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***Paranthura oriens* sp. nov. (Isopoda: Anthuroidea: Paranthuridae) from Tateyama,**

Chiba, Japan

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A new *Paranthura* species from Japan

Abstract: We describe *Paranthura oriens* sp. nov. based on specimens collected from Tateyama, Chiba, Japan. *Paranthura* is the most speciose genus in Anthuroidea, with five groups defined by the condition of the pleonites. Our new species belongs in Group E, defined by having dorsally fused pleonites 1–5. It differs from the other 17 species in Group E in the following combination of characters: (1) the apical edge of the telson is rounded, not sharp, (2) the uropodal endopod is triangular and tapering, and (3) the uropodal exopod is narrow, 2.72–2.84 times longer than wide. We determined a partial cytochrome *c* oxidase subunit (COI) nucleotide sequence for the new species.

Key words: COI, Crustacea, new species, Peracarida, taxonomy

Introduction

The paranthurid isopod genus *Paranthura* Bate & Westwood, 1866 comprises relatively large-sized species with around 10 mm in length. All species are marine, but one species, *P. punctata* (Stimpson, 1855), was also reported from a freshwater lake in New Zealand (Chilton 1906; Barnard 1925). *Paranthura* anthuroids occur worldwide, ranging in depth from the intertidal zone to 2707 m (Poore 2001), but most are shallow species (Frutos et al. 2011), found on muddy/sandy bottoms under rocks and among algae (Nunomura & Shimomura 2012). They seem to be predators, feeding mainly on crustaceans (Wägele 1981, Shiraki & Kakui 2022).

Paranthura differs from other, confamilial genera in having an acute mandible with a 3-articulate palp, pereopod 7 present in non-manca individuals, pleonite 6 not fused dorsally to the telson, and a leaf-shaped uropodal exopod (Shiraki et al. 2022). It is the most speciose genus in the superfamily Anthuroidea Leach, 1814, with 67 valid species listed in the World Register of Marine Species (WoRMS; Boyko et al. 2024). Among these, *P. australis* Haswell, 1881 has been regarded as a *nomen dubium* (Poore 1978), and *P. verrillii* Richardson, 1902 has been synonymized with *P. infundibulata* Richardson, 1902 (Barnard 1925); *Paranthura* thus contains 65 valid species. *Paranthura* species resemble one another morphologically (Kensley & Schotte 2000) but differ subtly in the shapes of articles of pereopods, uropods, and the telson, and in the number of spiniform setae on article 3 of the mandibular palp

(Poore 1984, Negoescu 1997).

Poore (1984) suggested that there were still many undiscovered, endemic, and cryptic species in *Paranthura*. This must be the case for *Paranthura* in Japan. While this is the most-studied anthuroid genus in Japan, with nine species reported, most of their reports were from shallow waters in restricted areas, suggesting that the diversity of *Paranthura* in Japan is underestimated.

Here we describe a new *Paranthura* species collected subtidally at Tateyama, Chiba, Japan. We also present a partial sequence of the cytochrome *c* oxidase subunit (COI) gene for future DNA barcoding.

Materials and methods

Specimens were collected from sandy mud bottoms covered with algae (Fig. 1) by means of a boat and biological dredge provided by the Institute for Marine and Coastal Research, Ochanomizu University, from off Kouyatsu, Tateyama, Chiba, Japan on 25 February and 1 June 2022; they are fixed and preserved in 70–99% ethanol. The methods used for dissection, preparation of slides, light microscopy, and drawing were as described in Shiraki et al. (2021). Body length was measured from the tip of the anterolateral lobe of the head to the tip of the telson, and body width at the widest point of pereonite 5. Measurements were made axially from digital images by using Adobe Illustrator CC and ImageJ (Schneider

et al. 2012). The material examined has been deposited in the Invertebrate Collection of the Hokkaido University Museum (ICHUM), Sapporo, Hokkaido, Japan (ICHUM8805–ICHUM8808).

DNA was extracted from pereopod 3 of paratype ICHUM8807 with a NucleoSpin Tissue XS Kit (Macherey–Nagel, Germany). Primers LCO-1490 and HCO-2198 (Folmer et al. 1994) were used for PCR amplification and cycle sequencing of COI. PCR conditions with KOD One (Toyobo, Japan) were 45 cycles of 98°C for 10 seconds, 56°C for 5 seconds, and 68°C for 1 second. The COI sequence was determined by direct sequencing with a BigDye Terminator Kit ver. 3.1 and a 3730 Genetic Analyzer (Life Technologies, USA), and was deposited in the International Nucleotide Sequence Database (INSD) through the DNA Data Bank of Japan (DDBJ) under accession number LC778095.

Results

Systematics

Superfamily Anthuroidea Leach, 1814

Family Paranthuridae Menzies & Glynn, 1968

Genus *Paranthura* Bate & Westwood, 1866

Calamura Boone, 1920: 25–26.

Edanthura Boone, 1923: 148.

Diagnosis. See Frutos et al. (2011).

Species composition. Sixty-six valid species (including our new species) in *Paranthura* can be classified into five groups based on the condition of the pleonites (cf. Negoescu 1997; Fig. 2), with two species of uncertain status. The phylogenetic validity of these groups has not been tested.

Group A contains species having free pleonites 1–5 (37 species): *Paranthura acasia* Poore, 1984; *P. alba* Nunomura, 1977; *P. algophila* Kensley & Schotte, 2000; *P. antarctica* Kussakin, 1967; *P. argentinae* Kussakin, 1967; *P. barnardi* Paul & Menzies, 1971; *P. bellicauda* Miller & Menzies, 1952; *P. boronia* Poore, 1984; *P. brucei* Negoescu, 1999; *P. caesia* Poore, 1984; *P. caribbiensis* Kensley, 1982; *P. ciliata* Whitelegge, 1901; *P. costana* Bate & Westwood, 1866; *P. dryandra* Poore, 1984; *P. elegans* Menzies, 1951; *P. epacris* Poore, 1984; *P. gracilipes* Nordenstam, 1930; *P. infundibulata*; *P. involuta* Whitelegge, 1901; *P. kunzea* Poore, 1984; *P. linearis* (Boone, 1923); *P. lineata* Nunomura, 1977; *P. lobelia* Poore, 1984; *P. longitelson* Wägele, 1984; *P. maculosa* Nunomura, 1974; *P. microtis* Poore, 1984; *P. nigrocaudata* (Nunomura, 1975); *P. nigropunctata* (Lucas, 1846); *P. nordenstami* Kensley, 2003; *P. ostergaardi* Miller & Menzies, 1952; *P. plumosa* Pillai, 1966; *P. porteri* (Boone, 1920); *P. possessia* Kensley, 1980; *P. santiparrai* Frutos, Sorbe & Junoy, 2011; *P. senecio* Poore, 1984; *P. skottsbergi* Nordenstam, 1930; *P. societensis* Müller, 1993.

Group B contains species having free pleonites 1–3 and fused pleonites 4 and 5 (one species): *P. urodentata* Kensley & Schotte, 2000.

Group C contains species having free pleonite 1 and dorsally fused pleonites 2–5 (seven species): *P. amorensis* Jarquín-Martínez & García-Madrigal, 2021; *P. floridensis* Menzies & Kruczynski, 1983; *P. grevillea* Poore, 1984; *P. lifuensis* Stebbing, 1900; *P. setigera* Negoescu, 1997; *P. tientai* Jarquín-Martínez & García-Madrigal, 2021; *P. urochroma* Pires, 1981.

Group D contains species having dorsally fused pleonites 1–3 and free pleonites 4 and 5 (one species): *P. longa* Wägele, 1985).

Group E contains species having pleonites 1–5 dorsally fused (18 species): *P. algicola* Nunomura, 1978; *P. astrolabium* Kensley, 1979; *P. bunakenensis* Negoescu, 1997; *P. californiae* Nunomura, 1978; *P. deodata* Müller, 1990; *P. flagellata* (Chilton, 1882); *P. hasticauda* Nunomura, 1974; *P. japonica* Richardson, 1909; *P. kagawaensis* Nunomura, 1993; *P. kobensis* Nunomura, 1975; *P. laticauda* Nunomura, 1975; *P. latipes* Barnard, 1955; *P. nana* Nordenstam, 1930; *P. oriens* sp. nov.; *P. polynesica* Kensley, 1979; *P. punctata*; *P. seychellensis* Kensley & Schotte, 2000; *P. telopea* Poore, 1984.

Two species have not been assigned to a group, as information is lacking on the segmentation of their pleons: *P. antillensis* Barnard, 1925; *P. neglecta* Beddard, 1886.

Remarks. The conditions of the pleonites for *P. nigropunctata*, *P. punctata*, and *P.*

seychellensis were based on Wägele (1982), Barnard (1914), and Chew & Abdul Rahim (2020), respectively, as the original descriptions lacked this information. We treated *P. involuta* as a member of Group A based on a redescription of the holotype specimen (Poore 1984), even though the original description mentioned that the pleonites were fused laterally (Whitelegge 1901). We include *P. flagellata* from New Zealand in Group E, based on the original description (Chilton 1882). Poore (1981) examined other specimens from New Zealand and concluded they were conspecific with *P. flagellata*, though the character states of his material were those of Group C. It appears to us that *P. flagellata* sensu Poore (1981) is not conspecific with *P. flagellata* Chilton and should be regarded as *Paranthura* sp. Drawings of *P. hasticauda* and *P. lineata* accompanying the original descriptions (Nunomura 1974, 1977) indicated that pleonites 1–5 are fused dorsally, but the original descriptions mentioned a “Demarcation of pleonal somites visible in dorsal view” for both species. Nunomura & Shimomura (2012) treated *P. hasticauda* as Group E and *P. lineata* as Group A, and we have followed this treatment. For other species, we used information from the original descriptions.

Based on current knowledge, the condition of pleonites is stable through ontogenetic stages and is useful as a taxonomic character. For example, in Group A, *P. brucei*, *P. costana*, and *P. santiparrai* retain free pleonites 1–5 in females, males, and mancae (Wägele 1982; Negoescu 1999; Frutos et al. 2011). In Group E, *P. bunakenensis* and *P. oriens* sp. nov. retain fused

pleonites 1–5 between sexes (Negoescu 1997; this study). To test the monophyly of each Group or even the validity of elevation of each Group to subgenus or genus, comprehensive phylogenetic analysis is needed.

***Paranthura oriens* sp. nov.**

[New Japanese name: Hinode-uminanafushi]

(Figures 3–7)

Diagnosis. Body with dark brown spots on each segment and orange pigmentation on anterior part of head, bases of antennula and antenna, and uropod. Pleonites 1–5 subequal in length, segmented laterally but fused dorsally (Group E). Telson with a rounded rather than sharp apical edge. Uropodal endopod triangular, tapering. Uropodal exopod narrow, 2.72–2.84 times longer than wide.

Etymology. The specific name is the nominative singular Latin noun *oriens* (sunrise), referring to the orange coloration as noted above.

Material examined. *Holotype.* ICHUM8805 (13 slides and 1 vial), ovigerous female with 47 embryos, body length 10.74 mm; from 5 m depth off Kouyatsu (34°58.931'N, 139°49.133'E), Tateyama, Chiba, Japan; collected by Ryuta Yoshida and Mamoru Yamaguchi, 1 June 2022. *Allotype.* ICHUM8806 (7 slides and 1 vial), male, body length 7.93 mm; collection data as for holotype. *Paratypes.* ICHUM8807 (10 slides and 1 vial), female lacking oostegites, body length 9.15 mm; from 12.0–19.8 m depth, Stn. 1 off Kouyatsu

(34°59.313'N, 139°48.595'E to 34°59.230'N, 139°48.433'E), Tateyama, Chiba, Japan; collected by Ryuta Yoshida and Mamoru Yamaguchi, 25 February 2022. ICHUM8808 (5 slides and 1 vial), ovigerous female, body length 10.85 mm; collection data as for holotype.

Habitat. Sandy mud bottom covered with algae (as periphyton?) (Fig. 1).

Sequence. Partial COI (658 bp; LC778095) sequence from paratype ICHUM8807.

Description of female holotype. Body (Figs 3A, B, 4A, B) slender, 11.39 times longer than wide, with dark brown spots on each segment and orange pigmentation on anterior part of head, base of antennula and antenna, and uropod when alive (Fig. 3A). Head (Fig. 4C) length 1.10 times head width; rostrum not reaching past anterolateral lobes; eyes dorsolateral, relatively large, length 0.22 times head length, with scattered ommatidia. Pereonites 1–7 (Fig. 4A, B) with length ratio 1.21:1.33:1.59:1.70:1.80:1.30:0.82 relative to head length. Pleonites 1–5 (Fig. 4A, B) subequal in length, segmented laterally but fused dorsally. Pleonite 6 distinct from telson dorsally. Telson (Fig. 6H) long-pyriform, tapering, apical edge rounded, with length (tip of the telson to narrowest point) 2.31 times width, with 41 simple setae and three setae (tips broken); base narrow, concave, 0.62 times width.

Antennula (Fig. 4D, E) with three peduncular and six flagellar articles. Peduncular article 1 longest, with one distal plumose sensory seta, five outer and one distal simple setae, and one distal seta (tip broken); article 2 with two outer plumose sensory setae and one outer and one distal simple setae; article 3 with seven distal simple setae. Flagellar article 1 with

one distal plumose sensory seta and one inner distal simple seta; article 2 with two aesthetascs and three distal simple setae; article 3 with two aesthetascs and three distal simple setae; article 4 with five aesthetascs and three distal simple setae; article 5 tiny, naked; article 6 tiny, with five simple setae.

Antenna (Fig. 4F, f1) with five peduncular articles and five flagellar articles.

Peduncular article 1 triangular; article 2 with two distal simple setae; article 3 with one inner and two distal simple setae; article 4 with one distal plumose sensory seta and 10 simple setae; article 5 with four distal plumose sensory setae and seven middle and 13 distal simple setae. Flagellar article 1 with numerous inner simple setae; articles 2–5 tiny, with numerous simple setae.

Mandible (Fig. 4G) with 3-articulate palp. Palp article 1 with one distal simple seta; article 2 longest, with one distal simple seta; article 3 with 11 spiniform setae. Molar absent. Incisor acute.

Maxilla (Fig. 4H) slender, with 11 teeth and narrow lamella.

Maxilliped (Fig. 4I) with uniarticulate palp. Palp article 1 long, with 11 simple setae and one proximal seta (tip broken). Endite absent.

Pereopod 1 (Fig. 5A) subchelate. Basis with three dorsal plumose sensory setae and nine dorsal and five ventral simple setae. Ischium with 10 simple setae and two setae (tips broken). Merus with two dorsal and three ventral simple setae. Carpus triangular, with 12

ventral simple setae. Propodus broader proximally and narrower distally, with 11 outer short simple setae, one dorsodistal simple seta, and one dorsodistal seta (tip broken). Palm with proximal trapezoidal projection and 29 simple setae. Dactylus with 10 ventral, one ventrodistal, and three inner simple setae. Unguis nearly one-quarter dactylus length, naked.

Pereopod 2 (Fig. 5B) subchelate, slightly narrower than pereopod 1. Basis with two dorsal plumose sensory setae and 21 short simple setae. Ischium with six dorsal and 13 ventral simple setae. Merus with four dorsal and nine ventral simple setae. Carpus triangular, with nine simple setae. Propodus oval, with one dorsodistal plumose sensory seta and three dorsal, three dorsodistal, and six outer simple setae. Palm with eight spiniform setae with sensory bristle sensu Negoescu (1994) and 16 simple setae. Dactylus with nine ventral, three ventrodistal, and five inner simple setae. Unguis about one-sixth dactylus length, naked.

Pereopod 3 (Fig. 5C) subchelate, similar to pereopod 2 except in numbers of spiniform setae with sensory bristle and simple setae. Palm with seven spiniform setae with sensory bristle.

Pereopod 4 (Fig. 5D, d1) narrower than pereopods 2 and 3. Basis with four dorsal plumose sensory setae and 10 simple setae. Ischium with two dorsal and 15 ventral simple setae, and ventral seta (tip broken). Merus with two dorsal and 10 ventral simple setae. Carpus rectangular, with three ventral spiniform setae with sensory bristle, three outer dorsodistal tiny spiniform setae, one dorsal plumose sensory seta, and two dorsodistal and

eight ventral simple setae. Propodus narrowly rectangular, with three ventral spiniform setae with sensory bristle, one dorsodistal plumose sensory seta, seven dorsal and one ventrodistal simple setae, and 12 ventral small triangular processes. Dactylus with four ventral, four ventrodistal, and four outer simple setae. Unguis about one-sixth dactylus length, naked.

Pereopods 5–7 (Fig. 5E–G, g1) similar to pereopod 4 except in number of spiniform setae with sensory bristle, plumose sensory setae, and simple setae. Carpi with four (pereopod 5) or five (pereopods 6 and 7) ventral spiniform setae with sensory bristle.

Pleopod 1 (Fig. 6A) protopod with six inner hooks. Exopod with 45 plumose setae and 27 simple setae on surface. Endopod with 24 plumose setae.

Pleopods 2–5 (Fig. 6B–E) similar. Protopods with two or three inner hooks and zero or one outer simple seta. Exopods 2–5 with slit in middle and zero or one outer proximal simple seta; 19, 17, 15, and 14 distal plumose setae, respectively; and zero, one, one, and five short simple setae, respectively. Endopods 2–5 articulate, with nine, seven, six, and seven distal plumose setae, respectively.

Uropod (Fig. 6F, G) protopod triangular-prism shaped, with three outer distal plumose setae, two inner and 20 outer simple setae, and one inner and one outer setae (tips broken). Endopod triangular, tapering, 2.04 times longer than wide, with four distal plumose sensory setae, 46 simple setae, and six setae (tips broken). Exopod narrow, tapering, 2.72 times longer than wide, with 20 plumose setae, 45 simple setae, and 24 setae (tips broken).

Description of male allotype. Body (Fig. 3C) similar to female, with same pigmentation pattern. Eye length 0.20 times head length, with scattered ommatidia. Telson length 2.47 times width; base 0.73 times width.

Antennula (Fig. 7A) with three peduncular and six flagellar articles. Peduncular article 1 longest, with one distal plumose sensory seta and three simple setae; article 2 with two outer plumose sensory setae and three distal simple setae; article 3 with six distal simple setae. Flagellar article 1 with one plumose sensory seta; article 2 naked; article 3 with two aesthetascs and five distal simple setae; article 4 with two aesthetascs and four distal simple setae; article 5 tiny, with one aesthetasc; article 6 tiny, with one aesthetasc and four simple setae.

Antenna with five peduncular articles and several tiny flagellar articles; similar to that in female, except in number of simple setae.

Mandible with 3-articulate palp (Fig. 7B). Palp article 1 naked; article 2 longest, with one seta (tip broken); article 3 with eight spiniform setae.

Maxilla lost during dissection.

Maxilliped similar to that in female.

Pereopod 1 broken.

Pereopods 2 and 3 similar to those in female, dactylus more slender; differing in number of simple setae.

Pereopods 4–7 similar to those in female but more slender; carpus with three (pereopods 4, 5, and 7) or four (pereopod 6) spiniform setae and propodus with three spiniform setae; differing from those in female in number of plumose sensory setae and simple setae.

Pleopod 1 (Fig. 7C) protopod with four inner hooks. Exopod with 28 plumose setae (possibly 30; two pores observed) and 20 simple setae on surface. Endopod with 28 plumose setae.

Pleopod 2 (Fig. 7D) protopod with two inner hooks and one inner simple seta. Exopod with a short outer slit in the middle, with 11 distal plumose setae and three outer simple setae. Endopod not articulate, with distal eight plumose setae and appendix masculina reaching past distal margin of endopod and curving to outside. Pleopods 3–5 broken.

Uropod similar to that in female. Exopod 2.81 times longer than wide.

Variation. The range in the ratio of eye length to head length was 0.20–0.22. The spiniform setae on article 3 of the mandibular palp ranged in number from eight for the allotype and paratype ICHUM8807 to 11 for the holotype and paratype ICHUM8808. The numbers were the same for the left and right palps within specimens. The range in the length to width ratio of the uropodal exopod was 2.72–2.84 among six uropodal exopods for three females and one male; the remaining two uropodal exopods were lost (ICHUM8808) or broken (allotype).

Genetic information. A partial COI sequence (658 bp, encoding 219 amino acids; LC778095) was determined from paratype ICHUM8807. In BLAST searches (Altschul et al. 1990), the COI sequence most similar to that from our species was from the congener *Paranthura japonica* (accession number LC661620.1; identity score 77.51%, query cover 100%; Shiraki & Kakui 2022). No other congeneric COI sequences have yet been deposited in public databases.

Remarks. As *Paranthura oriens* sp. nov. has fused pleonites 1–5, this species belongs in Group E. *Paranthura oriens* sp. nov. differs from its 17 congeners in Group E in the following combination of characters: (1) the apical edge of the telson is rounded, not sharp, (2) the uropodal endopod is triangular and tapering, and (3) the uropodal exopod is narrow, 2.72–2.84 times longer than wide. While the orange pigmentation on the anterior part of head, bases of the antennula and antenna, and uropod is also characteristic of the new species, we observed it to be somewhat faded 21 months after fixation, and it may be completely lost after long preservation in ethanol. In contrast, the dark brown pigmentation had not faded after 21 months in ethanol.

The above three characters differentiate *P. oriens* sp. nov. from the Group A species *P. lineata*, for which information on the condition of pleonites 1–5 is ambiguous (see the Remarks section for *Paranthura* above). *Paranthura oriens* sp. nov. also differs from the two species for which the condition of pleonites 1–5 is unknown: from *P. antillensis* in the shape

of the uropodal endopod (triangular, longer than wide in *P. oriens* sp. nov. vs. subcircular, as long as wide in *P. antillensis*; Barnard 1925), and from *P. neglecta* in the ratio of the length of pleonite 1 to the combined lengths of pleonites 2–4 (pleonite 1 much shorter than pleonites 2–4 in *P. oriens* sp. nov. vs. somewhat longer in *P. neglecta*; Beddard 1886).

The Kimura (1980) 2-parameter (K2P) distance for COI between *Paranthura oriens* sp. nov. paratype ICHUM8807 (LC778095) and a *P. japonica* topotype specimen (LC661620; Shiraki & Kakui 2022) was 27.2%. This value is greater than the maximum 4.79% intraspecific variation observed among several isopod species (Raupach et al. 2015), supporting our conclusion from morphology that *P. oriens* sp. nov. and *P. japonica* in Group E are different species.

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References

Altschul SF, Gish W, Miller W, Myers EW, Lipman DJ (1990) Basic local alignment search tool. *J Mol Biol* 215: 403–410.

Barnard KH (1914) Contributions to the crustacean fauna of South Africa. 3. Additions to the marine Isopoda, with notes on some previously incompletely known species. *Ann S Afr Mus* 10: 325a–358a, 359–440.

Barnard KH (1925) A revision of the family Anthuridae (Crustacea Isopoda), with remarks on certain morphological peculiarities. *Zool J Linn Soc* 36: 109–160.

Bate CS, Westwood JO (1866) A history of the British sessile-eyed Crustacea. Vol. 2. John Van Voorst, London, 536 pp.

Beddard FE (1886) Report on the Isopoda collected by H.M.S. Challenger during the years 1873–76, Part II. Report of the Voyage of H.M.S. Challenger 17: 1–178.

Boone PL (1920) *Calamura porteri* a new genus and species of isopod from Chile. *Rev Chil Hist Nat* 24: 25–31.

Boone PL (1923) New marine tanaid and isopod Crustacea from California. *Proc Biol Soc Wash* 36: 147–156.

Boyko CB, Bruce NL, Hadfield KA, Merrin KL, Ota Y, Poore GCB, Taiti S (Eds) (2024)

World marine, freshwater and terrestrial isopod crustaceans database. *Paranthura*

Bate & Westwood, 1866. Available at:

<https://www.marinespecies.org/aphia.php?p=taxdetails&id=118307> (accessed on 30 September 2024)

Chew M, Abdul Rahim A (2020) A checklist of the marine Anthuroidea (Crustacea: Isopoda:

Cymothoida) from the reefs of peninsular Malaysia, with some new distributional data. *Biodivers Data J* 8: e54748.

Chilton C (1882) Additions to the New Zealand Crustacea. *Trans Proc New Zeal Inst* 14:

171–174, Pl. 8.

Chilton C (1906) Note on some Crustacea from the freshwater lakes of New Zealand. *Proc*

Zool Soc Lond 1906: 702–705.

Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R (1994) DNA primers for amplification of

mitochondrial cytochrome *c* oxidase subunit I from diverse metazoan invertebrates.

Mol Marine Biol Biotechnol 3: 294–299.

Frutos I, Sorbe JC, Junoy J (2011) The first blind *Paranthura* species (Crustacea, Isopoda,

Paranthuridae) from the 'El Cachucho' Marine Protected Area (Le Danois Bank, southern Bay of Biscay). *Zootaxa* 2971: 17–32.

Kensley B, Schotte M (2000) New species and records of anthuridean crustaceans from the

- Indian Ocean. *J Nat Hist* 34: 2057–2121.
- Kimura M (1980) A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences. *J Mol Evol* 16: 111–120.
- Leach WE (1814) Crustaceology. In: *The Edinburgh Encyclopædia*. Vol. 7. (ed. Brewster D). William Blackwood, Edinburgh. Pp. 383–437.
- Menzies RJ, Glynn PW (1968) The common marine isopod Crustacea of Puerto Rico: A handbook for marine biologists. *Studies on the Fauna of Curaçao and other Caribbean Islands* 27: 1–133.
- Negoescu I (1994) Isopoda Anthuridea (Crustacea: Peracarida) from New Caledonia and Loyalty Islands (South-western Pacific Ocean), I. *Trav Mus Natl Hist Nat “Grigore Antipa”* 34: 147–225.
- Negoescu I (1997) Isopoda Anthuridea. Results of the zoological expedition organized by "Grigore Antipa" Museum in the Indonesia Archipelago (1991). 1. Peracarida (Crustacea). *Trav Mus Natl Hist Nat “Grigore Antipa”* 38: 177–251.
- Negoescu I (1999) Isopoda Anthuridea (Crustacea) from Fiji Islands. Three new species, first record of primary and secondary males in Paranthuridae family. *Trav Mus Natl Hist Nat “Grigore Antipa”* 41: 199–280.
- Nunomura N (1974) Marine Isopoda from the coast of Hikigawa Town, Kii Peninsula, middle Japan (1). *Bull Osaka Mus Nat Hist* 28: 1–12.

Nunomura N (1977) Marine Isopoda from Amakusa, Kyushu (1). Publ Amakusa Mar Biol

Lab 4: 71–90.

Nunomura N, Shimomura M (2012) Isopoda from Japan (14) Suborder Cymothoidea—

Superfamily Anthuroidea 2—Family Paranthuridae. Aquabiology 34: 180–189. (in

Japanese)

Poore GCB (1978) *Leptanthura* and related genera (Crustacea, Isopoda, Anthuridea) from

eastern Australia. Mem Mus Vic 39: 135–169.

Poore GCB (1981) Marine Isopoda of the Snares Islands, New Zealand—1. Gnathiidea,

Valvifera, Anthuridea, and Flabellifera. N Z J Zool 8: 331–348.

Poore GCB (1984) *Paranthura* (Crustacea, Isopoda, Paranthuridae) from south-eastern

Australia. Mem Mus Vic 45: 33–69.

Poore GCB (2001) Families and genera of Isopoda Anthuridea. Crustacean Issues 13: 63–

173.

Raupach MJ, Barco A, Steinke D, Beermann J, Laakmann S, Mohrbeck I, Neumann H,

Kihara TC, Pointner K, Radulovici A, Segelken-Voigt A, Wesse C, Knebelsberger T

(2015) The application of DNA barcodes for the identification of marine crustaceans

from the North Sea and adjacent regions. PLoS One 10: e0139421.

Schneider C, Rasband W, Eliceiri K (2012) NIH Image to ImageJ: 25 years of image analysis.

Nature Methods 9: 671–675.

- Shiraki S, Shimomura M, Kakui K (2021) A new species of *Expanathura* (Crustacea: Isopoda: Anthuroidea) from Iriomote Island, Japan, with a note on male polymorphism. *Zootaxa* 5047: 377–390.
- Shiraki S, Kakui K (2022) Observations on predation in *Paranthura japonica* Richardson, 1909 (Isopoda: Cymothoidea: Paranthuridae). *Zool Sci* 39: 1–5.
- Shiraki S, Shimomura M, Kakui K (2022) A new neotenous genus and species, *Deltanthura palpus* gen. et sp. nov. (Isopoda, Anthuroidea, Paranthuridae) from Japan, with a revised key to the genera in Paranthuridae. *Zoosyst Evol* 98: 109–115.
- Wägele JW (1981) Zur Phylogenie der Anthuridea (Crustacea, Isopoda) mit Beiträgen zur Lebensweise, Morphologie, Anatomie und Taxonomie. *Zoologica (Stuttgart)* 132: 1–127.
- Wägele JW (1982) Neubeschreibung und Vergleich der mediterranen *Paranthura*-Arten (Crustacea, Isopoda, Anthuridea). *Mar Ecol* 3: 109–132.
- Whitelegge T (1901) Scientific results of the trawling expedition of H.M.C.S. "Thetis" on the coast of New South Wales. Crustacea. Part II. Isopoda. Part I. *Aust Mus Mem* 4: 203–246.

Figure legends

Fig. 1. Habitat of *Paranthura oriens* sp. nov. at the type locality, photographed by an underwater drone at 6.5 m depth off Kouyatsu (34°58.933'N, 139°49.136'E), Tateyama, Chiba, Japan, on 20 April 2021.

Fig. 2. Five species groups in *Paranthura* based on the condition of the pleonites. Group A (37 species), free pleonites 1–5; Group B (one species), free pleonites 1–3 and fused pleonites 4 and 5; Group C (seven species), free pleonite 1 and dorsally fused pleonites 2–5; Group D (one species), dorsally fused pleonites 1–3 and free pleonites 4 and 5; Group E (17 species), pleonites 1–5 dorsally fused. Two species in *Paranthura* remain unplaced due to a lack of relevant information. Abbreviations: p7, pereonite 7; pl1–5, pleonites 1–5.

Fig. 3. *Paranthura oriens* sp. nov. **A**, holotype, ovigerous female, dorsal view, fixed specimen. **B**, paratype ICHUM8807, female lacking oostegites, dorsal view, living animal. **C**, allotype male lateral view, fixed specimen. Scale bars: 1 mm.

Fig. 4. *Paranthura oriens* sp. nov., holotype, ovigerous female. **A**, **B**, body, dorsal and lateral views. **C**, head, dorsal view. **D**, right antennula. **E**, right antennula from another angle

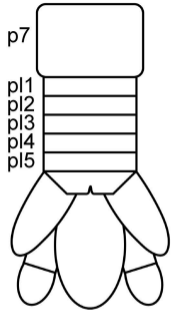
(setae omitted). **F**, right antenna; **f1**, tip of flagellar article 1 of right antenna, with tiny articles 2–5 (setae omitted). **G**, left mandible. **H**, right maxilla. **I**, maxilliped. Scale bars: 1 mm (**A–C**); 200 μm (**D–I**); 50 μm (**f1**).

Fig. 5. *Paranthura oriens* sp. nov., holotype, ovigerous female. **A–F**, left pereopods 1–6; **d1**, three outer dorsodistal tiny spiniform setae on carpus of left pereopod 4 (outer view). **G**, right pereopod 7; **g1**, dactylus and unguis of right pereopod 7. Scale bars: 1 mm (**A–G**, **g1**); 100 μm (**d1**).

Fig. 6. *Paranthura oriens* sp. nov., holotype, ovigerous female. **A–E**, left pleopods 1–5. **F**, right uropodal endopod. **G**, right uropodal exopod. **H**, telson, ventral view. Scale bars: 500 μm .

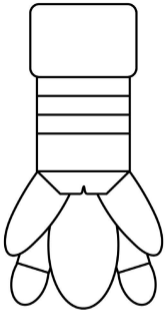
Fig. 7. *Paranthura oriens* sp. nov., allotype, male. **A**, left antennula. **B**, left mandibular palp. **C**, right pleopod 1. **D**, left pleopod 2. Scale bars: 100 μm .





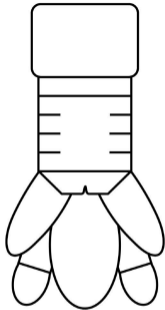
Group A

37 spp.



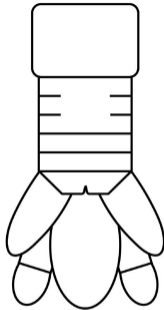
Group B

1 sp.



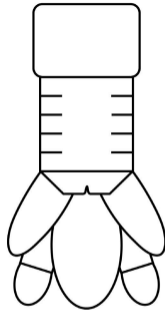
Group C

7 spp.



Group D

1 sp.



Group E

18 spp.

A**B****C**