Two new species of the stenopodidean shrimp genus *Odontozona* Holthuis, 1946 (Decapoda: Stenopodidae) from the Indo-West Pacific

Tomomi Saito, Junji Okuno, Arthur Anker

**Abstract.**— Two new species of the stenopodid shrimp genus *Odontozona* Holthuis, 1946 are described and illustrated based on material from several Indo-West Pacific localities, including Japan, Indonesia, Australia and Madagascar. *Odontozona arbur* sp. nov. is described on the basis of numerous specimens collected in Australia (Queensland, Western Australia), Indonesia, Japan and Madagascar. *Odontozona stigmatica* sp. nov. is described on the basis of a single specimen from Ishigaki Island, Ryukyu Archipelago, southern Japan. *Odontozona arbur* sp. nov. and *O. stigmatica* sp. nov. differ from all other species of the genus by a combination of morphological characters, mainly involving spination on the carapace and third pereopod, as well as sculpture of the pleon. This study increases the total number of species described in the genus *Odontozona* to 19, eight of them occurring in the Indo-West Pacific. An identification key to all species presently assigned to *Odontozona* is also presented.

urn:lsid:zoobank.org:pub:8CC14884-94C5-49CA-A129-73FB8E8E3828

**Key words:** Malacostraca, new species, Japan, Indonesia, Australia, Madagascar

■ Introduction

The stenopodid shrimp genus *Odontozona* Holthuis, 1946, contains 17 described species occurring in tropical, subtropical and warm-temperate parts of the world oceans (Table 1). Most species of this genus are small-sized shrimps, living cryptically on shallow coral and rocky reefs or, more rarely, in deep-water hard-bottom habitats, submarine caves, etc.; some species are known to be associated with other marine invertebrates, such as crinoids and sponges (Alcock and Anderson, 1899; Gore, 1981; Saito & Fujita, 2009; Anker & Tavares, 2013). So far, only six species of *Odontozona* have been reported from the vast Indo-West Pacific region, viz. *O. crinoidicola* Saito & Fujita, 2009; *O. ensifera* (Dana, 1852); *O. fasciata* Okuno, 2003; *O. sculpticaudata* Holthuis, 1946; *O. spinosissima* Kensley, 1981 and *O. spongicola* (Alcock and Anderson, 1899). In addition, some unidentified species have been reported as *Odontozona* sp. in underwater field guides (e.g. Minemizu, 2000; Kawamoto & Okuno, 2003; Kuiter & Debelius, 2009; Minemizu, 2013). In the present study, two additional Indo-West Pacific species are described and illustrated as new, based on material recently collected in Japan, Indonesia, Australia and Madagascar.

■ Material and Methods

The material examined in this study is deposited in the following institutions: Coastal Branch of Natural History Museum and Institute, Chiba, Japan (CMNH); Florida Museum of Natural History, University of Florida, Gainesville, USA (FLMNH UF); Muséum National d’Histoire Naturelle, Paris, France.
Table 1. Geographical ranges and ecological data of the 19 presently known species of *Odontozona* Holthuis, 1946

<table>
<thead>
<tr>
<th>Species name</th>
<th>Currently known geographical range and ecological data</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Odontozona arbur</em> sp. nov.</td>
<td>Indo-West Pacific: Japan (Ryukyu Is.); Indonesia; New Caledonia; Vanuatu; French Polynesia; Australia; UAE; Madagascar</td>
<td>Okuno, 2007; Minemizu, 2013; Goy, 2015; present study</td>
</tr>
<tr>
<td><em>Odontozona crinoidicola</em> Saito &amp; Fujita, 2009</td>
<td>Indo-West Pacific: Japan (Ryukyu Is.); Philippines; Solomon Is. (associated with crinoids)</td>
<td>Saito &amp; Fujita, 2009; present study</td>
</tr>
<tr>
<td><em>Odontozona edwardsi</em> (Bouvier, 1908)</td>
<td>East Atlantic: off W Europe and NW Africa (deep-water, 511–2070 m)</td>
<td>Bouvier, 1908; García Raso, 1996; Goy &amp; Cardoso, 2014</td>
</tr>
<tr>
<td><em>Odontozona ensisfera</em> (Dana, 1852)</td>
<td>Indo-West Pacific: Japan; Indonesia; Fiji; New Caledonia; Madagascar</td>
<td>Dana, 1852; Holthuis, 1946; Goy, 1981; Kawamoto &amp; Okuno, 2003; Goy, 2015; present study</td>
</tr>
<tr>
<td><em>Odontozona foresti</em> Hendrickx, 2002</td>
<td>East Pacific: Mexico (Gulf of California) (deep-water, 1035–1270 m)</td>
<td>Hendrickx, 2002</td>
</tr>
<tr>
<td><em>Odontozona joegoyi</em> Hendrickx &amp; Ayón-Parente, 2014</td>
<td>East Pacific: Mexico (Baja California) (deep-water, 650–850 m)</td>
<td>Hendrickx &amp; Ayón-Parente, 2014</td>
</tr>
<tr>
<td><em>Odontozona libertae</em> Gore, 1981</td>
<td>West Atlantic: SE USA (Florida); Colombia (Caribbean side)</td>
<td>Gore, 1981; Criales, 1997</td>
</tr>
<tr>
<td><em>Odontozona lopheliae</em> Goy &amp; Cardoso, 2014</td>
<td>West Atlantic: SE USA (Georgia); Gulf of Mexico; Brazil (deep-water, 459–665 m; associated with deep-water coral <em>Lophelia</em>)</td>
<td>Goy &amp; Cardoso, 2014</td>
</tr>
<tr>
<td><em>Odontozona meloi</em> Anker &amp; Tavares, 2013</td>
<td>West Atlantic: Brazil (moderately deep-water, 81 m)</td>
<td>Anker &amp; Tavares, 2013</td>
</tr>
<tr>
<td><em>Odontozona minoica</em> Dounas &amp; Koukouras, 1989</td>
<td>East Atlantic: Greece (deep-water, 330 m)</td>
<td>Dounas &amp; Koukouras, 1989</td>
</tr>
<tr>
<td><em>Odontozona rubra</em> Wicksten, 1982</td>
<td>East Pacific: Mexico (Gulf of California) (deep-water, 650–850 m)</td>
<td>Wicksten, 1982; present study</td>
</tr>
<tr>
<td><em>Odontozona sculpticaudata</em> Holthuis, 1946</td>
<td>Indo-West Pacific: Indonesia; New Caledonia; NE Australia; Mariana Is. (Guam)</td>
<td>Holthuis, 1946; Goy, 1981; Goy, 2015; present study</td>
</tr>
<tr>
<td><em>Odontozona spongicola</em> (Alcock &amp; Anderson, 1899)</td>
<td>Indo-West Pacific: India; Andaman Sea; Philippines; Caribbean Sea? (deep-water, 496–900 m; associated with hexactinellid sponges)</td>
<td>Alcock &amp; Anderson, 1899; Alcock, 1901; Wicksten, 1982</td>
</tr>
<tr>
<td><em>Odontozona stigmatica</em> sp. nov.</td>
<td>Indo-West Pacific: Japan (Ryukyu Is.)</td>
<td>Minemizu, 2013; present study</td>
</tr>
<tr>
<td><em>Odontozona striata</em> Goy, 1981</td>
<td>West Atlantic: Cuba (deep-water, 238–730 m)</td>
<td>Goy, 1981</td>
</tr>
</tbody>
</table>
and so on, while the term ‘spine’ is used mainly for fixed, usually sharp projections arising from the surface of the carapace, pleon, third maxilliped, third pereopod, and so on. Counts of the teeth on the lateral margins of the antennal scale and uropods include the terminal tooth. Marginal teeth of the telson are counted as: (1) teeth on the lateral margin, excluding one tooth at the posterolateral angle, and (2) teeth on the posterior margin. Setae were omitted from most drawings for better clarity. Drawings were made with the aid of a drawing tube mounted on a LEICA MZ95 stereomicroscope. Comparative material examined in this study (with taxonomically most relevant collection data) is listed below:

**Odontozona anaphorae** Manning & Chace, 1990: holotype, female (cl 4.4 mm), USNM 221886, Ascension Island, off North Point.

**Odontozona crinoidicola** Saito & Fujita, 2009: holotype, female (cl 3.6 mm), NSMT-Cr 18133, Japan, Ryukyu Islands, Okinawa Island, Mizugama; paratype, male (cl 2.2 mm), NSMT-Cr 18134, same collection data.

**Odontozona edwardsi** (Bouvier, 1908): female (cl 5.3 mm), MNHN-Na 13311, Thalassa 1973–2453, stn 303, off western France, 48°34′32.9″N 10°45′0″W, depth 1975–2070 m.

**Odontozona ensifera** (Dana, 1852): 1 male (cl 2.1 mm), FLMNH UF Arthropoda 13917, Madagascar, Nosy-Bé, Nosy Iranja.

**Odontozona fasciata** Okuno, 2003: 1 male (cl 4.9 mm), FLMNH UF Arthropoda 6106, Northern Mariana Islands; 1 male (cl 7.8 mm), 1 female (cl 9.8 mm), NSMT Cr 22363–22365, Philippines, Mactan Island, Marigondon Cave.

**Odontozona libertae** Gore, 1981: holotype, male (cl 2.6 mm), USNM 181242, USA, Florida, Key Largo, Elbow Reef; allotype, female (cl 2.7 mm), USNM 181243, same collection data; paratype, male (cl 2.1 mm), USNM 181244, same collection data.

**Odontozona rubra** Wicksten, 1982: paratype, 1 ovig female (cl 5.2 mm), USNM 184957, Mexico, Baja California Sur, Cabo San Lucas.

**Odontozona sculpticaudata** Holthuis, 1946: 1 ovig female (cl 3.5 mm), FLMNH UF Arthropoda 28137, Mariana Islands, Guam, Apra Harbor.

**Odontozona spongicola** (Alcock & Anderson, 1899): 1 male (cl 3.5 mm), NSMT-Cr 24243, 1 male (cl 3.7 mm), 1 female (cl 5.3 mm), NSMT-Cr 24598), Philippines, Sulu Sea.

**Odontozona striata** Goy, 1981: holotype, ovig female (cl 6.1 mm), USNM 34924, Cuba, Gulf of Mexico side, west of San Antonio.

### Taxonomic Account

**Family Stenopodidae** Claus, 1872

**Genus Odontozona** Holthuis, 1946

**Odontozona arbur** sp. nov. (Figs. 1–8A–C, 13A–D) [Japanese name: Shinonome-subesube-otohime-ebi]

urn:lsid:zoobank.org:act:A4A5B46E-9296-41EA-ADC7-5736BE06EA70

**Odontozona sp. 2** – Okuno 2007: 58.

**Odontozona sp. 4** – Minemizu 2013: 21.

**Odontozona ensifera** – Minemizu 2013: 19. – Goy 2015: 320, figs. 15–17 [not *O. ensifera* (Dana, 1852)].

**Odontozona sculpticaudata** – Goy 2015: 329, fig. 22 (partim) [not *O. sculpticaudata* Holthuis, 1946].

**Material examined**

Type material. Holotype: male (cl 4.1 mm), QM W28334, Australia, Queensland, Lizard Island, Casuarina Beach, 14°40′42.1″S 145°26′43.7″E, sand flat with rocks, corals, rubble, under massive rocks, depth 1–2 m, leg. A. Anker, 23 Feb. 2009 [fcn AUST-1696]. Paratypes: 1 male (cl 3.1 mm), FLMNH UF Arthropoda 17453, same collection data as for holotype [fcn AUST-1713]; 1 male (cl 2.5 mm), FLMNH UF Arthropoda 17499, same collec-

Additional material examined: 1 male (cl 2.3 mm), FLMNH UF Arthropoda 14099, Madagascar, NW side of Nosy Komba, 13°26'46.3"S 48°19'53.8"E, lagoon, fringing reef slope and top, depth 1–12 m, leg. A. Anker, 26 May 2008 [fcn BMADA-0511]; 1 male (cl 2.1 mm), FLMNH UF Arthropoda 14081, Madagascar, off E-NE side of Nosy Vorona, 13°25'27.8"S 48°21'51.1"E, broken reef, rubble, sand, shallow slope, extracted from large, dead colony of Porites rus, depth 4 m, leg. A. Anker, 15 May 2008 [fcn NBE-0962]; 1 male (cl 3.7 mm), FLMNH UF Arthropoda 3428, New Caledonia, Nouméa, Baie de Citron, fringing reef, sand, depth 0.5–5 m, leg. G. Paulay, 1 Jan. 1999; 1 male (cl 3.0 mm), FLMNH UF Arthropoda 7495, Vanuatu, Sanma Province, Tutuba Island, S side at “crossroads” dive site, depth 3–9 m, leg. C. Meyer, 23 Jan. 2005; 1 female (cl 2.2 mm), FLMNH UF Arthropoda 5351, American Samoa, Tutuila Island, under rocks and crevices, depth 3–15 m, leg. V. Bonito, 30 Oct. 2002; 1 male (cl 2.1 mm), FLMNH UF Arthropoda 29009, French Polynesia, Society Islands, S side of Moorea, 17°36’11.2”S 149°50’20.0”W, reef flat, depth 15–20 m, leg. J. Moore, 18 Nov. 2010 [fcn BMOO-15147]; 1 ovig. female (cl 2.8 mm), FLMNH UF Arthropoda 33894, French Polynesia, Society Islands, Moorea, Baie de Cook, off Gump Station, fringing reef, depth 10–17 m, leg. F. Michonneau & G. Paulay, 3 Feb. 2012 [fcn BMOO-18171]; 1 ovig female (cl 3.0 mm), OUMNH.ZC. 2016.01.029, Indonesia, Sumba, Kallala, reef flat with abundance of rubble and algae (cold current), some living corals, under large pieces of coral rubble, depth 0.5–1 m, leg. A. Anker, 23 Sep. 2014; 1 ovig female (cl 2.7 mm), NSMT-Cr 24244, Japan, Ryukyu Islands, Yaeyama Islands, W coast of Ishigaki Island, Osaki, depth 5 m, leg. R. Minemizu, 2 Oct. 2011 [fcn MG1910]; 1 female (cl 2.3 mm), CMNH-ZC 02497, Japan, Ryukyu Islands, Yaeyama Islands, Iriomote Island, depth 18 m, leg. Y. Ikeda, 8 Jul. 2003.

**Diagnosis**

Small-sized stenopodid shrimp with subcylindrical body. Rostral dorsal margin with 5–9 teeth, ventral margin with 3–5 teeth; lateral margins each usually with 1 minute tooth. Carapace with cervical and postcervical grooves bearing cincture of several spines; posterior margin with shallow groove bearing row of numerous minute spines or with scattered minute spines; 1–4 additional grooves bearing rows of small spines present on lateral and posterodorsal portions of carapace. Pleonites evenly sculptured with transverse and longitudinal
grooves. First to third pleura with transverse carina. Sixth pleuron with lateral spines and transverse row of several small spines. Telson lance-shaped; dorsal surface with dorsolateral carinae each bearing 5–6 large spines; lateral margins each with 1 submarginal tooth near base and 1 strong tooth; posterior margin with 2 posterolateral teeth. Cornea darkly pigmented, shorter than eyestalk. Antennal scale bearing 7–10 lateral teeth. Chela of third pereopod subcylindrical, unarmed or with row of several spines on dorsal and ventral margins. Fourth and fifth pereopods with propodi subdivided into 4–6 joints; ventral margins armed with 11–13 movable spines; carpi subdivided into 7–8 joints. Uropodal exopod with lateral margin nearly straight, with row of 6–9 teeth, dorsal surface unarmed, with 2 smooth longitudinal carinae; endopod with lateral margin bearing 2–5 teeth, dorsal surface unarmed, with 2 smooth longitudinal carinae.

Description of holotype male

Rostrum (Figs. 1, 2A, B) moderately long and slender, directed straight-forward, overreaching mid-length of antennal scale, 0.76 of carapace length, narrowly triangular in dorsal view; dorsal margin armed with 9 strong, anteriorly directed teeth, posterior-most tooth situated posterior to orbital margin; ventral margin armed with 4 small, widely spaced teeth; lateral margins each with minute spine at about mid-length.

Carapace (Figs. 1, 2A, B) with postrostral median ridge extending to epigastric region; rostral base armed with 1 pair of minute spines; supraorbital region armed with 2 pairs of stout spines and several additional spines of various sizes; orbital margin concave, armed with large orbital spine; antennal lobe rounded, armed with large, acuminated, submarginal antennal spine; pterygostomial margin produced anteriorly, with large, acuminated, submarginal branchiostegal spine and several additional spines, sometimes extending to anteroventral margin of carapace, diminishing in size posteriorly; gastric region with 3 pairs of large, postrostral submedian spines; cervical groove distinct, posterior margin with cincture of large spines,
Fig. 2. *Odontozona arbur* sp. nov., holotype, male (cl 4.1 mm), QM W28334, from Lizard Island, Queensland, Australia. A, carapace and cephalic appendages, lateral view; B, same, dorsal view; C, sixth to eighth thoracic sternites, ventral view; D, telson and right uropod, dorsal view.
directed anteriorly, ending in 1 larger hepatic spine; postcervical groove indistinct dorsally, distinct laterally, posterior margin armed with numerous large slender spines; dorsal surface with row of spines; lateral surface between cervical and postcervical grooves with shorter groove bearing row of 4–5 spines; posterior margin with shallow groove and 1 row of numerous small slender spines, decreasing in size ventrally and dorsally; area posterior to hepatic spine with distinct lateral groove, latter armed with row of several spines, decreasing in size; area between postcervical and posterior marginal grooves with additional long shallow groove, latter armed with row of densely inserted, slender spines, ending in group of small, anteriorly directed spines on branchial region; anterolateral region with numerous scattered, anteriorly directed spines of different sizes.

Sixth thoracic sternite (Fig. 2C) with medially jointed pair of slender, contiguous lobes; each distolateral angle sharply produced; lateral and anteromesial margins armed with few small spines or blunt teeth; ventral surface concave, unarmed. Seventh thoracic sternite with pair of broad subrectangular plates; distolateral angle produced; lateral and anteromesial margins armed with several spines; ventral surface concave, unarmed. Eighth thoracic sternite with pair of smaller trapezoid plates; distolateral angle produced; lateral margin armed with several spines; anteromesial margin unarmed; ventral surface concave, unarmed.

Fig. 3. *Odontozona arbur* sp. nov., holotype, male (cl 4.1 mm), QM W28334, from Lizard Island, Queensland, Australia. A, pleon and tail fan, lateral view; B, first to third pleonites, dorsal view; C, fourth to sixth pleonites, dorsal view.
Pleonites (Figs. 1, 3) sculptured; second to fifth pleura with 1–2 short transverse depression(s) and rows of few small spines, ventral margins with teeth, fourth and fifth pleura strongly produced, each terminating in large tooth, in addition to some smaller anterior and posterior teeth. First pleonite short, divided into two sections by distinct transverse carina; anterior section with pleuron unarmed laterally, posteroventrally ending in short process; posterior section with pleuron unarmed laterally, with short groove posteroventrally, its posteroventral margin armed with several small teeth. Second pleonite rather long, divided into 2 sections by distinct transverse carina, extending intermittently to about 0.35 of pleuron height, forming transverse groove dorsolaterally and laterally; anterior section of tergum with 3 shallow transverse grooves; posterior section with long transverse groove extending to about mid-height of pleuron and short transverse groove on mid-lateral portion. Third pleonite longest; tergum bearing distinct transverse carina extending longitudinally to posterior margin and 2–3 marked longitudinal grooves dorsolaterally; anterior portion of pleuron with 1 additional transverse carina running down to about 1/3 of anterior pleuron height; posterior section with 2 additional longitudinal grooves, extending posterodorsally on mid-lateral portion. Fourth and fifth pleonites each with 1–2 transverse grooves. Sixth pleonite with short anterior and long central transverse grooves; posterolateral surface with transverse rows of 10 (left) or 9 (right) small spines; anterolateral region with some long, sharp, posteriorly directed spines.

Telson (Fig. 2D) elongate, lance-shaped, slightly constricted near base, gradually tapering distally, 2.4 times as long as maximum width; dorsal surface with shallow median groove flanked by dorsolateral carinae each bearing 5 strong, symmetrically located spines, and 1 pair of proximal and 2 pairs of submedian small spines; lateral margins each armed with 1 large submarginal tooth near base and 1 strong tooth posterior to mid-length; posterior margin generally convex, armed with 2 long submarginal posterolateral teeth.

Eyes (Fig. 4A) well developed; cornea narrower and shorter than peduncle, hemispherical, darkly pigmented; mesial and anterodorsal surfaces of eyestalk armed with several acute spines of various sizes.

Antennular peduncle (Fig. 4B, C) reaching mid-length of antennal scale. First article subequal to distal 2 articles combined, armed with 1 small proximal tooth on dorsal surface; stylocerite strongly curved inwards, distally acute. Second article armed with 2 strong dorsomesial, 1 dorsal and 1 distolateral spines; third article armed with 1 distolateral spine. Flagella slender, long, 4.4 times as long as carapace.

Antenna (Fig. 4D, E) with stout basicerite bearing 2 moderately large distolateral spines and some additional spines of various sizes on ventrolateral surface; mesial margin with laminate process. Antennal scale 3.5 times longer than broad, lateral margin slightly concave, armed with 9 (left) or 10 (right) teeth, proximal-most tooth smallest, blunt, situated near base; dorsal surface with 2 longitudinal carinae, otherwise unarmed. Carpocerite short, reaching level of third article of antennular peduncle, armed with few strong spines on mesial and lateral margins. Flagellum slender, long, 5.6 times as long as carapace.

Mandible (Fig. 4F, G) robust; palp composed of 3 articles, distal article oval, furnished with dense setae, intermediate article subequal to distal article in length, distally with tuft of setae; molar and incisor processes clearly separated.

Maxillule (Fig. 4H) with simple, slender, distally tapering endopod; coxal endite suboval, with submarginal row of stiff setae on lateral surface; basal endite moderately broad, truncate distally, with several slender spinules and some long spiniform setae.

Maxilla (Fig. 4I) with curved, slender endo-
Fig. 4. *Odontozona arbur* sp. nov., holotype, male (cl 4.1 mm), QM W28334, from Lizard Island, Queensland, Australia. A, right eye, dorsal view; B, right antennule, dorsal view; C, same, ventral view; D, right antenna, dorsal view; E, same, ventral view; F, right mandible, ventral view; G, same, dorsal view; H, right maxillule, ventral view; I, right maxilla, ventral view; J, right first maxilliped, ventral view; K, right second maxilliped, ventral view; L, right third maxilliped, ventral view. Setae omitted.
pod; coxal and basal endites bilobed; scaphognathite well developed, anterior lobe subquadrate distally, posterior lobe short, widening posteromesially.

First maxilliped (Fig. 4J) with endopod subdivided into 3 articles, tapering distally, distal article spiniform; basal endite large, subtriangular, with concave mesial margin; coxal endite short, unilobed; exopod with well-developed flagellum; epipod large, feebly bilobed.

Second maxilliped (Fig. 4K) with moderately broad endopod; dactylus tapering distally; propodus anteromesially truncate, 0.8 times as long as dactylus; carpus slightly elongate, cup-shaped; merus 2.4 times as long as carpus, oblong, mesial margin bearing row of stiff setae; ischium compressed laterally; epipod elongate, with well-developed podobranch; exopod with well-developed flagellum.

Third maxilliped (Fig. 4L) overreaching tip of antennal scale by length of dactylus. Dactylus tapering distally; lateral margin furnished with row of long setae extending to propodus, distomesial surface with shallow depression furnished with dense grooming setae. Carpus subequal to propodus in length, unarmed, distoventral margin slightly projecting. Merus armed with 5 strong spines on dorsolateral margin and with row of 9 moderately small spines on ventral margin. Ischium compressed laterally, armed with row of several equally spaced spines on ventromesial margin. Epipod elongate, rod-like. Exopod with well-developed flagellum.

First pereopod (Fig. 5A) slender, overreaching tip of antennal scale by length of chela, with well-developed carpo-propodal grooming apparatus; all articles unarmed; dactylus about half of chela length; palm subcylindrical; carpus 1.3 times as long as chela; merus 0.8 of carpal length; ischium 0.7 of meral length.

Third pereopod (Figs. 5C, 6A) longest and strongest, overreaching tip of antennal scale by lengths of chela and carpus. Chela about twice as long as carapace. Dactylus 0.4 of chela length, armed with 2 large acute spines on postero dorsal margin; slightly curved, cutting edge proximally with large triangular tooth, otherwise unarmed. Fixed finger slightly longer than dactylus, hooked distally, cutting edge proximally with large blunt tooth fitting into hiatus on opposed cutting edge of dactylus. Palm subcylindrical, about 3 times as long as wide; dorsal margin not carinate, with irregular longitudinal rows of numerous strong spines, decreasing in size posteriorly; ventral margin not carinate, with irregular longitudinal rows of minute spines, extending to proximal 0.35 length of fixed finger; lateral surface armed with longitudinal row of minute teeth or small tubercles; mesial surface unarmed. Carpus widening distally, 4.9 times as long as wide, 0.7 of chela length; dorsal margin armed with 2 rows of widely spaced, strong spines of various sizes, distal-most strongest; lateral and mesial surface unarmed; ventral margin armed with 2 strong spines. Merus 0.9 of carpal length; dorsal margin with irregular rows of well-spaced teeth; ventral margin with row of much stronger teeth, distal-most tooth strongest; mesial surface with rows of small spines proximally. Ischium about 0.6 of meral length; distodosal angle bluntly projecting and with 1 strong spine.

Fourth and fifth pereopods (Figs. 5D, E, 6B, C) similar in shape and length. Dactylus compressed laterally, 3.9 times as long as wide, biunguiculate. Propodus 3.5 times as long as dactylus, subdivided into 4 to 6 joints; ventral margin armed with 12–13 movable spines. Carpus 2.4 times as long as propodus, subdivided into 6 to 8 joints. Merus 0.8 of carpal length, not subdivided. Ischium about half-
Fig. 5. *Odontozona arbur* sp. nov., holotype, male (cl 4.1 mm), QM W28334, from Lizard Island, Queensland, Australia. A, right first pereopod, lateral view; B, right second pereopod, lateral view; C, right third pereopod, lateral view; D, right fourth pereopod, lateral view; E, same, dactylus.
length of merus.

First pleopod (Fig. 6D) uniramous, shorter than other pleopods. Second to fifth pleopods biramous. Second pleopod (Fig. 6E) with protopod shorter than both rami, armed with rows of small teeth or tubercles on mesial and lateral margins. Third to fifth pleopods generally similar, decreasing in size posteriorly.

Uropod (Fig. 2D) with stout protopod, its lateral margin terminating in blunt process, pos-
teroventral margin armed with several small teeth. Exopod relatively broad, slightly overreaching posterior margins of telson and endopod; lateral margin nearly straight, armed with row of 8 (left) or 7 (right) teeth; dorsal surface unarmed, with 2 smooth longitudinal carinae. Endopod tapering distally; lateral margin armed with 5 (left) or 4 (right) teeth, distal part unarmed; dorsal surface unarmed, with 2 longitudinal carinae.

Gill formula as shown in Table 2.

**Paratype males**

Rostrum 0.62–0.94 of carapace length; dorsal margin armed with 6–8 strong, anteriorly directed teeth, posterior-most tooth situated posterior to orbital margin; ventral margin armed with 2–5 small teeth; each lateral margin usually with 1 minute tooth at about mid-length.

Carapace with 1–2 pairs of minute spines at rostral base; gastric region with 2–3 pairs of postrostral submedian spines; row of several spines present on dorsal portion and 1–2 shorter groove(s) armed with rows of several small spines, on lateral part between cervical and postcervical grooves; posterior margin of carapace with shallow groove and row of numerous small spines, decreasing in size ventrally and dorsally.

First pleonite short, divided into 2 sections by distinct transverse carina; posterior section with pleuron unarmed laterally, without groove. Second pleonite rather long, divided into 2 sections by distinct transverse carina, extending to about mid-height of pleuron, forming transverse groove dorsolaterally and laterally; posterior section without groove or with 1 long transverse groove, extending to about mid-height of pleuron and 1 short transverse groove on mid-lateral portion. Third pleonite longest; tergum with distinct transverse carina, latter extending longitudinally to posterior margin, with 1–2 longitudinal groove(s) dorsolaterally, and 1 additional groove running ventrally to anterior part of pleuron; posterior section with 1–2 additional longitudinal grooves. Fourth and fifth pleonites without or with 1 short oblique groove. Sixth pleonite with a long anterior, transverse groove; armed with transverse row of 12 small teeth dorsolaterally, near posterior margin.

Telson with dorsal surface bearing shallow median groove flanked by 2 dorsolateral carinae each bearing 5 strong, symmetrically situated spines, and 1 pair of proximal and 2–3 pairs of submedian spines; lateral margins each armed with 1 large submarginal tooth near base and 1 long tooth posterior to mid-length; posterior margin armed with 2 posterolateral teeth.

Antennal scale about 3.5 times longer than broad, lateral margin slightly concave, armed with 6–10 teeth, posterior-most tooth smallest, blunt; dorsal surface with 2 longitudinal carinae.

Third pereopod chela 1.4–2.0 times as long as carapace. Palm subcylindrical, about 3 times as long as wide; dorsal margin not carinate, with irregular longitudinal rows of numerous strong spines decreasing in size posteriorly; ventral margin not carinate, with irregular longitudinal rows of minute spines, extending to 1/3 of fixed finger; lateral surface armed with

<table>
<thead>
<tr>
<th>Maxillipeds</th>
<th>Pereopods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleurobranches</td>
<td>1</td>
</tr>
<tr>
<td>Arthrobranches</td>
<td>2</td>
</tr>
<tr>
<td>Podobranchs</td>
<td>—</td>
</tr>
<tr>
<td>Epipods</td>
<td>1</td>
</tr>
<tr>
<td>Exopods</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. Gill formula of *Odontozona arbur* sp. nov. and *O. stigmatica* sp. nov.
irregular longitudinal rows of minute spines or small tubercles; mesial surface unarmed. Carpus widening distally, about 4.9 times as long as wide, 0.7–0.9 of chela length; dorsal margin armed with 2 rows of several, widely spaced, strong spines of various sizes, distal-most spine strongest; lateral and mesial surfaces unarmed; ventral margin armed with 2 strong teeth.

Fourth and fifth pereopods similar in shape and length. Propodi about 3.5 times as long as dactylus, subdivided into 5–6 joints; ventral margin armed with 12–17 movable spines. Carpi about 2.4 times as long as propodi, subdivided into 7–10 joints.

Uropodal exopod with lateral margin armed with row of 4–9 teeth; endopod with lateral margin armed with 2–5 teeth.

**Females**

Rostrum (Fig. 7) 0.66–0.73 of carapace length, dorsal margin armed with 5 small, anteriorly directed teeth, all subequal in size; posterio-most tooth situated at same level as orbital margin; ventral margin with 3 small, subdistal teeth. Carapace armed with spines on postorbital and anterolateral regions, lacking rows of spines on posterior margin of carapace and rows of spines between postcervical groove and posterior margin of carapace; spines generally less numerous than in males.

Sixth thoracic sternite (Fig. 8A) with pair of broad, triangular lobes, their lateral and mesial margins unarmed, posterolateral angles rounded with 1 minute tooth; seventh sternite with pair of broad, quadrangular lobes, distolateral angles produced or rounded, lateral and anteromesial margins unarmed; eighth sternite with pair of trapezoid lobes, distolateral angles produced or rounded, lateral margin unarmed or armed with few teeth on posterolateral angles, anteromesial margins unarmed.

Chela of third pereopod (Fig. 8B, C) 1.4–1.7 times as long as carapace; dactylus 0.4 of chela length; palm subcylindrical, 3.3–7.6 times as
Fig. 8. *Odontozona arbur* sp. nov., ovig female (cl 2.7 mm), NSMT-Cr 24244, from Ishigaki Island, Ryukyu Islands, Japan (A–C) and *Odontozona rubra* Wicksten, 1982, paratype, ovig. female (cl 5.2 mm), USNM 184957, from Cabo San Lucas, Baja California, Mexico (D), A, sixth to eighth thoracic sternites, ventral view; B, left third pereopod, chela and carpus, lateral view; C, left third pereopod, chela and carpus, mesial view; D, posterior part of sixth pleonite, dorsal view.
long as wide, dorsal and ventral margin unarmed, lateral and mesial surfaces unarmed, except for 1 small spine on anterior 1/4 of ventromesial margin; carpus somewhat broadened distally, 7.1–7.6 times as long as wide, subequal to chela length; merus 6.8–8.6 of carpus length.

Number of eggs: 43–57; eggs subspherical, diameter 0.58–0.75 × 0.43–0.53 mm.

**Color in life**

Body and appendages with semitransparent-whitish background. Carapace and pleon covered with small red chromatophores, especially dense on rostrum and anterior portion of carapace, and forming larger red patches on posterolateral and epigastric regions of carapace, e.g. marking rows of spines on cervical, postcervical and more posterior rows of spines; first, second and anterior portion of third pleonite with reddish chromatophores forming M-shaped bands; posterior margin of third pleonite with reddish chromatophores forming narrower transverse bands; fourth pleonite with reddish chromatophores laterally; pleural margins generally with reddish chromatophores forming longitudinal bands. Telson and uropodal exopods with red chromatophores proximally and on distal half; endopods with red chromatophores on entire surface. Anterior surface of eyestalks and corneal margins, as well as antennular peduncle and antennal scale, with reddish chromatophores; antennular and antennal flagella pale orange to reddish. Third maxillipeds and first, second, fourth and fifth pereopods semitransparent with scattered reddish chromatophores. Third pereopod fingers whitish; palm and carpus ranging from white with beige tinge to crimson-reddish or orange mesially or dorsomesially; merus and ischium varying from crimson to red-orange. Eggs or maturing ovaries in females bright bluish green (Fig. 13A–E).

**Etymology**

The specific epithet “arbur” is an anagram of “rubra”, referring to the new species’ resemblance with *Odontozone rubra* (see below).

**Common name**

Crimson-clawed boxer shrimp, Shinonome-subesube-otohime-ebi (Japanese name meaning “small coral banded shrimp with third pereopod of crimson colour like glowing in the morning sky”).

**Distribution**

Presently known from tropical Australia (Western Australia, Queensland), Japan, Indonesia, New Caledonia, Vanuatu, American Samoa, French Polynesia, Madagascar, United Arab Emirates (record based on underwater photograph in Fig. 13E).

**Ecology**

Shallow coral reefs and adjacent sand flats with abundant rocks, corals, coral rubble; typically found under large rocks and pieces of rubble; depth range 0.5–36 m.

**Remarks**

*Odontozone arbur* sp. nov. appears to share most characters with *O. rubra* from shallow waters of the tropical eastern Pacific. For instance, in both species, the distinct cervical and postcervical grooves on the carapace bear a cincture of numerous spines; the pleonites are sculptured; the posterolateral surface of the sixth pleonal somite is armed with transverse rows of spines; the antennal scale (scaphocerite) is dorsally unarmed; and the third pereopod palm is armed with a row of spines (Wicksten 1982; Okuno, 2007; see below). From initial comparison with the original description of *O. rubra*, the new species can be readily distinguished from *O. rubra* by several morphological features, including (1) the spines on the cervical groove of the carapace being larger in size, but smaller in number, i.e. a row of 15–20
spines (vs. about 70 spines in *O. rubra*), (2) the presence of a field of scattered spines on the anterolateral portion of the carapace (vs. its absence in *O. rubra*), (3) the presence of a few spines on the lateral surface of the pleura on the second to fifth pleonal somites (vs. its absence in *O. rubra*) and (4) the absence of a posterior tooth on the telson (vs. telson with a tooth in *O. rubra*). Furthermore, a re-examination of the paratype of *O. rubra* (USNM 184957) revealed that it also has a transversal row of 12 (left) or 13 (right) small spines on the sixth pleonite (Fig. 8D), which were not mentioned by Wicksten (1982), instead of less than 10 spines in *O. arbur* sp. nov.

*Odontozona arbur* sp. nov. also has affinities to two Indo-West Pacific species, *O. sculpticaudata* (Fig. 14A) and *O. spinosissima*, sharing with them the markedly sculptured pleonites. The absence of row of small spines on the dorsal surface of the antennal scale in *O. arbur* sp. nov. distinguishes it from *O. sculpticaudata*, which has this feature. In addition, in *O. sculpticaudata*, the posterior portion of the carapace is uniformly covered with scattered small spines, whereas in the new species, this area is either glabrous or has defined rows of closely inserted small spines. The second species, *O. spinosissima*, is a very distinctive deep-water boxer shrimp known only from the incomplete holotype specimen missing both third pereopods. The armature of the pleon and telson readily distinguishes *O. arbur* sp. nov. from *O. spinosissima*, which is uniformly covered with numerous small, flattened spines.

The non-type specimens of *O. arbur* sp. nov. from Moorea, French Polynesia, differ slightly from the other examined specimens by the somewhat reduced pleonal sculpture. For instance, the ovigerous female (FLMNH UF 33894) has one less groove on each of the second and third pleonite, but is otherwise very similar to the Japanese specimens, e.g. the ovigerous female from Ishigaki Island (NSMT-Cr 24244).

The colour pattern of *O. arbur* sp. nov. appears to be somewhat variable (Fig. 13A–E); however, most of the variation lies in the intensity of colour on the carpus and palm of the third pereopods. In some specimens, e.g. a large female from Sumba, Indonesia (OMNH.ZC. 2016.01.029), the carpus and palm are whitish with a beige tinge; the chela fingers are hyaline white (Fig. 13A). The opposite end of the spectrum is represented by the much smaller male from Moorea (FLMNH UF 29009), in which the carpus and palm are of an intense crimson-orange colour, markedly contrasting with the white of the fingers (Fig. 13C). Since the Moorea specimens also present some slight morphological deviations (see above), a DNA analysis is desirable to confirm their identity as *O. arbur* sp. nov., as proposed here.

Bruce (1982, 1986) provided a habitus illustration and a photograph, respectively, of specimens identified as *Odontozona* sp., collected in Zanzibar and Indonesia, and associated with crinoids. The general characters of the female specimen illustrated in Bruce (1982), such as the presence of well-marked transverse and longitudinal grooves on the pleonites and the posterior region of the carapace lacking uniformly scattered spines, agree well with those of *O. arbur* sp. nov., but are also present in some related species, e.g. *O. sculpticaudata*, thereby making a positive identification impossible without examination of the material.

Okuno (2007) reported two taxa as *Odontozona* sp. 1 and *Odontozona* sp. 2 from the Dampier Archipelago, Western Australia. One of them, viz. *Odontozona* sp. 2, corresponds to *O. arbur* sp. nov., with three male specimens examined by Okuno (2007) included in the paratype series of the new species. The specimen reported as *Odontozona* sp. 4, in Minemizu (2013) was not available for the present study; however, its colour pattern corresponds to that of the present new species. The ovigerous female illustrated by a colour photograph
in Minemizu (2013) and identified as *O. ensifera* was re-identified as *O. arbur* sp. nov. (NSMT-Cr 24244).

Goy (2015) redescribed *O. ensifera* and *O. sculpticaudata*, the former based on two ovigerous females from New Caledonia, and the latter based on three specimens from New Caledonia and Loyalty Islands. However, Goy’s (2015) figs. 15 and 16, as well as part of his redescriptions of *O. ensifera* clearly show or mention the diagnostic characters of *O. arbur* sp. nov., such as the presence of a well-marked sculpture on the third, fifth and sixth pleonites, which was not described by Holthuis (1946). The shrimp in the colour photograph of an apparently non-collected specimen from Nouméa, New Caledonia (Goy, 2015: fig. 17), closely resembles *O. arbur* sp. nov. (Fig. 13A–E). The female specimen in Goy’s (2015) figs. 20 and 21 clearly represents *O. sculpticaudata* for it has a row of small spines on the dorsal surface of the antennal scale. The colour pattern of the Guam specimen identified here as *O. sculpticaudata* (Fig. 14A) corresponds well to that of the Enewetak specimens in Goy (2015: fig. 23). However, the male specimen from Nouméa (FLMNH UF Arthropoda 3428), identified and illustrated as *O. sculpticaudata* by Goy (2015: fig. 22), was re-examined and confirmed to be *O. arbur* sp. nov. based on its diagnostic morphological characters and colour pattern.

**Odontozona stigmatica** sp. nov.
(Figs. 9–12, 13F)
[Japanese name: Yuugiri-subesube-otohime-ebi]
urn:lsid:zoobank.org:act:B9D7FAC3-D970-4E58-B17C-135D6B91B5C6

**Odontozona** sp. 3 – Minemizu 2013: 21.

**Material examined**

Holotype: male (cl 2.3 mm), NSMT-Cr 24245, Japan, Ryukyu Islands, Yaeyama Islands, W coast of Ishigaki Island, Osaka, depth 5 m, leg. R. Minemizu, 2 Oct. 2011 [fcn MG2051].

**Diagnosis**

Small-sized stenopodid shrimp with subcylindrical body. Rostral dorsal margin with 7 teeth, ventral margin with 1 subdistal tooth. Carapace with cervical groove; posterior margin with cincture of several spines ending in large hepatic spine; postcervical groove with cincture of about 20 small spines; posterior margin of carapace with shallow groove and row of 3–4 minute spines. Pleonites not sculptured. First to third pleura with transverse carinae. Sixth pleuron with lateral spines and transverse row of several small spines. Telson lance-shaped; dorsal surface with dorsolateral carinae each bearing 5 large spines; lateral margins each with 1 submarginal tooth near base and 1 strong tooth; posterior margin with 2 posterolateral teeth. Cornea darkly pigmented, shorter than eyestalk. Antennal scale bearing 7 lateral teeth. Chela of third pereopod subcylindrical, with row of strong spines on dorsal margin. Fourth and fifth pereopods with propodi subdivided into 5 joints; ventral surfaces with 12–16 movable spines; carpi subdivided into 7–8 articles. Uropodal exopod with lateral margin nearly straight, with row of 6–7 teeth, dorsal surface unarmed, with 2 smooth longitudinal carinae; endopod with lateral margin with 2 teeth, dorsal surface unarmed, with 2 smooth longitudinal carinae.

**Description of holotype male**

Rostrum (Figs. 9, 10A, B) slender, directed forwards, overreaching mid-length of antennal scale, 0.74 of carapace length, narrowly triangular in dorsal view; dorsal margin armed with 7 anteriorly directed teeth of similar size, all teeth situated anterior to orbital margin; ventral margin with 1 subdistal tooth; lateral margins unarmed; ventrolateral ridge merging into orbital margin.

Carapace (Fig. 10A, B) with postrostral me-
dian ridge extending to anterior portion of epigastric region; supraorbital region armed with 3 pairs of stout spines of various sizes; orbital margin concave with 1 small postorbital spine; antennal lobe rounded, lower angle with large antennal spine, latter acuminate, submarginal; pterygostomial margin produced anteriorly, with large acuminate branchiostegal spine and several small marginal spines; pterygostomial angle armed with 1 relatively large spine; gastric region with rows of 2 (left) or 3 (right) postrostral submedian spines, latter different in size; cervical groove distinct, posterior margin with cincture of 12 spines of various sizes, directed anteriorly, ending in large hepatic spine; postcervical groove dorsally indistinct, laterally distinct, posterior margin armed with cincture of 20 small spines or blunt teeth; poorly marked transverse groove ending in 1–2 small spines present posterior to branchiostegal spine, adjacent to terminal postcervical groove; few small spines present on lateral portion between cervical and postcervical grooves; posterior margin with shallow groove and row of 3–4 minute spines; anterolateral region armed with several anteriorly directed spines of different sizes.

Sixth thoracic sternite (Fig. 10C) with medially jointed pair of slender, contiguous lobes; each distolateral angle produced; lateral margin armed with 2 spines; anteromesial margin unarmed; ventral surface concave, unarmed. Seventh thoracic sternite with pair of broad triangular plates; distolateral angle produced; lateral and anteromesial margins armed with several spines or blunt teeth; ventral surface concave, unarmed. Eighth thoracic sternite with pair of smaller trapezoid plates; distolateral angle produced; lateral margin armed with 1 spine; anteromesial margin unarmed; ventral surface concave, unarmed.

Pleonites (Fig. 9) not sculptured. First pleonite short, divided into 2 sections by distinct transverse carina; anterior section with pleuron...
Fig. 10. *Odontozona stigmatica* sp. nov., holotype, male (cl 2.3 mm), NSMT-Cr 24245, from Ishigaki Island, Ryukyu Islands, Japan. A, carapace and cephalic appendages, lateral view; B, same, dorsal view; C, sixth to eighth thoracic sternites, ventral view; D, sixth pleonite, telson and right uropod, dorsal view.
unarmed laterally, posteroventrally ending in elongate process; posterior section with pleuron unarmed laterally; posteroventral margin armed with 2 minute teeth. Second to fourth pleura unarmed laterally; ventral margin produced, with few minute teeth anteriorly and posteriorly. Second and third pleonites with 2 distinct transverse carinae, posterior one ending at mid-height of pleuron. Third pleonite longest. Fifth pleonite armed with 1 strong spine on pleuron; ventral margin produced in large tooth, with some minute teeth anteriorly and posteriorly. Sixth pleonite armed with 2 strong spines laterally and transverse row of 8 (left) or 10 (right) small blunt teeth posteriorly on pleuron; ventral margin produced, forming strong tooth.

Telson (Fig. 10D) elongate, lance-shaped, slightly constricted near base, gradually tapering distally, about 2.4 times as long as maximum width; dorsal surface with shallow median groove flanked by dorsolateral carinae each bearing 5 strong, symmetrically situated, large spines, 1 pair of proximal spines near base and 1 additional small spine at anterior 0.4 of left carina; lateral margins each armed with 1 submarginal tooth near base and 1 strong tooth posterior to mid-length; posterior margin convex, armed with 2 posterolateral teeth.

Eyes (Fig. 10A, B) with cornea shorter than peduncle, hemispherical, darkly pigmented; dorsal and anterior surfaces of eyestalk armed with several spines or denticles of various sizes.

Antennular peduncle (Fig. 10A, B) reaching mid-length of antennal scale. First article subequal to distal 2 articles combined, unarmed on mesial surface; stylocerite strongly curved forwards, distally acute. Second article armed with 2 strong mesial, 1 dorsal and 1 distolateral spines. Third article armed with distolateral spine. Flagella slender, long, almost 6 times as long as carapace.

Antenna (Fig. 10A, B) with stout basicalate bearing 1 moderately large distolateral tooth and several additional teeth of various sizes on ventrolateral and ventral surfaces; mesial margin with laminate process. Antennal scale 2.8 times as long as broad, lateral margin nearly straight, armed with 7 teeth; dorsal surface with 2 longitudinal carinae. Carpocerite short, reaching level of third article of antennular peduncle, armed with few strong spines on mesial and lateral margins. Flagella slender, about 9 times as long as carapace.

Mouthparts generally similar to those of O. arbur sp. nov. (see above). Third maxilliped (Fig. 11A) overreaching tip of antennal scale by length of dactylus. Dactylus tapering distally, lateral margins of dactylus and propodus furnished with long setae; distomesial surface with shallow depression densely furnished with grooming setae. Carpus subequal to propodus in length, unarmed; distoventral margin produced. Merus armed with row of 3 strong spines dorsolaterally and row of 4 strong spines laterally. Ischium compressed laterally, armed with row of several equally spaced, minute spines on ventromesial margin. Epipod elongate, rod-like. Exopod with well-developed simple flagellum.

First pereopod (Fig. 11B) slender, overreaching tip of antennal scale by length of chela, with well-developed carpo-propodal grooming apparatus; all articles unarmed; dactylus about half of chela length; palm subcylindrical; carpus slender, 1.1 of chela length; merus 0.9 of carpal length; ischium 0.7 of meral length. Second pereopod (Fig. 11C) longer than first pereopod, overreaching tip of antennal scale by lengths of chela and half of carpus; all articles unarmed; dactylus about half of chela; palm subcylindrical; carpus 1.3 times as long as che- la; merus 0.8 of carpal length; ischium 0.7 of meral length.

Third pereopod (Fig. 12A–D) longest and strongest, overreaching tip of antennal scale by lengths of chela and carpus, slightly unequal in size between left and right chelae: left chela 1.8 times, right chela 1.6 times as long as carapace.
Fig. 11. *Odontozona stigmatica* sp. nov., holotype, male (cl 2.3 mm), NSMT-Cr 24245, from Ishigaki Island, Ryukyu Islands, Japan. A, right third maxilliped, ventral view; B, right first pereopod, lateral view; C, right second pereopod, lateral view; D, right fourth pereopod, lateral view; E, same, dactylus; F, right fifth pereopod, lateral view, G, same, dactylus; H, right first pleopod, dorsal view; I, right first and second pleopods, lateral view.
Fig. 12. *Odontozona stigmatica* sp. nov., holotype, male (cl 2.3 mm), NSMT-Cr 24245, from Ishigaki Island, Ryukyu Islands, Japan. A, right third pereopod, lateral view; B, right third pereopod, mesial view; C, left third pereopod, chela, lateral view; D, same, mesial view.
Dactylus 0.4 of chela length, with hook-like tip, unarmed on dorsal margin; cutting edge proximally with triangular tooth opposed to hiatus on fixed finger, otherwise unarmed. Fixed finger generally similar to dactylus, slightly hooked distally, cutting edge unarmed; ventral margins unarmed (left) or armed with 1 strong spine at mid-length (right). Palm subcylindrical, 2.8 times as long as wide; dorsolateral margin armed with row of several widely spaced strong spines, decreasing in size posteriorly; ventromesial margin armed with irregular row of several teeth or granules; lateral and mesial surfaces with few spinules and granules. Carpus slightly widening distally, almost 5 times as long as wide, 0.6–0.7 of chela length, dorsolateral surface armed with 2 rows of 3–4 widely spaced strong spines of various sizes, distal-most strongest; ventral margin armed with 2 strong spines. Merus 0.9 of carpal length; dorsal margin with 4 strong spines; ventral margin with 4 strong spines, distal-most strongest. Ischium 0.8 of meral length; distodorsal angle somewhat produced, with 1 strong subdistal spine.

Fourth and fifth pereopods (Fig. 11D–G) similar in shape and length. Dactylus compressed laterally, 3.7 times as long as wide, biunguiculate. Propodus 4.3 times as long as dactylus, subdivided into 5 joints, ventral surfaces armed with 12–16 movable spines. Carpus about twice as long as propodus, subdivided into 7–8 joints. Merus 0.7 of carpal length, not subdivided. Ischium about half-length of merus.

First pleopod (Fig. 11H) uniramous, shorter than other pleopods. Second to fifth pleopods biramous. Second pleopod (Fig. 11I) with protopod shorter than both rami, armed with several blunt teeth on posterolateral margin. Third to fifth pleopods generally similar, decreasing in size posteriorly.

Uropod (Fig. 10D) with stout protopod, its lateral margin terminating in acute process. Exopod relatively broad, overreaching posteri-
or margin of telson; lateral margin nearly straight, armed with row of 6–7 teeth; dorsal surface unarmed, with 2 smooth longitudinal carinae. Endopod tapering distally, overreaching posterior margin of telson; lateral margin armed with 2 teeth; dorsal surface unarmed, with 2 smooth longitudinal carinae.

Gill formula as shown in Table 2.

**Color in life**

Body and appendages semitransparent with small red dots. Carapace and pleon covered with small red dots, especially dense on anterio-
or region of carapace and rostrum, forming larger patches and semicircular transverse bands on posterolateral and epigastric regions of carapace; mid-dorsal posterior region of carapace without red dots. First to third pleonites with conspicuous U-shaped colourless band. Telson and uropods entirely covered with red dots. Eyestalks, antennular peduncle and antennal scale also with red dots; antennular and antennal flagella reddish. Third maxilliped, first, second, fourth and fifth pereopods pale-orange with red dots; third pereopod fingers white (except for most-proximal part), palm, carpus, merus and ischium pale orange with red dots (Fig. 13F).

**Etymology**

The specific epithet “stigmatica” (Latin for dotted) refers to the red dotting of the body.

**Common name**

Red-dotted boxer shrimp (English name), Yuugiri-subesube-otohime-ebi (Japanese name meaning “small coral banded shrimp with small red dots like evening mists”).

**Distribution**

Presently known only from the type locality (Osaki, Ishigaki Island) in the Ryukyu Islands, southern Japan.
Fig. 13. *Odontozona arbur* sp. nov. (A–E) and *Odontozona stigmatica* sp. nov. (F), colour patterns in life. A, *O. arbur* sp. nov., ovig. female (cl 3.0 mm), OUMNH.ZC. 2016.01.029, from Sumba, Indonesia; photograph by A. Anker. B, *O. arbur* sp. nov., holotype, male (cl 4.1 mm), QM W28334, from Lizard Island, Queensland, Australia; photograph by A. Anker. C, *O. arbur* sp. nov., male (cl 2.1 mm) from Moorea, French Polynesia, FLMNH UF 29009; photograph by A. Anker. D, *O. arbur* sp. nov., male (specimen not collected) from Ishigaki Island, Ryukyu Islands, Japan; photograph by Y. Yamada. E, *O. arbur* sp. nov., ovig. female (specimen not collected) from Khorfakkan, United Arab Emirates; photograph by P. Lecomte. F, *O. stigmatica* sp. nov., holotype, male (cl 2.3 mm), NSMT-Cr 24245, from Osaka, west of Ishigaki Island, Ryukyu Islands, Japan; photograph by R. Minemizu.
Ecology

Coral reefs, under large coral rocks; depth: around 5 m.

Remarks

The non-sculptured pleonites of Odontozona stigmatica sp. nov. easily separates it from O. arbur sp. nov., O. rubra, O. scalpticaudata and O. spinosissima, all of which characterised by sculptured pleonites. One of the distinguishing features of O. stigmatica sp. nov. is the presence of cinctures or rows of teeth on the carapace in the vicinity of the postcervical groove and posterior margin of the carapace. This feature separates this new species from the deep-water O. edwardsi, O. spongicola, O. foresti Hendrickx, 2002, O. lopheliae Goy & Cardoso, 2014, and O. joegyi Hendrickx & Ayón-Parente, 2014, all lacking rows of small spines on the carapace, except for a single row on the cervical groove (Hendrickx, 2002; Goy & Cardoso, 2014; Hendrickx & Ayón-Parente, 2014; present study).

The characteristic pattern of cinctures with spines on the carapace in combination with several other morphological characters separates O. stigmatica sp. nov. from all the remaining Indo-West Pacific species of the genus, viz. O. ensifera, O. crinoidicola and O. fasciata. O. stigmatica sp. nov. appears to be morphologically most similar to O. ensifera, wide-spread shallow-water species, sharing with it a similar armature on the rostrum, carapace, pleon and thoracic appendages. However, O. stigmatica sp. nov. can be easily distinguished from O. ensifera by several morphological features, including (1) rostrum with 7 dorsal and 1 ventral teeth (vs. 8–9 dorsal, 1–4 ventral, and small lateral teeth in O. ensifera); (2) postcervical groove with cincture of 20 small spines (vs. about 70 slender spines in O. ensifera); (3) lacking a row of spines on the hepatic region of the carapace (vs. having a short oblique row of about 10 spines in O. ensifera); (4) lacking a row of several slender spines between the postcervical groove and the posterior margin of the carapace (vs. having an oblique row of 11–20 spines in O. ensifera); and (5) a row of 3–4 minute spines on each side of the posterior margin of the carapace (vs. a row of 8–12 slender spines in O. ensifera) (cf. Holthuis, 1946).

Odontozona crinoidicola, a wide-ranging species associated with feather stars (Fig. 14B), has a much more depressed body than any other species in the genus, including O. stigmatica sp. nov. They also differ in the number of rows of strong spines on the dorsal margin of the third pereopod palm, with 2 rows in O. crinoidicola (Saito & Fujita, 2009: fig. 6) vs. a single row in O. stigmatica sp. nov. (Fig. 12A, C).

Odontozona stigmatica sp. nov. is also distinguishable from O. fasciata, a cave-dwelling species, by the rostrum directed slightly downwards and with only one subdistal tooth on the ventral margin, as opposed to the longer, upwards curving rostrum, with its ventral margin armed with 4–12 teeth in O. fasciata. In addition, the two species can be distinguished by the presence (O. stigmatica sp. nov.) vs. absence (O. fasciata) of scattered minute tubercles or granules on the lateral surface of the third pereopod palm. They also differ in the subdivision of the propodi and carpi of the fourth and fifth pereopods, with 5 and 7 joints in the propodus and carpus, respectively, in O. stigmatica sp. nov. (Fig. 11) vs. 7–12 and 14–20 joints, respectively, in O. fasciata (Okuno, 2003: fig. 5; Goy, 2015: fig. 18). The colour patterns of O. stigmatica sp. nov. and O. fasciata are different; for instance, the latter species possesses a very broad transverse band on the posterior section of the third pleonite (compare Fig. 13E with Okuno, 2003: fig. 6).

Discussion

The present study increases the total number of species in the genus Odontozona to 19 (Table 1), with 8 species present in the Indo-West
DESCRIPTION OF TWO NEW ODONTOZONA

Pacific, 3 in the eastern Pacific, 5 in the western-central Atlantic, and 3 in the eastern Atlantic, 2 being endemic to the Mediterranean Sea. Undoubtedly, more species of Odontozona will be described in the future, as evidenced by recent underwater photographs (e.g. Kawamoto & Okuno, 2003: Odontozona sp. C; Kuiter & Debelius, 2009: Odontozona sp.; Minemizu, 2013: Odontozona spp.). Furthermore, several species are known based on incomplete specimens, such as O. spinosissima. Colour patterns, which are highly diagnostic for species of Stenopus, remain unknown for the majority of species of Odontozona, including O. ensifera. Therefore, Odontozona needs a thorough taxonomic revision based on examination of type material and recently collected, photo-vouchedered material, as well as a phylogenetic analysis, preferably integrating both morphological and molecular data.

Key to the species of Odontozona (modified from Okuno, 2003)

Note: for distribution range and ecology see Table 1.

1. Pleonites scultured
   — Pleonites not scultured

2. Dorsal surface of uropods scattered with spines
   — Dorsal surface of uropods unarmed

3. Dorsal surface of antennal scale with row of small spines
   — Dorsal surface of antennal scale unarmed

4. Lateral surface of fifth pleuron with several spines; telson without posterior tooth
   — Lateral surface of second to fifth pleura unarmed; telson with 1 posterior tooth

5. Posterior half of carapace behind spinous cervical groove smooth; cornea not pigmented
   — Posterior half of carapace behind spinous cervical groove armed with scattered spinules or with postcervical groove bearing cincture of spines or spinules organised in transverse rows; cornea pigmented

6. Spines on cervical groove longer than diameter of cornea; telson without

---

Fig. 14. Odontozona sculpticaudata Holthuis, 1946 (A) and Odontozona crinoidicola Saito & Fujita, 2009 (B), colour patterns in life. A, O. sculpticaudata, ovig. female (cl 3.5 mm) from Guam, FLMNH UF 28137; photograph by A. Anker. B, O. crinoidicola, ovig. female (specimen not collected) from Batangas, Philippines, in situ on a crinoid; photograph by A. Kang.
dorsolateral teeth. ............ O. foresti
- Spines on cervical groove shorter than diameter of cornea; telson armed with
dorsolateral teeth .................................. 7
7. First three pleonites with transverse carinae; sixth pleonite with dorsal transverse carina
.......................................................... O. edwardsi
- All pleonites smooth .................................. 8
8. Rostrum with 2 ventral teeth; third pereopod palm with row of more than 19 strong spines dorsally, unarméd on lateral and mesial surfaces .......... O. lopheliae
- Rostrum with 3 ventral teeth; third pereopod palm unarmed or with few spines dorsally and scattered spinules on lateral and mesial surfaces ........... 9
9. Hepatic region unarmed; sixth pleonite with 4 lateral small spines .... O. joegoyi
- Hepatic region with small spines; sixth pleonite without lateral spines
.......................................................... O. spongicola
10. Dorsal and ventral margins of third pereopod palm with row of long, fine, flexible setae ................. O. meloi
- Dorsal and ventral margins of third pereopod palm without row of long setae
.......................................................... 11
11. Body markedly depressed; rostrum directed downward ............ O. crinoidicola
- Body rather compressed; rostrum directed forward or slightly upward .......... 12
12. Third maxilliped ischium without dorsolateral spines; antennal scale with 5–7 lateral teeth .................. 13
- Third maxilliped ischium with dorsolateral spines; antennal scale with 9–13 lateral teeth .......................... 14
13. Ventral margin of rostrum with 3 teeth; branchial region of carapace with distinct oblique row of spines; dorsal margin of third pereopod propodus without rows of spines ..................... O. anaphorae
- Ventral margin of the rostrum with 1 subdistal tooth; branchial region of the carapace lacking row of spines; dorsal
dorsal margin of third pereopod propodus with rows of spines .......... O. stigmatica sp. nov.
14. Third pereopod palm unarmed ........... 15
- Third pereopod palm with dorsal row of spines ........................................... 16
15. Anteroventral margin of carapace unarmed; third pleonite unarmed laterally
.......................................................... O. fasciata
- Anteroventral margin of carapace with 3 teeth; third pleonite with 3 spines laterally
.......................................................... O. striata
16. Lateral surface of second pleuron with spines .......................... O. addaia
- Lateral surface of second pleuron unarmed ............................................ 17
17. Lateral surface of sixth pleuron with 2 spines; uropodal endopod with 4 lateral teeth ..................... O. minoica
- Lateral surface of sixth pleuron unarmed or with 1 spine; uropodal endopod with 2 lateral teeth .................. 18
18. Rostrum overreaching mid-length of antennal scale, with 7–9 closely spaced dorsal teeth; postcervical groove with cincture of about 70 slender spines
............................................. O. ensifera
- Rostrum reaching mid-length of antennal scale, with 4–5 widely spaced dorsal teeth; postcervical groove with cincture of at most 50 slender spines .... O. libertae

Acknowledgements

We are indebted to Ryo Minemizu (Ryo Minemizu Photo Office) for providing us with Japanese material, as well as underwater photographs and field data. Our thanks are extended to Diana S. Jones (WAM) for arranging loan of the Dampier Archipelago specimens. The first author wishes to express his gratitude to Tomoyuki Komai (Natural History Museum and Institute, Chiba) for his continuous guidance and encouragement. The third author thanks the two main organisers of CReefs Australia Expedition to Ningaloo Reef in 2010, Ju-
Caley and Shawn Smith (Australian Institute of Marine Science, Townsville, Queensland, Australia). The CReefs Australia Project was a field program of the Census of Marine Life and was sponsored by BHP Billiton in partnership with The Great Barrier Reef Foundation, the Australian Institute of Marine Science (AIMS), the Australian Biological Resources Study and the Alfred P. Sloan Foundation. Viatcheslav Ivanenko (Moscow State University, Moscow, Russian Federation) helped collecting additional specimens in Ningaloo. The Nosy-Bé material was collected as part of BIOTAS project in 2008, organised jointly by FLMNH (PI: Gustav Paulay) and Université de la Réunion, Saint-Denis, La Réunion, France (PI: Henrich Bruggemann). The Moorea material was collected during the Biocode Moorea project in 2008–2010, based at the Richard B. Gump South Pacific research station of the University of California at Berkeley, and sponsored through the Gordon and Betty Moore Foundation. Gustav Paulay, Jenna Moore (FLMNH) and Seabird McKeon (Smithsonian Institution, Fort Pierce, USA), among others, helped collecting specimens, while the Gump station staff provided excellent logistical support and assistance in the laboratory. Research permits in Moorea were issued by the Délégation à la Recherche of the Government of French Polynesia. We especially thank Gustav Paulay, who supported the third author’s taxonomic studies on Decapoda for several years and invited him to participate in fieldwork in Australia, Madagascar and French Polynesia. Our cordial thanks are also extended to Sammy de Grave (OUMNH), Hironori Komatsu (NSMT) and Janice C. Walker (USNM) for arranging loans of additional comparative material and/or technical advice. Finally, we deeply thank Yusuke Yamada (Okinawa, Japan), Philippe Lecomte (Abu Dhabi, UAE) and Albert Kang (Kuala Lumpur, Malaysia) for providing colour photographs used in the present study.

### Literature cited


Addresses
(TS) Usa Marine Biological Institute, Kochi University, Usa-cho, Tosa, Kochi 781–1164, Japan; (JO) Coastal Branch of Natural History Museum and Institute, Chiba, 123 Yoshio,
Katsuura, Chiba 299–5242, Japan; (AA) Museu Paraense Emílio Goeldi, Campus de Pesquisa, Avenida Perimetral 1901, CEP 66077–830, Terra Firme, Belém, PA, Brazil. Current address: Universidade Federal de Goiás, Instituto de Ciências Biológicas, Avenida Esperança s/n, Campus Samambaia, CEP 74690–900, Goiânia, GO, Brazil.

**E-mail addresses**
(TS) tsaito@kochi-u.ac.jp
(JO) okuno@chiba-muse.or.jp
(AA) arthuranker7@gmail.com