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Wide geographical distribution of *Aorella vanhoeffeni* (Cnidaria, Scyphozoa, Coronatae) in Japan

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Abstract. Medusae of a rare, small scyphomedusa, *Aorella vanhoeffeni* Bigelow, 1909 (Cnidaria, Scyphozoa, Coronatae), were collected and/or photographed at three sites in Japan: Notojima, Ishikawa Prefecture, in the Sea of Japan; Osezaki, Shizuoka Prefecture, on the Pacific coast; and Yonaguni Island, Okinawa Prefecture, in the East China Sea. In Japanese waters this species has been previously reported only from Kakeroma Island, Kagoshima Prefecture. The detailed morphology is described based on a medusa from Yonaguni Island.

Key words: *Aorella*, medusa, distribution, morphology, Japan

Introduction

Species of the genus *Aorella* are unique in the Coronatae in having hexamerous symmetry superimposed on the tetramerous symmetry typical of scyphozoans; hence this genus is assigned to the monotypic family Aorellidae. Medusae of all species of the genus have six tentacles, six rhopalia, and 12 lapets, as well as four lips and four groups of gastric cirri. The number of gonads varies among species (four, six, or eight) and may show intraspecific variation as well; *A. subglobosa* Vanhöffen, 1902, for

example, has four or six gonads (Mills *et al.*, 1987).

In Japanese waters two identified species of *Aorella*, *A. vanhoeffeni* Bigelow, 1909 and *A. japonica* Kawaguti and Matsuno, 1981 have been reported (Kawaguti and Matsuno, 1981; Kubota, 2008), and an unidentified *Aorella* sp. was reported from Suruga Bay by Kitamura and Lindsay (2008). *Aorella japonica* was described only on the basis of the polyp and the newly released ephyra, and the mature medusa is not yet known. The medusa of *A. vanhoeffeni* is characterized by having four gonads and a warty exumbrellar surface (Bigelow, 1909; Mayer, 1910; Kramp, 1961; Mills *et al.*, 1987). The first, and until now only specimen of *A. vanhoeffeni* from Japan was found near Kakeroma Island,

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Kagoshima Prefecture, in 1995 (Kubota, 2008). Here we report other specimens of this species from Japan, more recently collected and/or photographed at two localities in Honshu and one in the Ryukyu Islands.

***Atorella vanhoffeni* Bigelow, 1909**

[New Japanese name:

Hime-mitsuashi-kamuri-kurage]

(Figs 1, 2)

Atorella vanhoffeni Bigelow, 1909: 30, pl. 1, fig. 2, pl. 11, figs 1-8, pl. 12, figs 2-4; Mayer, 1910: 568; Kramp, 1961: 313; Mills *et al.*, 1987: 426; Kubota, 2008: 125.

Material. One medusa photographed and collected on 21 January 2008 by R. Minemizu at a depth of 20 m off Yonaguni Island, Okinawa Prefecture (East China Sea: 24°27' N, 122°57' E; water temperature 23°C) was examined in detail. Two other medusae were photographed: one found in May, 2003, by S. Ikeguchi in surface waters off the coast of Notojima, Ishikawa Prefecture (Sea of Japan: 37°8' N, 136°58' E; water temperature 14.5°C); another found on 11 January 2007 by R. Minemizu at a depth of 1 m off Osezaki, Numazu, Shizuoka Prefecture (Pacific Ocean: 35°1' N, 138°47' E; water temperature 15°C).

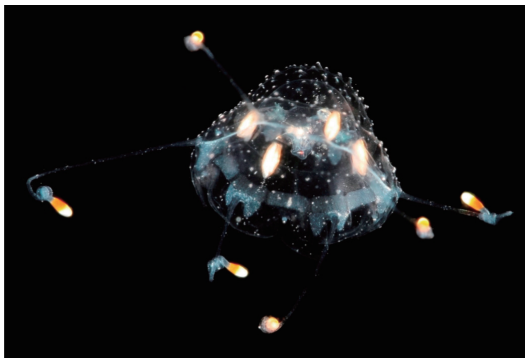


Fig. 1. Medusa of *Atorella vanhoffeni* found at Yonaguni Island, Okinawa (oblique view, photographed *in situ*).

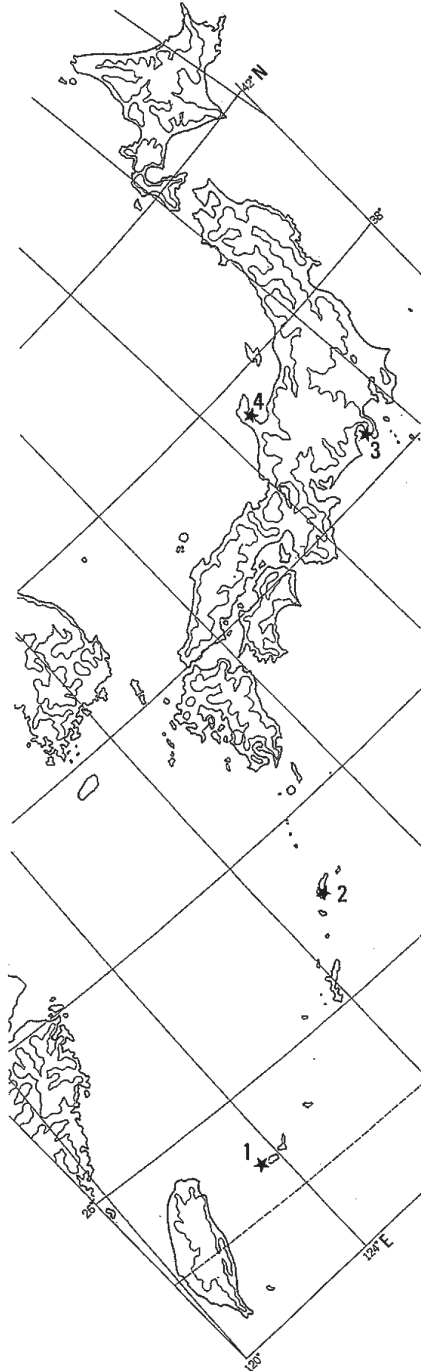


Fig. 2. Known geographical distribution of the medusa of *Atorella vanhoffeni* in Japanese waters. 1: Yonaguni Island, Okinawa Prefecture; 2: Kakeroma Island, Kagoshima Prefecture (after Kubota, 2008); 3: Osezaki, Shizuoka Prefecture; 4: Notojima, Ishikawa Prefecture.

Description of external morphology. The umbrella of the medusa collected off Yonaguni Island (Fig. 1) was about 4.0 mm high and 4.5 mm wide. The center of the umbrella was dome-like, and demarcated from the marginal pedaliar region by a distinct ring furrow. The umbrellar margin was divided into 12 oval lappets that were longer than wide. Six tentacles and six rhopalia were alternately set between the lappets. The tentacles were longer than the diameter of the umbrella and each was provided with an opaque, knob-like swelling at the tip; the distal 1/3 to 1/2 of this swelling was densely covered with nematocysts and more opaque than the remaining proximal part. Each rhopalium was provided with a large statocyst but no ocelli. The mouth was cruciform and surrounded by four short lips. The stomach was flat and shallow, and provided with four groups of gastric filaments, each group consisting of 20–30 filaments arising from a short, stout gelatinous stalk. The entire exumbrellar surface (both the central disc and the pedaliar region) was sprinkled with numerous nematocyst warts. The coronal muscle was poorly developed but the subumbrella plates at the bases of the tentacles were prominent. There were four leaf-shaped gonads, each abaxial to a group of gastric filaments. The gonads were beige in color when alive but became opaque white after preservation.

Distribution. The medusa of the present species has been taken at the surface near the Pacific coast of Panama, at depths of 100–600 m in the Pacific off California and Baja California, and at undisclosed depths in the Caribbean and the Gulf of Mexico (Bigelow, 1909; Mayer, 1910; Mills *et al.*, 1987). Werner (1966) reared young medusae of this species from a polyp collected in the Indian Ocean off East Africa at 100–200 m depth. In Japanese waters only one medusa has been previously collected (Kakeroma island, Kagoshima Prefecture, 1 m deep: Kubota, 2008); however, the present records show that *Atorella vanhoeffeni* is widely distributed in Japanese waters, from Yonaguni Island in Okinawa Prefecture (the southernmost record in Japan) to Notojima, Ishikawa Prefecture, in the Sea of Japan (the northernmost

record), and to Osezaki, Shizuoka Prefecture, on the Pacific coast (Fig. 2). In Japan it has usually been found in shallow waters in winter.

Remarks. A deep-dwelling specimen of *Atorella* sp. was photographed in Suruga Bay, Japan, at a depth of 1038 m (Kitamura and Lindsay, 2008). This species has eight gonads like *A. octogonos* described by Mills *et al.* (1987), and the color of its gonads and manubrium is also different from that of *A. vanhoeffeni*; therefore, these medusae may be specifically distinct. The life cycle of *A. vanhoeffeni* was reported by Werner (1966); the number of tentacles of the solitary polyp, the number of ephyrae produced, and the number of tentacles and gastric filaments of the newly released ephyra are all different from those reported for *A. japonica* by Kawaguti and Matsuno (1981).

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