**Ikedosoma** (Annelida: Echiura: Thalassematidae) from the Tropical Pacific, with Description of a New Species

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A new species of the thalassematid echiuran *Ikedosoma abemama* sp. nov. is described based on a single specimen collected from Abemama Atoll, the Gilbert Islands, Kiribati. The species is particularly distinguishable from all congeners by the absence of the proboscis lower lip. A single specimen of *Ikedosoma* collected from Dam Bay, Nha Trang, Vietnam is also described, being similar to the new species, although its poor condition prevented a positive identification. The first confirmed records of *Ikedosoma* from the tropical Pacific Ocean are included (hitherto known only from temperate waters of Japan), in addition to a summary table of diagnostic characteristics and a dichotomous key to the species of *Ikedosoma*.

**Key Words:** Spoon worm, singleton, Abemama Atoll, the Gilbert Islands, Kiribati, Nha Trang, Vietnam, *Alpheus echiru-philus*, *Eupontonia nudirostris*.

**Introduction**

After long-standing taxonomic confusion, the thalassematid genus *Ikedosoma* Bock, 1942 was recently redefined and its valid status confirmed. Three nominal species [*I. elegans* (Ikeda, 1904), *I. gogoshimense* (Ikeda, 1904), and *I. qingdaoense* Li, Wang, and Zhou, 1994] have been proposed, although the third is now regarded as incertae sedis (Tanaka et al. 2014). *Ikedosoma* is most closely related to the genus *Listriolobus* Spengel, 1912, but can be distinguished from the latter by the absence of a rectal caecum (Tanaka et al. 2014).

Previous records of the species of *Ikedosoma* have been essentially limited to temperate Japanese waters (Tanaka et al. 2014). However, Dawydoff (1952) reported a species close to *I. gogoshimense* [as *Thalassema gogoschimense* (sic)] collected from coastal waters off French Indochina (= Vietnam). Later, Dawydoff (1959) briefly noted the presence of *I. elegans* (as *T. elegans*) in Indochina and Japan, possibly a reconsideration of his 1952 record. Furthermore, Tseng and Chen (1992) reported an unidentified species of *Ikedosoma*, being the host of a snapping shrimp, *Alpheus barbatus* Coutière, 1897 (Anker and Dworschak 2004; Anker et al. 2005), from Taiwan. Since these reports included few morphological details of the specimens, the identifications remain uncertain and should be considered as doubtful.

Recently, the author had the opportunity to examine a single specimen of *Ikedosoma*, collected from the Gilbert Islands, Kiribati during "the Expedition to the North Equatorial Current Areas" in 1984 (see Imajima 1986). The specimen is described herein as a new species, and together with a Vietnamese specimen of *Ikedosoma* [reported as *Listriolobus* sp. by Marin (2014); and Anker et al. (2015)] of uncertain specific identity (also described herein), constitute the first confirmed records of *Ikedosoma* from the tropical Pacific Ocean.

**Materials and Methods**

The holotype of the new species was fixed with Bouin’s fluid and subsequently transferred to 70% ethanol; the specimen of *Ikedosoma* sp. had been fixed and preserved in 70% ethanol (Ivan Marin, personal communication). Observations, dissections, and drawings were made using a stereoscopic microscope, and trunk musculature examined with the aid of a light box. General terminology follows Stephen and Edmonds (1972) and Tanaka et al. (2014). The holotype has been deposited in the National Museum of Nature and Science, Tsukuba (NSMT), and the specimen of *Ikedosoma* sp. in the Natural History Museum and Institute, Chiba (CBM), Japan. For comparison, photographs of the live specimen of *I. elegans* (NSMT-Ec 113) and that of *I. gogoshimense* (NSMT-Ec 116), both examined in Tanaka et al. (2014), were utilized. Abbreviations: trunk length, TL; proboscis length, PL; longitudinal muscle band, LMB.

**Systematics**

Family *Thalassematidae* Forbes and Goodsir, 1841
Genus *Ikedosoma* Bock, 1942
*Ikedosoma abemama* sp. nov. 
(Figs 1, 2A, B, 3)

**Material examined.** Holotype: NSMT-Ec 187, male, intertidal sandy bottom, lagoon side of Abatiku, Abemama
Atoll, the Gilbert Islands, Kiribati (approximate geolocation: 0°23'12.1"N, 173°47'15.4"E), collected by Teruaki Nishikawa, 26 July 1984.

**Diagnosis.** A species of *Ikedosoma* without proboscis lower lip; more than two pairs of gonoducts present anterior to the ventral setae.

**Description.** Coloration in life unknown. Trunk and proboscis pale yellow in preservative, probably due to discoloration by Bouin's fluid (Fig. 1A). TL ca. 140 mm; PL ca. 70 mm. Proboscis elongate, laterally curled inward, truncated at anterior extremity; dorsal surface covered with minute papillae; lower lip absent, lateral margins not united at base; margin of mouth opening weakly undulated due to shrinkage (Figs 1A, 2A, B). Trunk wall thin, uniformly cov-
Ikedosoma from the tropical Pacific

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Vascular system consisting of dorsal, neurointestinal, ventral, and ring vessels (Fig. 3). Dorsal vessel branched, one branch attached to posterior end of gizzard, the other connected to ring vessel; branches connected by additional narrow vessel between distal end of former and middle part of latter, forming a loop (Fig. 3A). Ring vessel incompletely encircling posterior end of crop (Fig. 3A). Ventral vessel running along almost entire length of ventral nerve cord, terminating at posterior end of postsiphonal intestine with mesenteries (Fig. 3). Neurointestinal vessel linked to ventral vessel at level of first pair of gonoducts, immediately bifurcating into a large loop, and terminating on each side of ring vessel (Fig. 3A).

Etymology. The specific name is after the type locality of the new species, Abemama Atoll, and is used as a noun in apposition.

Remarks. The new species has the following diagnostic characteristics of Ikedosoma, as redefined by Tanaka et al. (2014): (1) regularly thickened longitudinal muscle and continuous oblique muscle layer in the trunk, (2) elongated, spirally coiled gonostomal lips, and (3) absence of a rectal caecum.

The diagnostic characteristics of the species of Ikedosoma are summarized in Table 1. Ikedosoma abemama sp. nov. differs from I. elegans (Fig. 2C) and I. gogoshimense (Fig. 2D) in the absence of a proboscis lower lip, in contrast to the presence of such in the latter two species [see also Ikeda (1904: fig. 19) for I. gogoshimense, and Ikeda (1907: fig. 4) for I. elegans]. In addition, the former is unique in the genus in having at least two pairs of gonoducts in front of the ven-

Fig. 2. Comparison of morphology around the basal proboscis among three species of Ikedosoma (ventral view). Arrowheads indicate mouth position to show lower lip absence (B) or presence (C, D). A, B, Ikedosoma abemama sp. nov., preserved specimen (holotype, NSMT-Ec 187); C, I. elegans, live specimen (non-type, NSMT-Ec 113); D, I. gogoshimense, live specimen (non-type, NSMT-Ec 116). Scales: A, C, D, 1 cm; B, 2 mm.

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tral setae, although the precise number of anterior pairs (two or three) could not be determined because it was unclear whether or not the proximate second and third gonoducts on the right side represented a single cluster corresponding to the second gonoduct on the left side.

The vascular system of *I. abemama* sp. nov. is unique among Thalassematidae in having a branched dorsal vessel [usually simple in other members of the family (Stephen and Edmonds 1972; Amor 1973)]. Because some intraspecific variations in blood vessel architecture have been reported (e.g., Jameson 1899; Tanaka and Nishikawa 2013; Tanaka et al. 2014), more material is needed to determine whether or not the branched dorsal vessel is typical in *I. abemama* sp. nov.

![Internal morphology of *Ikadosoma abemama* sp. nov.](image)

**Fig. 3.** Internal morphology of *Ikadosoma abemama* sp. nov. (holotype, NSMT-Ec 187), dorsal view. Most mesenteries and gonostomal lips, and appearance of trunk musculature omitted for clarity. A, anterior end of trunk; B, posterior end of trunk. Abbreviations: an, anus; av, anal vesicle; cg, ciliated groove; cr, crop; dv, dorsal vessel; e, esophagus; gd, gonoduct; gl, gonostomal lip; gz, gizzard; i, intestine; m, mesentery; nv, neurointestinal vessel; ph, pharynx; pp, papilla; r, rectum; rv, ring vessel; vnc, ventral nerve cord; vss, ventral setal sac; vv, ventral vessel. Scales: 1 cm.

**Table 1.** Summary of diagnostic characteristics of the species of *Ikadosoma*.

| Species                        | Proboscis lower lip | Coloration in life | Number of pairs anterior to ventral setae | Longitudinal separation between adjacent pairs | Region occupied      | Sources                                      |
|-------------------------------|---------------------|--------------------|------------------------------------------|-----------------------------------------------|----------------------|---------------------------------------------|
| *Ikadosoma abemama* sp. nov.  | absent              | n/a                | 2 or 3 (see text)                        | Almost consistent                             | Anterior one-third of trunk | Present study                               |
| *Ikadosoma* sp. (from Vietnam)| absent              | Pale pink with dark green spots | 3                                        | Almost consistent                             | Anterior one-third of trunk | Marin (2014); Anker et al. (2015); Present study |
| *Ikadosoma elegans*           | present             | Deep wine red      | 0–1                                      | Increasing posteriorly                        | Anterior half of trunk | Ikeda (1907); Ikeda et al. (2014); Present study |
| *Ikadosoma gogoshimense*      | present             | Pale reddish-green with dark green spots | 0–1                                      | Almost consistent                             | Anterior one-third of trunk | Ikeda (1904); Ikeda et al. (2014); Present study |
|                               |                     | Yellow to orange, green pigment on distal part of gutter |                           |                                               |                      |                                             |
|                               |                     | Yellow to orange, green spots |                           |                                               |                      |                                             |
Previously only two species of Echiura have been recorded from the Gilbert Islands: *Achaetobonellia maculata* Fisher, 1953 (Bonelliidae) from Onotoa Atoll and *Ochetosoma* sp. (Thalassematidae) from Aranuka Atoll (Bock 1942; Fisher 1953). Thus, *Ikedosoma abemama* sp. nov. represents the third echiuran species known from that region.

**Distribution.** Known only from Abemama Atoll, the Gilbert Islands, Kiribati.

*Ikedosoma abemama* sp. nov.

(Fig. 4)

Listriolobus sp.: Marin 2014: 564, fig. 5c.

Ikedosoma sp.: Anker et al. 2015: 447, fig. 8c.

**Material examined.** CBM-ZW 1100, one specimen, sex unknown, mud-sand flat below mangroves, southeast of Tre Island, Dam Bay, Nha Trang, Vietnam [original geolocation: 12°12′19.53″N, 109°18′11.12″E (sic)], collected by yabby suction pump, I. Marin and S. Sinelnikov, 06 April 2014.

**Description.** Trunk pale pink, proboscis pale yellow base color in life, covered with dark green spots; LMB indiscernible externally due to shrinkage (Marin 2014: fig. 5c; Anker et al. 2015: fig. 8c). Coloration faded to cream in preservative (Fig. 4). TL 53 mm; PL 22 mm. Proboscis elongate, laterally carved inwards, anterior extremity truncated; dorsal surface covered with minute papillae; lower lip absent, lateral margins not united at base (Marin 2014: fig. 5c; Anker et al. 2015: fig. 8c). Trunk wall thin, uniformly covered with numerous papillae, particularly prominent (up to ca. 600 µm in height) posteriorly. Trunk musculature comprising outermost circular, middle longitudinal, and innermost continuous oblique muscle layers (Fig. 4). Due to poor fixation, circular layer wrinkled ventrally; although precise number of LMB unclear, at least eight present, somewhat inconspicuous dorsally (Fig. 4). Paired ventral setae hook-shaped; internally no interbasal muscle between setal sacs. All gonoducts damaged, proximal parts only remaining; 12 in total, comprising six pairs along ventral nerve cord, three pairs anterior to and remainder posterior to ventral setae. All pairs of gonoducts occupying ca. one-fifth of trunk, with consistent longitudinal separation between adjacent pairs (Fig. 4A). Gonostome proximal, lips elongated and spirally coiled.

Most of alimentary canal fragmented; examination restricted to foregut remnant, posterior part of postsiphonal intestine, and rectum; contents included a few pebbles but no fecal pellets (Fig. 4A). Remnant of foregut fastened to ventral trunk wall by sheet-like mesentery, almost straight along ventral nerve cord. Ciliated groove present in remaining postsiphonal intestine. Rectum fastened to trunk wall by several strong mesenteries; rectal caecum absent. Fragments of paired simple anal vesicles remaining.

Most of vascular system missing, although ventral blood vessels apparent along ventral nerve cord.

**Biological notes.** The burrows of *Ikedosoma* sp. typical-
ly accommodate two commensal shrimps, Eupontonia nudirostris Marin, 2014 (Palaemonidae) and Alpheus echiurophilus Anker, Komai, and Marin, 2015 (Alpheidae), although the burrow shape is unknown (Marin 2014; Anker et al. 2015). According to the specimen label, the species inhabits bottom muddy sand sediments at a depth of ca. 50 cm.

Remarks. Although the internal anatomy was in poor condition, the generic identification of this specimen by Anker et al. (2015) was confirmed by the presence of the diagnostic characteristics of Ikedosoma, as mentioned above. Furthermore, the specimen was similar to I. abemama sp. nov., rather than I. elegans, previously recorded from Vietnam by Dawydoff (1959) (see above), in the following characteristics: (1) absence of the proboscis lower lip, and (2) presence of three pairs of gonoducts in front of the ventral setae. However, whether the specimen belonged to I. abemama sp. nov. or not was debatable, because (1) only a single poor condition specimen was available, and (2) the habit of the specimen was a muddy sand flat in an inner bay associated with mangroves, whereas that of the holotype of I. abemama sp. nov. was a fine sandy lagoon bottom in an atoll. Additional specimens from the same or adjacent localities should clarify the specific identity of this specimen.

Discussion

Ikedosoma abemama sp. nov. is based only on a single specimen (“singleton” sensu Lim et al. 2012). Although establishing a new species on a singleton may be debatable, with some authors recommending the discontinuation of such a practice (e.g., Dayrat 2005), the latter practice may well result in a significant underestimation of species diversity, due to a significant portion of all species being rare (Lim et al. 2012). In particular, in the case of echiurans and marine benthic invertebrates generally, present understanding of the diversity of such organisms, burrowing deeply into sediment or living within cryptic habitats, remains far from complete (Snellgrove 1999). In recent years, many new “singleton” species of burrowing decapod crustaceans have been described (e.g., Anker 2014; Komai 2017; Anker and Lazarus 2017; Komai and Fujita 2019).

One of the primary reasons for discouraging the description of “singleton” species is the unknown extent of intra-specific variation (Dayrat 2005). This may also be true for echiuran taxonomy, because certain intraspecific variations in characters, such as number and disposition of gonoducts (e.g., Stewart 1900; Nishikawa 2004; Tanaka et al. 2014), number of LMB (e.g., Fischer 1926; Bisewski 1983; Tanaka et al. 2014), and blood vessel architecture (see above Remarks), have been demonstrated in some species. However, intraspecific variations in established Ikedosoma species have been determined from a number of specimens and can therefore be considered well delineated (Tanaka et al. 2014). Accordingly, the present proposal to establish a new species of Ikedosoma based on a single specimen can be justified. Unfortunately, the original fixative (Bouin’s fluid) used for the specimen limited certain information that might have been otherwise available, including genetic information and coloration; these will hopefully be available when additional fresh specimens are collected in the future.

In this study, the absence of the proboscis lower lip has been emphasized as the most distinctive characteristic of the present new species. Although basal proboscis morphology has at times not been regarded as an important diagnostic character (except in Bonelliidae) (Stephen and Edmonds 1972), some authors have adequately described and/or explicitly depicted such morphology for certain species of Echiuridae and Thalassematidae (e.g., Greeff 1879; Ikeda 1904, 1907; Spengel 1912). Regarding presence or absence of the proboscis lower lip within a genus, for example, both conditions are known within Listriolobus, viz., lower lip present in L. pelodes Fisher, 1946 and L. sorbillans (Lampert, 1883), absent in L. brevirostris Chen and Yeh, 1958, and unknown status in L. bahamensis Fischer, 1926, L. capensis (Jones and Stephen, 1954), and L. hexamyotus Fisher, 1949. Although the overall intraspecific variability of basal proboscis morphology within a species is not completely known, developmental studies of Echiuridae and Thalassematidae have shown the region including the lower lip to be homologous to the peristomium, its shape being already identical to that in adult worms on the completion of metamorphosis (Conn 1886; Baltzer 1917). Accordingly, the presence/absence of the proboscis lower lip does not change with growth of a settled individual. Clearly, more attention should be paid to basal proboscis morphology as a potential diagnostic character for species of Echiuridae and Thalassematidae, as in Bonelliidae.

Key to Valid Species of Ikedosoma

1. Lower lip of proboscis absent; more than two pairs of gonoducts present in front of ventral setae ................................................................. I. abemama sp. nov.
   – Lower lip of proboscis present; at most a single pair of gonoducts present in front of ventral setae .................................................. 2
2. Longitudinal separation between adjacent pairs of gonoducts increasing toward posterior section ...................... I. elegans
   – Longitudinal separation between adjacent pairs of gonoducts almost constant .................................................................I. gogoshimense

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