricted to the serpentine part and cover a short portion, about 1/6 of manubrium. Four radial canals, stout, clearly visible, do not enter mesogloea above gastrodermal chambers of tentacle bulbs. Gastrodermal chamber bulbs are small, epidermal part is relatively high with even thickness and an abaxial ocellus. Tentacles short, about 1/4 as long as bell height in preserved specimen, with nematocyst clusters arranged in rings along the whole length, ending in a slightly enlarged globular cluster.

Distribution: The Bohai Sea of China.

Etymology: The Latin *bohaiensis* means Bohai. The species epithet refers to the species locality, the Bohai Sea of China.

Remarks. This species has simple marginal tentacles, and the tentacular bulbs contain ocelli. Gonads are not interrupted, undivided. Manubrium extends beyond umbrella margin, with a thin proximal section. These features place it in the family Corynidae Johnston, 1836, the genus *Sarsia* Lesson, 1843.

Currently, the *Sarsia tubulosa* group of the genus *Sarsia* contains 9 valid species (Bouillon *et al.*, 2006; Schushert, 2001). This new species can be distinguished from others in the *Sarsia tubulosa* group by its rounded medusa subumbrella which lacks angular subumbrella pockets. Similar to *Sarsia bella* Brinckmann-Voss, 2000 and *Sarsia densa* Hartlaub, 1897, it also has a gonad-free portion of the proximal manubrium that is longer than the subumbrella height. However, this new species differs from similar species in three ways: 1) its gonad covers only a short part of the serpentine part of the manubrium, and is about 1/3 as long as the stomach; 2) the manubrium has a swollen, spindle-shaped stomach with an oral tube at the distal end; and 3) its gastrodermal chambers contain small bulbs (see Table 1).

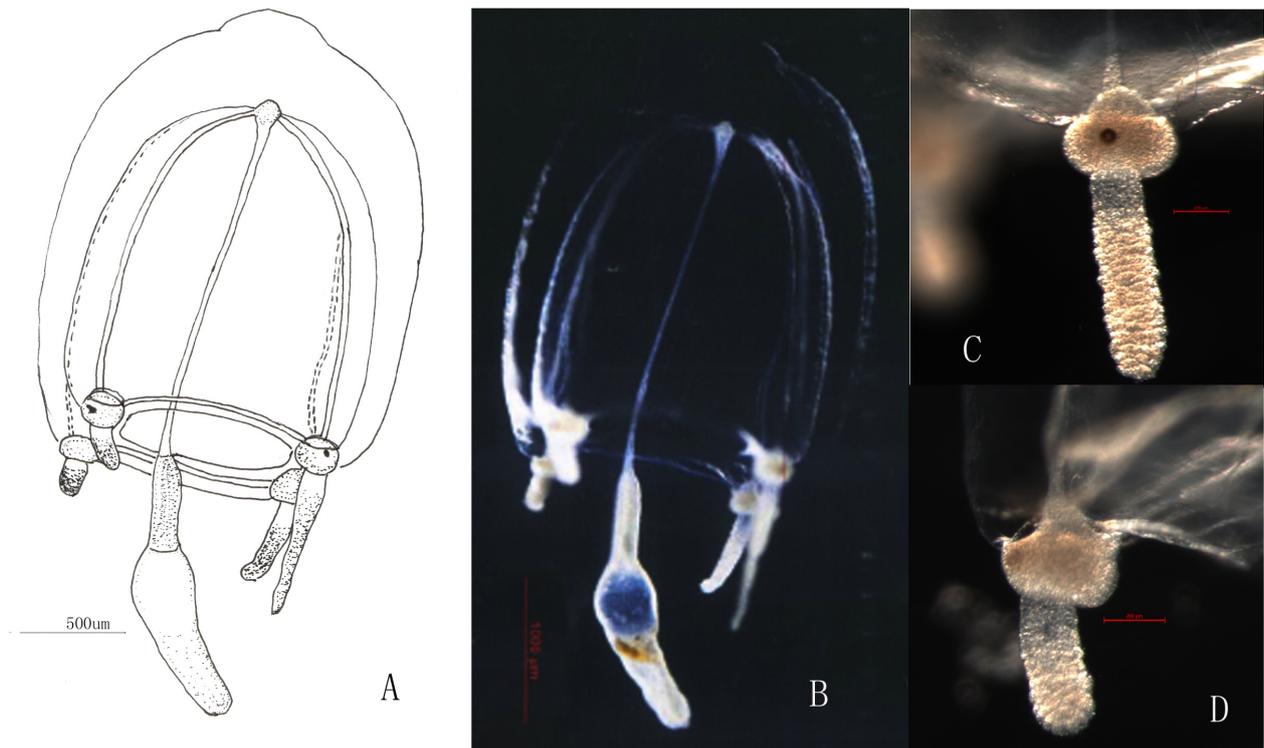


FIG. 2 *Sarsia bohaiensis* Xu, Wang, & Chen sp. nov.

A and B. lateral view; C. tentacle bulbs in frontal view.; D. tentacle bulbs in lateral view.

Sarsia macrogastera Xu, Chen, & Wang sp. nov. (Fig. 3)

LSIDurn:lsid:zoobank.org:act:3D943114-89E7-4EAB-B964-29FBD4EA63CB

Material examined. Holotype (FIO-HCCS02), one specimen from the Bohai Sea of China. Station 2-2 (39°55'37.98"N, 119°42'55.02"E), depth 3.4 m, July 2020, collected by Xiao Wang .

Diagnosis. Medusa subumbrella is pointed. Manubrium has a large, spindle-shaped stomach and short oral tube (about 2/3 of the manubrium). Bullet shaped apical knob present as a growth protruding up from the base of the manubrium. Radial canals are very broad, with glandular swellings; they enter the gastrodermal chambers of bulbs without passing through mesogloea. Tentacular bulbs are large, gastrodermal chambers of bulbs very shallow, epidermal part of bulb elevated relatively high, with even thickness and red ocelli.

Description: Medusa is 2.8 mm high, diameter 3.5 mm, greater in diameter than in height. Jelly relatively thick, thicker at apex with diminishing thickness towards margin. Bell top is rounded, subumbrella quite pointed, with scattered exumbrella nematocysts. Manubrium length is about the height of the bell cavity in preserved specimen, with bullet-shaped apical knob. Manubrium is divided into a short, thick serpentine part and a distal, large spindle shaped stomach part (about 2/3 of manubrium). Gonad only on serpentine part of manubrium, leaving only the

stomach and the base part of manubrium uncovered (about 1/18 the bell cavity height). Radial canals broad, with glandular swellings. Radial canals enter gastrodermal chambers of bulbs in the abaxial halves, without entering mesogloea. Tentacular bulbs large, frontal view narrow relative to tentacle width, gastrodermal chambers very shallow, with straight to concave abaxial sides, but more often concave in side view (Fig. 3C,3D). Epidermal parts of bulbs are relatively high, with even thickness and large red ocelli. Tentacles are short, about 1/3 as long as height of medusa in preserved specimen, with nematocyst clusters arranged in rings along nearly their whole length, ending in slightly enlarged globular clusters. Colors: manubrium, apical knob, epidermal part of bulbs are yellowish.

Distribution. The Bohai Sea of China.

Etymology. The species epithet is from the Latin *macrogastera*, meaning large stomach. The species name refers to the morphology of the stomach, which is very large.

Remarks. Based on the structural characteristics of its medusa, this medusa can be assigned to the genus *Sarsia* Lesson, 1843. This new species can be distinguished from the other species of the *Sarsia tubulosa* group by its pointed medusa subumbrella and manubrium lacking apical canal. It is similar to *Sarsia apicula* (Murbach & Shearer, 1903) which also has an apical knob, and very short base section of the manubrium that is not covered by gonad. However, this new species differs from similar species in four ways: 1) its manubrium has a large, spindle-shaped stomach and short oral tube (about 2/3 of the manubrium); 2) its radial canals are very broad, with glandular swellings, and they enter the gastrodermal chambers of bulbs without passing through mesogloea; 3) its tentacular bulbs large, and the gastrodermal chambers of bulbs are very shallow; and 4) the epidermal parts of bulbs are high, of uniform thickness, with red ocelli (see Table 1).

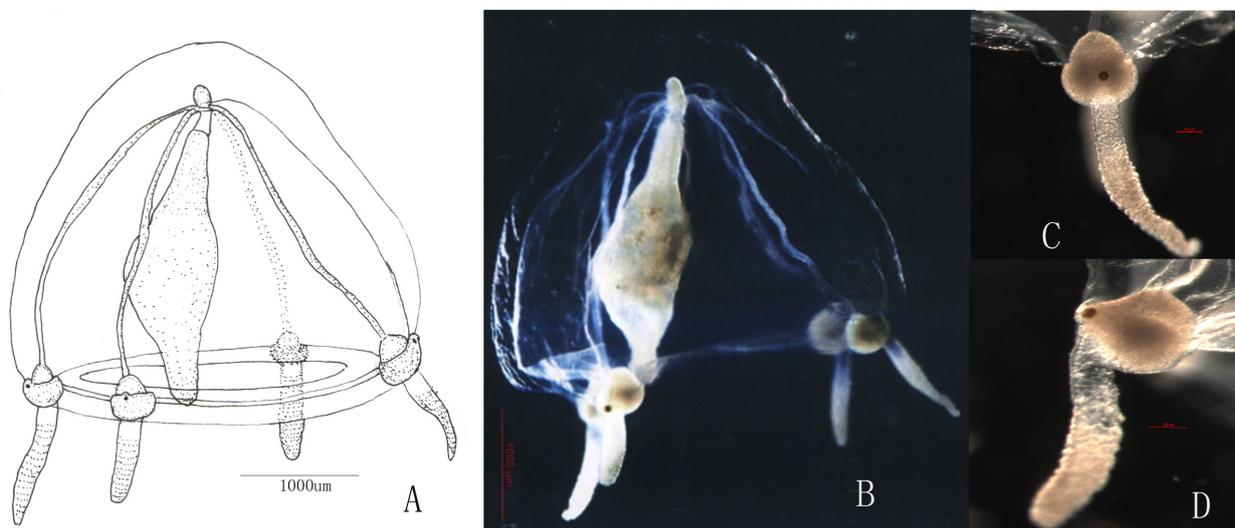


FIG. 3 *Sarsia macrogastera* Xu, Chen, & Wang sp. nov.

A and B. lateral view; C. tentacle bulbs in frontal view.; D. tentacle bulbs in lateral view.

TABLE 1 Key to medusa of all known species of the *Sarsia tubulosa* group

1a	Subumbrella pointed	
2a	Bell height > 12 mm, with thin, often branched apical canal.	<i>Sarsia princeps</i> (Haeckel, 1879)
2b	Bell height < 12 mm, with high conical apical knob	
3a	Bell top rounded; manubrium has short, thick serpentine part and distal, large, long spindle-shaped stomach, about 2/3 of manubrium; tentacular bulbs large, gastrodermal chambers shallow, epidermal parts high with uniform thickness	<i>Sarsia macrogastera</i> Xu, Chen, & Wang sp. nov.
3b	Bell top pointed; manubrium has long, thin serpentine part and distal swollen stomach, about 1/5 of manubrium; tentacular bulbs small, gastrodermal chambers high with low epidermis, not with uniform thickness.	<i>Sarsia apicula</i> (Murbach & Shearer, 1902)
1b	Subumbrella rounded	
4a	Medusa has angular subumbrella pockets at apex, exumbrella with interradial and perradial furrows.	<i>Sarsia striata</i> Edwards, 1983
4b	Medusa lacking angular subumbrella pockets	
5a	Gonad-free portion of proximal manubrium shorter than subumbrella height	

- 6a Proximal section of manubrium not distinct, very short
- 7a Bell top rounded, jelly rather thin with uniform thickness, exumbrella contains scattered nematocysts, lacking exumbrella furrows. *Sarsia occulta* (Edwards, 1978)
- 7b Bell top pointed, jelly thick, very thick at apex, exumbrella with interradial furrows *Sarsia piriforma* Edwards, 1983
- 6b Proximal section of manubrium distinct, long < 1/2 subumbrella height
- 8a Gonad-free part of manubrium short, about 1/6 of manubrium, exumbrella with interradial furrows, colors of bulbs and apical knob highly variable. *Sarsia tubulosa* (M. sars, 1835)
- 8b Gonad-free part of manubrium long, about < 1/2 of manubrium, exumbrella without interradial furrows, colors of bulbs and apical knob intense green *Sarsia viridis* (Brinckmann-Voss, 1980)
- 5b Gonad-free portion of proximal manubrium longer than subumbrella height
- 9a Gonad covering serpentine part of manubrium short, about 1/6 of manubrium; manubrium contains thick, spindle shaped stomach at distal end, mouth with oral tube; manubrium with apical chamber. . *Sarsia bohaiensis* Xu, Wang, & Chen **sp. nov.**
- 9b Gonad covering serpentine part of manubrium long, about 1/2 of manubrium
- 10a Exumbrella contains 1/6 adradial nematocyst patches which form an upper and a lower circle; mature medusae, patches faintly visible or absent; radial canals do not enter mesogloea, gastrodermal chambers of bulbs shallow with prominent epidermal parts *Sarsia bella* Brinckmann-Voss, 2000
- 10b Exumbrella with scattered nematocysts, not concentrated nematocyst patches, radial canals enter mesogloea, gastrodermal chambers of bulbs high. *Sarsia densa* Hartlaub, 1897

***Sarsia apicula* (Murbach & Shearer, 1902), new record to China (Fig. 4)**

Codonium apiculum Murbach & Shearer, 1902: 72; Murbach & Shearer. 1903: 165, pl. 17 Fig. 1, pl. 22 Figs. 4~5. *Sarsia apicula*, Hartlaub, 1907: 17, Fig. 9; Brinckmann-Voss, 1980: 18, Figs. 8. 9a; Brinckmann-Voss, 1985: 673, Figs. 1-5; Schuchert, 2001: 818~821, Fig. 30 A-C; Bouillon *et al.*, 2006: 239.

Material examined: Holotype (FIO-HCCS03), one specimen from the Bohai Sea of China. Station 4-5 (39°50'30.84"N, 119°38'16.41"E), depth 12.0 m, April 2020, collected by Xiao Wang .

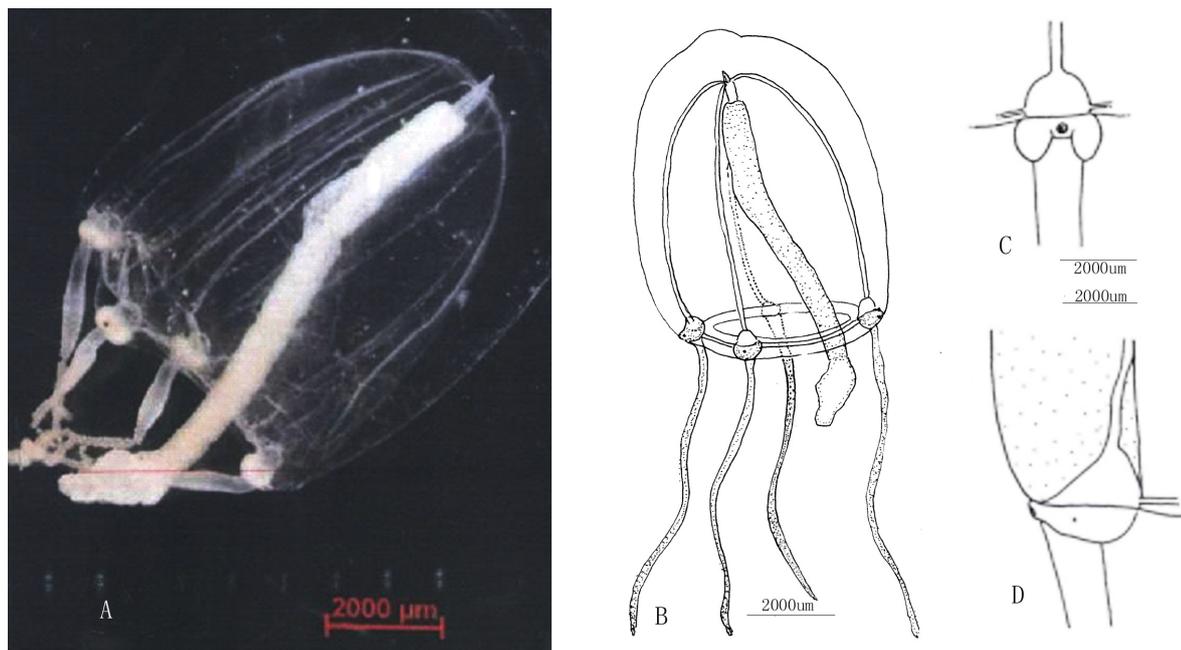


FIG. 4 *Sarsia apicula* Murbach & Shearer, 1902

A. and B. lateral view; C. Tentacle bulbs in frontal view; D. Tentacle bulbs in lateral view. (C, D. after Murbach & Shearer, 1902)

Description. Adult medusa is 9~10 mm high, diameter 8~9 mm, bell top pointed to rounded, jelly thick. Subumbrella nearly conical. Manubrium becomes very long, reaching about two times the height of the bell in living specimens, extending beyond the orifice of the bell when completely contracted in preserved specimens, with high conical apical knob. Manubrium has long, thin serpentine part with distal swollen stomach. Gonad covers nearly entire serpentine part, thickness near top in extended manubrium tapers evenly, very short portion of manubrium (about 1/20) not covered by gonad. Radial canals enter the gastrodermal chambers at the top, passing a very short

distance through mesogloea. Epidermal parts of bulbs have incomplete nematocyst rings. Bulbs have black ocelli. Tentacles are at least two times as long as bell, covered by dense nematocyst clusters, terminal cluster not thickened. Colors: manubrium, tentacles, and apical knob reddish.

Distribution: The Bohai Sea of China; Northeastern Pacific, Puget Sound, Sooke, Victoria Harbour, Friday Harbour, and San Juan Islands (Brinckmann-Voss, 2000).

Remarks. The medusa of *Sarsia apicula* is characterized by pinkish tentacles, its conical subumbrella, and the tapering of the gonad towards the manubrium base. Preserved medusae are almost indistinguishable from *S. tubulosa* and *S. princeps* which are sympatric (the Bohai Sea of China).

Sarsia apicula is distinguished from the typical blue *S. tubulosa* by its triangular bell, the pinkish color of its tentacles and manubrium, and the very short proximal part of the manubrium (about 1/20 of manubrium). It is distinguished from *S. princeps* by its non-branching apical canal, its radial canals entering the mesogloea, and the high gastrodermal chambers of the tentacular bulbs.

Sarsia piriforma Edwards, 1983, new record to China (Fig. 5)

Sarsia piriforma Edwards, 1983: 49, Figs 1–2; Schuchert, 2001; 826, Fig. 34.A–B; Bouillon *et al.*, 2006: 239.

Material examined: Holotype (FIO-HCCS04), one specimen from the Bohai sea of China. Station 5-4 (39°50' 2.58"N, 119°34' 27.4"E), depth 9.5 m, April 2020, collected by Xiao Wang.

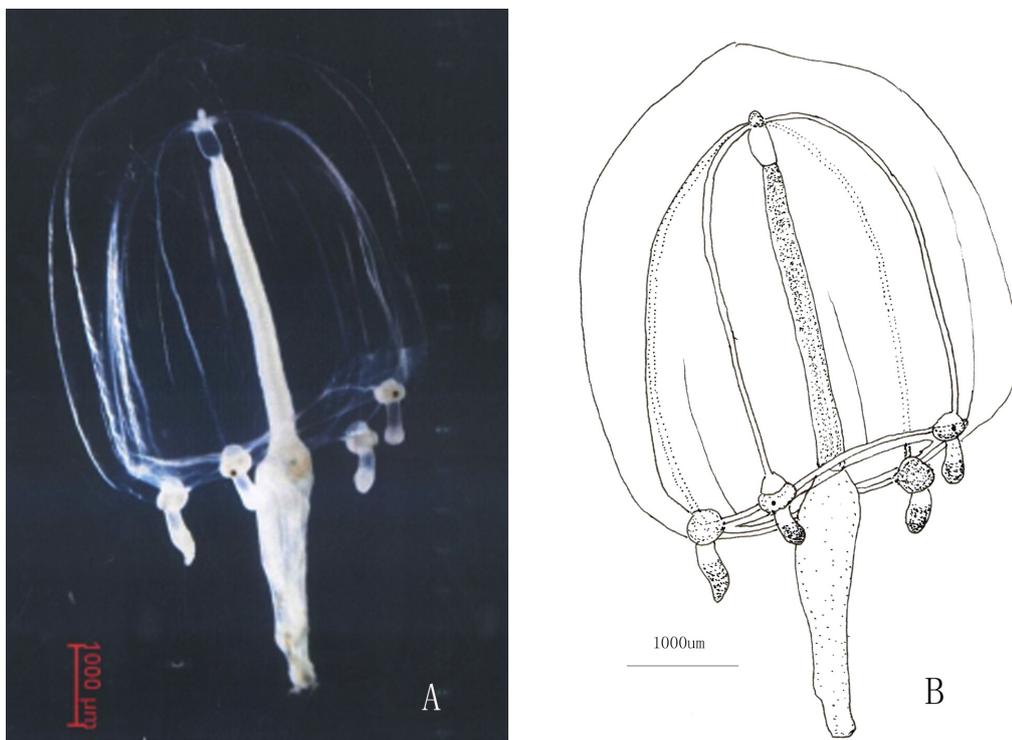


FIG. 5 *Sarsia piriforma* Edwards, 1983

A and B. Lateral view

Description. (in part after Schuchert, 2001) Adult medusa is 5~7 mm in height, 5~6 mm in width, jelly moderately thick, much thickened at apex which gives a conical shape to the upper of the bell. Interradial exumbrellar furrows shallow. Manubrium is about two times as long as height of bell cavity, with a conical to rounded apical knob. The manubrium has no distinct short proximal part of manubrium and thin serpentine part and a swollen spindle or cylindrical shaped stomach at distal end, the thickness tapers towards distal end (about 1/3 of manubrium). The gonad encircles the manubrium from nearly its origin along the proximal 2/3 of its length, only a short basal portion and stomach is gonad-free. Four radial canals of variable breadth enter gastrodermal chambers of bulbs at their tops. Gastrodermal chambers with concave abaxial sides. Tentacles with spirally arranged nematocyst clusters

along nearly their whole length, ending in slightly enlarged, globular clusters. Colors: apical knob and gastrodermal chamber of bulbs orange or scarlet, ocelli black.

Distribution. The Bohai Sea of China; Near Oban, Argyll, Scotland.

Remarks. The medusa of *Sarsia piriforma* has been found in plankton from the Bohai Sea, which is more similar to *Sarsia occulta* Edwards 1978. For its distinguishing characteristics, see Table 1.

Sarsia striata Edwards, 1983 new record to China. (Fig. 6)

Sarsia striata Edwards, 1983: 54, Figs. 3~4; Schushert, 2001; 831, Figs. 36A~C; Bouillon *et al.*, 2006: 239.

Material examined: Holotype (FIO-HCCS05), one specimen from Bohai sea of China. Station 5-5 (39°48'32.28"N, 119°36'32.70"E), depth 3.4 m, April 2020, collected by Xiao Wang.

Description. Umbrella is bell-shaped, 7~8 mm high, 6~7 mm wide, jelly relatively thick, more so at apex, top of bell rounded, exumbrella has deep interradial and shallower perradial furrows, subumbrella has interradial pockets at top marked with angular ridges. Manubrium is very extensive, extending far beyond umbrella margin when completely contracted, while in full extension it reaches four times the length of the bell height. Manubrium is divided into long and thin serpentine part and distal swollen stomach. The gonad encircles only the serpentine part of manubrium, leaving only the stomach and the base a part of the tubular section uncovered (totaling about 1/10 of the height of bell). Manubrium often has small apical knob. Radial canals are narrow, without glandular swellings, and pass through mesogloea to enter the gastrodermal chambers of the bulbs at their abaxial side. Bulbs well formed, gastrodermal chambers large, epidermises have black ocelli. Tentacles very long and hollow, covered with spirally arranged clusters of nematocysts, ending in slightly enlarged hollow terminal clusters.

Distribution. The Bohai Sea of China; Firth of Lom, Scotland.

Remarks. This medusae closely resembles *Sarsia tubulosa*, with interradial exumbrella furrows, an apical knob, and a long manubrium extending far beyond umbrella margin. This species can be distinguished from *Sarsia tubulosa* primarily by its characteristic subumbrellar pockets with angular ridges, its thicker jelly, and the shorter gonad-free portion at the base of the manubrium.

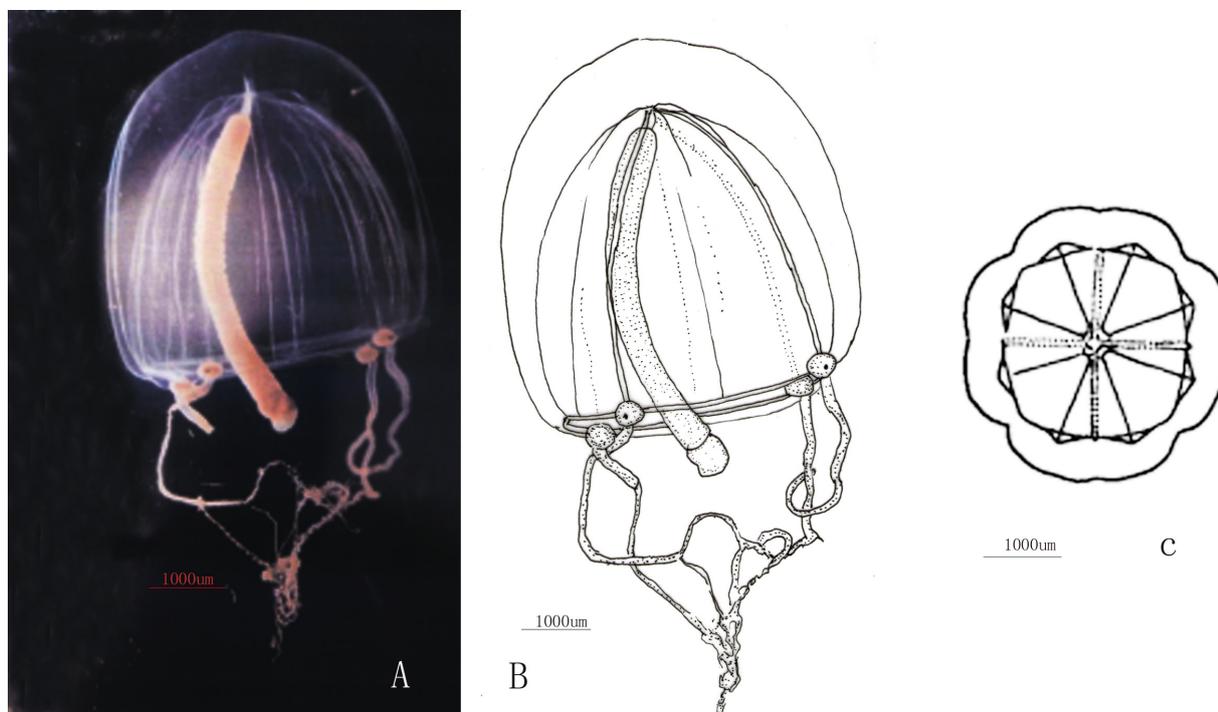


FIG. 6 *Sarsia striata* Edwards, 1983

A and B. lateral view; C. bell of mature medusa seen from above.(after Schuchert, 2001).

Sarsia viridis Brinckmann-Voss, 1980 new record to China (Fig.7)

Sarsia viridis Brinckmann-Voss, 1980: 29, Fig. 13; Schushert, 2001: 833, Figs. 37A–B; Bouillon *et al.*, 2006: 239.

Material examined: Holotype (FIO-HCCS07), one specimen from the Bohai Sea of China. Station 2-2 (39°55'37.98"N, 119°42'55.02"E), depth 3.4 m, April 2020, collected by Xiao Wang.

Description. Adult medusa is 4–5 mm height, maximal diameter slightly less than height, dome-like, jelly fairly thick, especially at top of bell, diminishing in thickness towards margin, umbrella transparent. Manubrium is about twice as long as bell, with conical and short apical chamber, and is divided into long and thin serpentine part and a distal swollen stomach. Gonad is on the serpentine part of manubrium only, leaving the proximal portion free of gonad cover (< 1/2 of manubrium). Radial canals enter gastrodermal chambers of bulbs at the top, passing briefly through mesogloea. Gastrodermal chambers of bulbs have concave or straight abaxial walls. Epidermal parts of bulbs relatively shallow with black ocelli. Radial canals are rather thick and clearly visible, thicker than ring canal. Tentacles have nematocyst clusters over most of their length, terminal clusters only slightly larger. Colors: apical chamber, base of manubrium, and marginal bulbs brilliant green, manubrium and tentacles paler green, umbrella slightly green.

Distribution. The Bohai Sea of China; British Columbia and Puget Sound.

Remarks. *Sarsia viridis* owes its name to the intense green color of the apical chamber, base of the manubrium, and marginal bulbs. Its long gonad-free proximal part of the manubrium resembles those of *Sarsia bella*, *S. densa*, and *S. bohaiensis* sp. nov. The characteristic green colors and the gonad-free proximal portion of the manubrium being shorter than subumbrella height may be considered its distinguishing features (see Table 2).

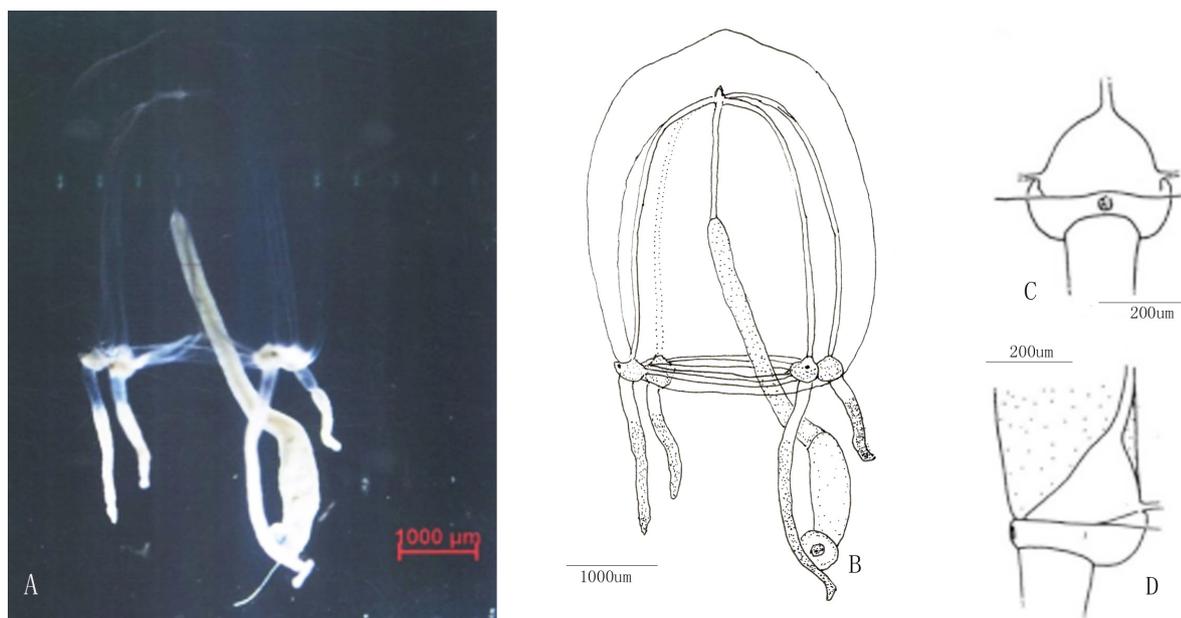


FIG. 7 *Sarsia viridis* Brinckmann-Voss, 1980

A and B. Lateral view; C. tentacle bulbs in frontal view; D. tentacle bulbs in lateral view; (C. and D. after Brinckmann-Voss, 1980)

Sarsia tubulosa (M. sars, 1835) (Fig. 8)

Oceania tubulosa M. Sars, 1835: 25, pl. 5 Fig. 11.

Syncoryne decipiens Dujardin, 1845: 275, pl. 14–15.

Sarsia mirabilis L. Agassiz, 1849: 224, pl. 4–5.

Sarsia litorea Hartlaub, 1907: 32, Figs. 23–24; Mayer, 1910: 53, Fig. 13.

Sarsia pulchella Hartlaub, 1907: 34, Fig. 27.

Sarsia reticulata Hartlaub, 1907: 45, Figs. 41–43; Kramp, 1961: 31.

Sarsia tubulosa Forbes, 1848: 55, pl. 6 Fig. 2; Hartlaub, 1907: 19, Figs. 10–14; Mayer, 1910: 53, pl. 3 Figs. 2–5, pl. 4, Figs. 1–2;

Russell, 1953: 55, Figs. 21~23; Kramp, 1959: 78, Fig. 10; Kramp, 1961: 32; Kramp, 1968: 6, Fig. 2; Calder, 1972: 223, pl. 1, Fig. 8; Edwards, 1978: 301, Figs. 4~5; Aral & Brinckmann-Voss, 1980: 25, Fig. 12; Schuchert, 2001: 813, Fig. 29_{A-F}; Bouillon et. al., 2004: 100, Fig. 53_{A-J}; Sheng et al. 2018; 1418.fig1~5.

Material examined: Holotype (FIO-HCCS06), paratypes (FIO-HCCS07), two samples from Station 5-1 (39°51'20.09"N, 119°31'42.20"E, depth 2.2 m) and 4-3 (119°34' 19.52"N, 39°53' 16.54"E, depth 9.5 m) in the Bohai Sea of China. April 2020, collected by Wang Xiao.

Description. Holotype. Umbrella is bell-shaped, about 4~5 mm in width and height, jelly moderately thick, thicker at apex, with interradial exumbrellar furrows. The manubrium very extensive, can extend beyond the bell orifice when completely contracted (Fig. 8A, B), reaching 2~3 times as long as the bell when fully extended (Fig. 8C). Apical knob of variable shape is usually present, apical canal usually absent. Manubrium consists of a long slender tubular proximal part and a capacious distal stomach terminating in a round tubular thick-walled oral part armed with nematocysts. Gonad encircles the long thin part, leaving the proximal part of manubrium uncovered (less than 1/5 of bell height in mature animals), and gonad ends distally at beginning of stomach. Radial canals enter gastrodermal chambers of bulbs on abaxial side and pass through mesogloea. Tentacle bulbs large, gastrodermal chambers high, arching-shaped, epidermal nematocyst ring incomplete, with abaxial black or red ocelli. Each bulb has a very long tentacle, covered by nematocyst clusters or spiral rings, terminal cluster of nematocysts spherical, but not enlarged. Preserved medusa are mostly pale orange to reddish.

Biology: This medusa is known to feed on mesoplankton and macroplankton such as copepods, mysids, amphipods, euphausiids and occasionally other medusae such as *Aurelia* (Aral & Brinckmann-Voss, 1980). Daan (1986) investigated its food intake, growth, and ecology and Van (1985) and Purcell (1986) focused on its ecological and potential economic impact on commercially important fish larvae.

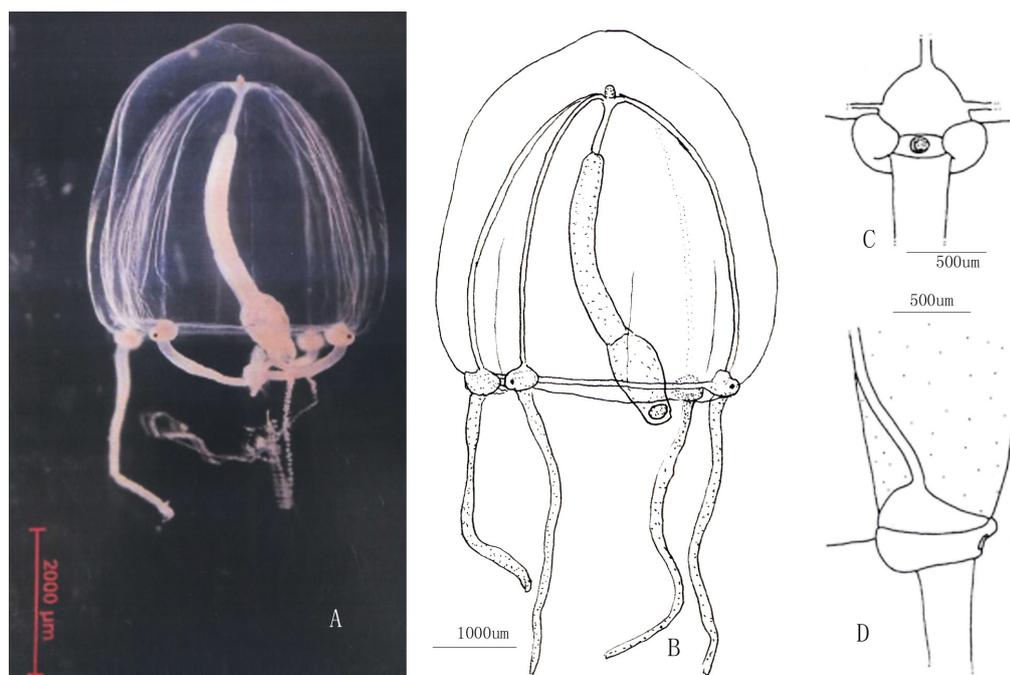


FIG. 8 *Sarsia tubulosa* (M. sars, 1835)

A. and B. Lateral view, after preserved specimen from the Bohai sea of China; C. tentacular bulbs in frontal view; D. tentacle bulbs in lateral view; (C–D after Edwards, 1978).

Distribution: The Bohai Sea and northern Yellow Sea of China. It is a circumpolar boreal neritic species and has been recorded in the Atlantic, Indo-Pacific, and Mediterranean.

Remarks. The life cycle of *Sarsia tubulosa* has been examined several times, commencing with Schulze (1873), but Edwards (1978) provided a particularly detailed and valuable account.

Sarsia tubulosa is a variable species with a complicated synonymy which has been widely discussed (Hartlaub, 1907; Kramp, 1926; Russell, 1953; Edwards, 1978, 1983; Aral & Brinckmann-Voss, 1980), even two or three species with different life cycles has been accounted into *S. mirabilis* which is confusing (Edwards, 1978).

While we do not discuss them here, some ambiguities in distinguishing this species remain, particularly in relation to the different color morphs of the medusa stage.

While *Sarsia mirabilis* is regarded as a subjective synonym of *Sarsia tubulosa* (Schushert, 2001). The specific characteristics of *Sarsia tubulosa* are similar to that of *Sarsia viridis* Brinckmann-Voss, 1980, which also has a distinct proximal part of the manubrium that is $< 1/2$ the subumbrella height. Despite the similarities, *Sarsia tubulosa* can be differentiated from similar species by: 1) its short gonad-free portion of the manubrium, about $1/6$ of manubrium; 2) exumbrella with interradial furrows; and 3) the highly variable colors of bulbs and apical knob (see Table 1).

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