First Record of Pandeid Jellyfish, *Eutiara decorata* Berberian, Michenet and Goy, 2021 (Hydrozoa, Anthoathecata, Pandeidae), from Japan

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Abstract: Two specimens of pandeid species, *Eutiara decorata* Berberian, Michenet and Goy, 2021 were collected from Kumejima Island in Okinawa Prefecture, Japan. These specimens with a small white apical process were not yet fully-grown adults. A hyperiid amphipod, *Brachyscelus crusculum*, was attached to *Eutiara decorata* in situ. *Eutiara decorata* has only been reported in Tahiti Island, French Polynesia, in 2021. This is the first record from Japan and the second record of occurrence since its original description.

Keywords: citizen science; hyperiid amphipod; Kuroshio Current; symbiont

1. Introduction

The genus *Eutiara* (Hydrozoa, Anthoathecata, Pandeidae) has four perradial canals, blind centripetal canals alternating with the radial canals, well-developed mesenteries, and a complex gonad similar to the genus *Neoturris* [1]. Three species have been described in this genus, *E. mayeri* Bigelow, 1918, *E. russelli* Bouillon, 1981, and *E. decorata* Berberian, Michenet and Goy, 2021 [1–3]. The ontogenetic development of the medusa stage of *E. decorata* collected in the field was described [2]. However, the polyp stage of this genus has not yet been reported [2,4].

*Eutiara mayeri* was found in the Atlantic Ocean near Chesapeake Bay [1] and the Virgin Islands, Caribbean Sea [5,6], *E. russelli* was found in the Bismarck Sea, Papua New Guinea, and *E. decorata* was found in Tahiti Island, French Polynesia. *Eutiara decorata* is the only species from the southern hemisphere.

*Eutiara decorata* is relatively large with eight long tentacles, an exumbrellar spur on each tentacle bulb, and a beautiful pattern of dendritic exumbrella ridges. Some divers photographed and reported a jellyfish matching this description from Okinawa, Philippine, and Palau via a social networking service [7–9]. However, these records lack an appropriate voucher specimen. Two specimens of this species were collected in Okinawa Prefecture, Japan. This is the first scientific record of this species based on voucher specimens in Japan from the northern hemisphere and the second occurrence record since the original description.

2. Materials and Methods

On 5 September 2021, two medusae were photographed and collected by SCUBA diving by boat at a depth of 12 m at off Hate-no-Hama, Kumejima Island, Okinawa, Japan (26.37488° N 126.844861° E; Figure 1). The water temperature was 29 °C and salinity was not measured. These specimens were fixed with 3% seawater formalin.
We observed morphological characteristics under a stereomicroscope (SZX10, Olympus Corporation, Tokyo, Japan) and performed species identification following Bigelow (1918) [1], Kramp (1959, 1961) [5,6], Bouillon et al. (2006) [4] and Berberian et al. (2021) [2]. According to Berberian et al. (2021) [2], the umbrella height (UH), exumbrella height (EUH), subumbrella height (SUH), umbrella diameter (UD), and manubrium length (ML) were measured from specimen photographs using image analysis software, Image J ver. 1.53 [10]. Color description was based on photographs taken at habitat sites when samples were collected. The specimens used in this report were deposited at the School of Marine Life Sciences, Kitasato University (specimen numbers: P02 and P06). Hyperiid amphipod found on the P06 specimens were also fixed in the same bottle of host specimen. The hyperiid amphipod was also identified following Vinogradov et al. (1996) [11], Chihara and Murano (1997) [12], and Mori et al. (2010) [13].

3. Results
3.1. Hydromedusa
3.1.1. Systematic Account of Pandeid Species
Phylum Cnidaria Hatschek, 1888
Subphylum Medusozoa Petersen, 1979
Class Hydrozoa Owen, 1843
Subclass Hydroidolina Collins, 2000
Order Anthoathecata Cornelius, 1992
Suborder Filifera Kühn, 1913
Family Pandeidae Haeckel, 1879
Genus Eutiara Bigelow, 1918
Eutiara decorata Berberian, Michenet and Goy, 2021
New Japanese name: Kuko-no-Mi Kurage (クコノミクラゲ)

3.1.2. Description of Specimens

Examined material
Sampling date: 5 September 2021
Sampling site: Off Hate-no-Hama, Kumejima-cho, Shimajiri-gun, Okinawa Prefecture
GPS coordinate: 26.37488° N 126.844861° E
Sampling gear: SCUBA
Depth: 12 m
Water temperature: 29 °C
Fixing method: 3% seawater formalin
Voucher number: P02 (Figure 2) and P06 (Figure 3)
Collector: Ryo Minemizu
P02: UH 6.2 mm, UD 3.1 mm, SUH 5.4 mm, ML 3.2 mm
P06: UH 15.0 mm, UD 7.9 mm, SUH 14.1 mm, ML 9.1 mm

These specimens were observed in the bottomless midwater range, which is slightly away from the coral reef drop-offs facing the open ocean. Conversely, this species has never been observed in the inner bay of Kumejima Island. Multiple individuals appeared at the same time under an existing tidal current. Further, many other hydromedusae, copepods, invertebrate larvae, and fish larvae were observed at the same time as the E. decorata observation.

Figure 2. Eutiara decorata, voucher #P02: (a) Live specimen in situ; (b) Fixed specimen, white arrow shows exumbrellar spurs; (c) Abaxial ocellus (yellow arrow) and cirrus (red arrow) on the bell margin. Scale bar = 1 mm.
These specimens had a bell-shaped umbrella with a very small white hemispherical apical process. The umbrella height was approximately twice the umbrella diameter. The eight tentacles showed basal bulbs that were laterally compressed, with four perradial tentacles and four adradial tentacles. Relaxed tentacles extended straight out and shrunken tentacles were coiled. Exumbrellar spurs without an ocellus extended above the tentacle bulbs. Branching blind longitudinal ribs extended from the exumbrella spurs and covered the exumbrella. The branch of the rib was asymmetric. Three to four marginal bulbs with abaxial ocellus and cirrus were found between each tentacle. Smooth and ribbon-like perradial canals connected the upper part of the manubrium through the mesenteries. Four mountain-shaped short centripetal canals were projected from the interradial part of the marginal ring canal. The marginal ring canal was broad and the velum was well developed. The manubrium was also well developed, but did not extend over the umbrella margin. Gonads with deep folds extended over the stomach wall at the adradial end and many folded gonads showed gaps at the interradial sections. The mouth had crenulated lips. When alive, the color of the ocelli, lips, and gonads were orange to red, tentacle bulbs were reddish-brown, and the tree-like ramified ribs on the exumbrella and apical process were white.

3.2. Symbionts on the Hydromedusae
3.2.1. Systematic Account of the Hyperiid Amphipod on *Eutiara decorata*, Voucher Specimen P06

Phylum Arthropoda von Siebold, 1848
Subphylum Crustacea Brünich, 1772
Superclass Multicrustacea Regier, Shultz, Zwick, Hussey, Ball, Wetzer, Martin and Cunningham, 2010
Class Malacostraca Latreille, 1802
Subclass Eumalacostraca Grobben, 1892
Superorder Peracarida Calman, 1904
Order Amphipoda Latreille, 1816
Suborder Hyperiidea H. Milne Edwards, 1830
Infraorder Physocyphalata Bowman and Gruner, 1973
Parvorder Physocyphalatidira Bowman and Gruner, 1973
Superfamily Platyscelioidea Spence Bate, 1862
Family Brachyscelidae Stephensen, 1923
Genus Brachyscelus Spence Bate, 1861
Species Brachyscelus crusculum Spence Bate, 1861
Japanese name: Nokoba-Umi-Nomi (ノコバウミノミ)
Voucher number: P06-Amphi (Figure 4)

Figure 4. Hyperiid amphipod, Brachyscelus crusculum, attached to Eutiara decorata. Scale bar = 1 mm.

3.2.2. Description of Specimen

This hyperiid amphipod (Amphipoda: Hyperiidea) was observed and collected with host specimen P06 (Figure 4). This species was observed holding on to the tree-like ramified ribs of Eutiara decorata in situ (Figure 3). The total length of the specimen was 3.7 mm. The head was anteriorly rounded without a rostrum. The subchela of the gnathopods I and II were well developed. The anterior edge of the carpopodite in the gnathopod I protruded forward significantly. The basipodite in pteropods V and VI were relatively broad, but not lid-shaped. The anterior edge of the basipodite in pteropod VI protruded only slightly. Pereopod VII showed all segments completely without degenerate segments. The rami of all uropods were separated from the peduncle; specifically, the rami of uropod III were broad. The telson was longer than its width.

4. Discussion

According to morphological observations, the two specimens collected from Okinawa were identified as Eutiara decorata. The growth stage of the specimens was classified as Stage 3 adult according to Berberian et al. (2021) [2] due to the eight tentacles, blind longitudinal branched rims, and a small white apical process. Pandea conica (Quoy, 1893), which belongs to the same family as this species, also has a small white apical process and it has been suggested that the white apical process is more prominent in the younger stage [14]. Eutiara decorata also has an apical process in the younger stage and no apical process in the fully-
grown adult stage. The small white apical process is a morphological characteristic unique to juvenile and young individuals in this species. In Tahiti, where this species was originally described, the water temperature ranges from 26 °C to 29 °C [2]. The specimens collected in Kumejima Island were also collected at a similar water temperature of 29 °C, suggesting this species is a warm water species and inhabits tropical to temperate regions.

_Eutiara decorata_ was first described from Tahiti Island in the southern hemisphere. This report is the first scientific record of this species from the North Pacific using voucher specimens and the second occurrence record since the original description. One of the authors (R. M.) observed _Eutiara decorata_ in the Philippines [9] and Palau [8] in 2019. Another SCUBA diver also observed _E. decorata_ at Kumejima Island in 2019 [7]. These three locations were located along the course of the Kuroshio Current and North Equatorial Current, which are important for transporting planktonic animals. Larvae of the Japanese eel, _Anguilla japonica_, were transported to East Asia from the West Mariana Ridge in the North Equatorial Current and the Kuroshio Current [15]. _Eutiara decorata_ is also possibly transported by the Kuroshio Current and the North Equatorial Current and distributed Kuroshio area in the northern hemisphere. Cubomedusa _Alatina alata_ also has a pan-tropical distribution [16]. _Alatina moseri_, which is considered a junior synonym of _A. alata_ [16], was found in Sagami Bay, Japan [17]. _Alatina moseri_ was most likely transported from the Okinawa area to Sagami Bay by the Kuroshio Current [17]. Hyperiid amphipod, _Brachyscelus crusculum_, was attached to the specimen P06. _Brachyscelus crusculum_ is a warm water species distributed in the Pacific, Atlantic and Indian Oceans, and found at depths of 0–400 m in the Kuroshio Current area around Japan [11,12]. The presence of symbionts also suggests that _E. decorata_ was in the Kuroshio Current water.

_Eutiara decorata_ was found by SCUBA divers, but not studied until 2021 [2]. This species has beautiful colors, morphology, and is large enough to be photographed. Therefore, when the public find beautiful or mysterious jellyfish, they typically document it. Many photographs and video footage of jellyfishes were uploaded on weblogs, SNS, YouTube, and citizen science platforms, such as iNaturalist and jellywatch. Documented species must be rare, undescribed, non-indigenous, or invading species in the online platforms. Recently, new species descriptions of jellyfish, reports of non-indigenous species, and biogeography and ecology of jellyfish using citizen science have been increasing [18–24]. This study also began by providing photos of pandeid species from a professional underwater photographer. Research with citizen science is extremely useful for taxonomy and biogeography. _Eutiara decorata_ has recently been described in 2021. To understand the widespread distribution of this species, it is necessary to clarify its life cycle. Furthermore, genetic information is not yet available. The type locality of this species is approximately 10,000 km away from Kumejima Island across the Equatorial Currents and Equatorial Counter Currents. In addition, an undescribed species that may be closely related to this species has been identified by SCUBA divers. Therefore, comparing the target species morphologically with this species and analyzing its genetic information is important. In the future, it is necessary to develop a protocol to obtain a set of specimens (for morphological observation, genetic analysis, and life cycle study), as well as images and videos (for behavioral analysis).

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