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The Hydroid Stage of the Medusa *Koellikerina bouilloni* (Cnidaria, Hydrozoa)

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Abstract The polyps of *Koellikerina bouilloni* Kawamura and Kubota, 2005 were discovered growing on the shell of the gastropod *Nassarius festivus* (Powys, 1835) collected from Isozaki, Hitachinaka, Ibaraki, Japan. This hydrozoan species was so far known only from the medusae collected in Tanabe Bay, Wakayama, Japan (type locality) and Papua New Guinea. The discovery of the polyp and the rearing of the medusae permitted us to complement the description of this species.
Key words: *Koellikerina bouilloni*, polyp, hydroid colony, nematocyst, host gastropod, *Nassarius festivus*.

Introduction

The author (HN) had the opportunity to survey the marine Hydrozoa of Ibaraki Prefecture, Japan as part of the monitoring program "Comprehensive surveys of Plants, Animals, and Geology in Ibaraki Prefecture by the Ibaraki Nature Museum—3rd period—." In this faunal survey of 2018, some bushy colonies of anthoathecate hydroid with medusa buds were found on the shells of living *Nassarius festivus* (Powys, 1835), a gastropod collected from seagrass bed in Isozaki, Hitachinaka, Ibaraki, Japan. These hydroids could subsequently be identified as *Koellikerina bouilloni* Kawamura and Kubota, 2005 based on the morphology of the mature medusae obtained by rearing the animals in the laboratory. *Koellikerina bouilloni* has been, however, only described based on the mature medusa morphology in the original description (Kawamura and Kubota, 2005). Therefore, the species description is here augmented and supplemented by the information of the polyp stage and its cnidome.

Materials and Methods

Eight hydroid colonies on the shells of living *Nassarius festivus* (3 specimens collected on 1st July 2018 and 5 specimens on 11 August 2018) were used for the taxonomic study. The host gastropods were gathered by baited traps from the seagrass bed in Isozaki, Hitachinaka, Ibaraki Prefecture, Honshu, Japan. All hydroid colonies growing on the gastropods were taken alive to the Department of Zoology, National Museum of Nature and Science, Tsukuba, and maintained in the laboratory in culture containers (6 cm in diameter, 3 cm in height) filled with artificial seawater (Marine Art SF-1: Osakayakken. Co. Ltd, Osaka) at 23–24°C in order to obtain the mature medusae, because knowledge of the medusa morphology is required the species within this family.

The polyps on the gastropod shells were fed once per week with nauplii of *Artemia* sp. and their host gastropods with flakes used to feed ornamental fish. The seawater in the culture containers was renewed almost daily. The released medusae were cultured until maturity under the same conditions as the polyps. Living polyp and

medusa morphologies were observed under a binocular stereo-microscope. Sizes of each nematocyst type observed in one mature medusa and some polyps were measured with a compound microscope.

After observation, the specimens were fixed with 37% formaldehyde solution diluted 1 : 10 with sea water and then deposited as voucher specimens of the above-mentioned survey program in the Ibaraki Nature Museum with the accession numbers INM-1-96232–96239 (the polyps on the host gastropods) and 96240–96243 (the subadult medusae).

Description

Family Bougainvilliidae Lütken, 1850
Genus *Koellikerina* Kramp, 1939
Koellikerina bouilloni Kawamura & Kubota, 2005

(Figs. 1–2)

Polyps

Hydroid colonial (Fig. 1A), only found on the old, eroded shells of living gastropods identified as *Nassarius festivus* (Powys, 1835). They were not found on fresh shells with well defined grooves and sculptures, and other substrata such as rocks, seagrass, and the other collected gastropod species. All colonies were covered with detritus and algal overgrowth. Stolons grow randomly on the eroded surfaces of the shell. Hydranths on unbranched hydrocauli (height up to 6 mm), the latter arising randomly distributed on the hydrorhiza. Hydranth body fusiform, with up to 13 filiform tentacles in a single whorl below a conical hypostome. Hydrorhiza and hydrocauli covered with thin periderm, continued onto hydranth body as filmy pseudohydrotheca but not enveloping tentacle bases. Medusa buds develop on the lower part of the cauli (Fig. 1A–B), ellipsoid shape, length about 0.4 mm, stalks shorter than bud. Nematocysts: desmonemes and microbasic euryteles (Table 2).

Medusae

Medusae (Fig. 2) were only obtained from the reared hydroid colonies in the laboratory, but were not found in the plankton. The meristic values of the newly liberated (within 24 hours after liberation from the hydroids), 2 weeks old, and 1

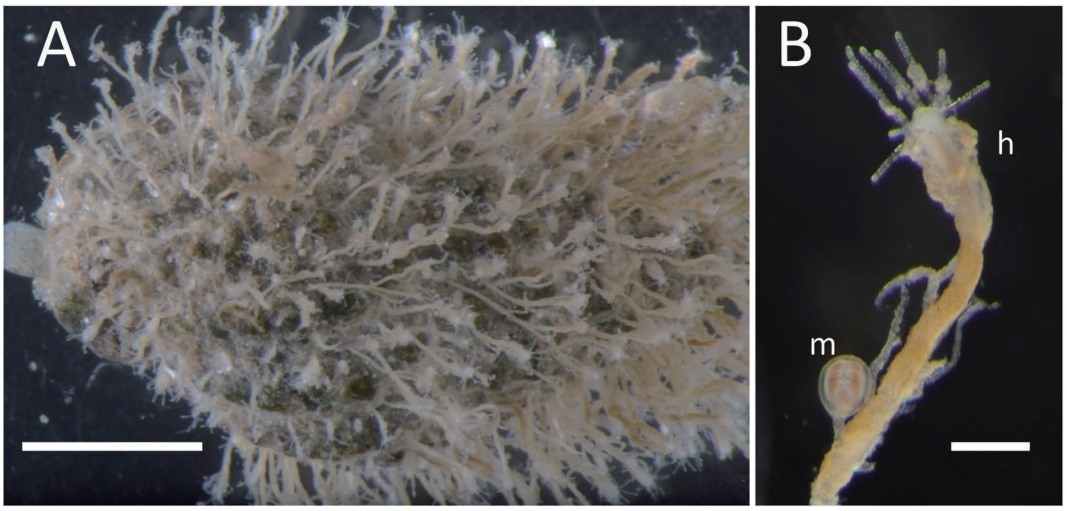

Fig. 1. The polyps of *Koellikerina bouilloni* Kawamura and Kubota, 2005 collected from Isozaki, Hitachinaka, Ibaraki, Japan. A. hydroid colony growing on the shell of *Nassarius festivus*. This photo was taken after the colony was cleared from detritus and algal overgrowth, B. a polyp with a medusa bud (m) and a hydranth (h). Scales = 5 mm (A), 0.5 mm (B).

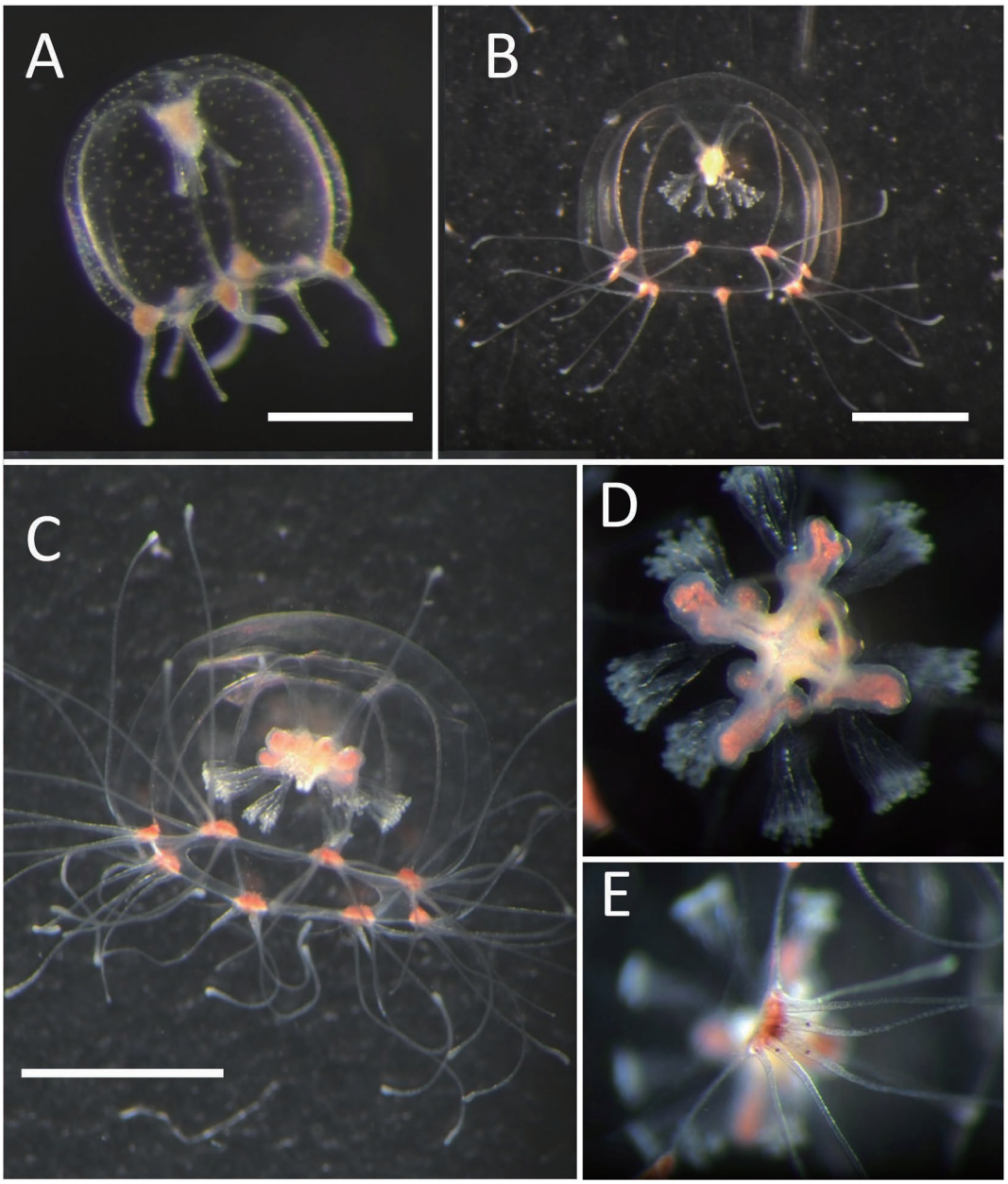

Fig. 2. The Medusae of *Koellikerina bouilloni* Kawamura and Kubota, 2005 released form the rearing polyps in the laboratory. A. a newly released medusa; B. a 2-weeks old medusa; C. a 2-months old male medusa with well visible gonads; D. gonads of C; E. a batch of marginal tentacles of C. Scales = 0.5 mm (A), 1 mm (B), 2 mm (C).

month old medusae with gonads are given in Table 1. The measured characters of Table 1 correspond to the ones of table 1 in Kawamura and Kubota (2005). The medusae had a spherical or barrel-shaped umbrella with four radial canals and a ring canal. The radial canals end in tentacle bulbs. Manubrium initially cylindrical with a simple mouth at its tip dangling from apex of sub-umbrella, mature with pronounced cruciform base (Fig. 2A, D). Number of marginal tentacles

Table 1. Morphology of medusae of *K. bouilloni* obtained in the laboratory.*[1]

Stage of medusae	No. of examined	Size of umbrella (mm)		No. of tentacles/ marginal bulb		No. of branching of oral tentacles	Projection or constriction of umbrella apex	Peduncle	Ocelli and its position	Position of gonad	No. of lateral folds of gonad (pairs)	Color except for ocelli
		height	width	perradial	interradial							
Newly liberated*[2]	20	0.8–1.0	0.8–1.0	1	1	0	—	—	—	—	—	marginal bulb orange
2-weeks old	9	1.3–2.0	1.3–2.0	3	1	2–3	—	+	—	—	—	marginal bulb orange
1-months old	5	4.0–4.3	4.0–4.3	4–7	4–7	5–6	—	+	+, adaxial	perradial	2–3	marginal bulb orange

*1: Items of this table followed those of table 1 in Kawamura and Kubota (2005).
*2: "Newly liberated" means the medusae within 24 hrs. after liberation from hydroid colonies.

per bulb increasing during development from one to up to seven. One ocellus on the basal part of each marginal tentacle in medusae having gonads (Fig. 2E). In most advanced stages observed four gonad groups at base of manubrium, developing close to perradial and adradial positions (Fig. 2D), resembling irregular groups of bulbous outgrowths or lappets. Examined animals were presumably all males. Three types of nematocysts: desmonemes, microbasic euryteles and basitrichous isorhizas (Table 2).

Discussion

The hydroids examined in this study could be identified as *Koellikerina bouilloni* because the subadult medusae obtained from the hydroid colonies agree well with the original description given by Kawamura and Kubota (2005), notably the size of umbrella, the arrangement of gonads, and number of tentacles per marginal bulb. This hydroid shows a strong substrate preference, being found exclusively on old, eroded shells of living *Nassarius festivus*.

Kawamura and Kubota (2005) stated that this species occurs mainly in tropical waters. The Ibaraki Prefecture (the new locality of our specimens in the present study) is, however, north of the localities given in the original description of this species and influenced by a cold current (Oyashio current). This finding suggests that *K. bouilloni* may be more widespread across the tropical to temperate zones of the western Pacific Ocean. This is also compatible with the wide distribution of *Nassarius festivus*, the specific host gastropod of this hydroid, from the Philippines to southern Hokkaido, Japan (see Tsuchiya, 2017). Therefore, in the future, the hydrozoan species growing on the shells of *N. festivus* must be verified in the various localities to confirm the true distribution area of *K. bouilloni*, because the real distribution of a hydrozoan species should be restricted to the sedentary polyps, but not in the medusae which may be spread by currents to a much wider area.

The hydroid of *K. bouilloni* is relatively simple and corresponds to hydroids found in several other

Table 2. Dimensions (mean ± S.D., range) of each type of nematocysts of *Koellikerina bouilloni*.

	n	Length	Width
Polyps			
Desmonemes	30	5.7 ± 0.2 (5.4–5.8)	3.5 ± 0.3 (3.2–4.2)
Microbasic euryteles	30	9.2 ± 0.3 (8.3–9.7)	4.3 ± 0.2 (3.7–4.6)
Medusae			
Oral tentacles			
Desmonemes	30	5.6 ± 0.3 (5.0–5.8)	3.1 ± 0.2 (2.9–3.7)
Microbasic euryteles	30	11.5 ± 0.3 (10.8–11.6)	4.3 ± 0.2 (4.2–4.6)
Marginal tentacles			
Desmonemes	30	7.3 ± 0.3 (6.6–7.5)	4.5 ± 0.2 (4.2–5.0)
Microbasic euryteles	30	7.5 ± 0.4 (6.6–8.3)	3.4 ± 0.3 (3.3–4.2)
Umbrella			
Basitrichous isorhizas	30	11.7 ± 0.3 (11.6–12.5)	9.2 ± 0.7 (8.3–10.0)

species of the Bougainvilliidae and Pandeidae (comp. Schuchert, 2007). Like many hydroid stages in these two families, it cannot be identified to species level without knowledge of the adult medusa. In the genus *Koellikerina*, the polyps were so far only known for *K. fasciculata* (Péron and Lesueur, 1810) (Bouillon *et al.*, 2006; Schuchert, 2007). The hydroid colonies of *Koellikerina* species appear to be regularly covered by detritus judging from the conditions of colonies observed in *K. fasciculata* (in Schuchert, 2007) and *K. bouilloni* (in this study). The polyps of *K. bouilloni* can be distinguished from those of *K. fasciculata* by the host animals (specific gastropod species versus polychaetes and spines of cidaroid sea urchins), and the position of medusa buds (on basal part of hydrocaulus versus upper part).

The cnidome of the *K. fasciculata* medusa comprises according to Schuchert (2007) desmonemes and microbasic euryteles. In *K. bouilloni* medusae we found additionally basitrichous isorhizas.

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