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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

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Abstract

We describe a new paranthurid isopod genus and species, *Deltanthura palpus* **gen. et sp. nov.**, collected from a depth of 805–852 m off the southern coast of Mie prefecture, Japan. *Deltanthura* is similar to *Pseudanthura* Richardson, 1911 in having a triangular pleotelson, acute mandible with a 3-articulate palp, a maxillipedal endite, and a tapering uropodal exopod, but differs in having eyes and neotenous characters (reduced pereonite 7 and pereopods 7 lacking). *Deltanthura* and four paranthurid genera (*Califanthura* Schultz, 1977, *Colanthura* Richardson, 1902, *Cruranthura* Thomson, 1946, and *Cruregens* Chilton, 1882) share neotenous characters, but in *Deltanthura* the mandible is acute, with a 3-articulate palp and maxillipedal endites are present. *Califanthura minuta* Kensley & Heard, 1991 may belong in *Deltanthura* as they share the triangular pleotelson and tapering uropodal exopod, but we refrain from transferring it to *Deltanthura* as its description lacks the other diagnostic characters of *Deltanthura*. We provide a revised key to all genera in Paranthuridae Menzies & Glynn, 1968.

Key Words

Califanthura, Cymothoida, deep sea, neoteny, Peracarida, taxonomy

Introduction

Species in the anthuroid isopod family Paranthuridae Menzies & Glynn, 1968 have the mouthparts acutely produced; the palm of pereopod 1 lacks a proximal tooth; and statocysts are absent (Poore 2001). Paranthuridae comprises six genera: *Paranthura* Bate & Westwood, 1866, *Pseudanthura* Richardson, 1911, *Califanthura* Schultz, 1977, *Colanthura* Richardson, 1902, *Cruranthura* Thomson, 1946, and *Cruregens* Chilton, 1882. The latter four are neotenous genera in which non-manca individuals lack pereopod 7, as is the case for manca-stage individuals, and share the character combination of having a blunt mandible lacking a palp and an extremely reduced pereonite 7. On the basis of morphological observations, Poore (1984) hypothesized that (1) the four neotenous genera comprise a monophyletic group (hereafter, the "neotenous clade"); (2) *Paranthura* is the sister group to the neotenous clade, as species in both groups lack maxillipedal endites; and (3) *Pseudanthura* is the most basal genus in Paranthuridae.

We collected a paranthurid individual lacking pereopod 7 from off the southern coast of Mie, Japan, but unlike the four known neotenous paranthurid genera, its mandible bears an acute incisor and 3-articulate palp, and its maxilliped bears an endite. Here we describe the species as new, establish a new genus for it, and provide a revised key to the genera in Paranthuridae.

Materials and methods

A single specimen was collected in 2008 from Shima Spur off the southern coast of Mie prefecture, Japan, with a 3-m beam trawl at a depth between 805 and 852 m, during the cruise KT 08-3 of RV *Tansei-maru*. The specimen was fixed in 5–10% borate-buffered formalin in seawater and preserved in 70% ethanol. The methods for dissection, observation, drawing, and measurement 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 portion of pereonite 4. The specimen examined is deposited in the collections of the Seto Marine Biological Laboratory (SMBL-V0645).

Systematics

Superfamily Anthuroidea Leach, 1814
Family Paranthuridae Menzies & Glynn, 1968

Deltanthura gen. nov.

http://zoobank.org/04EA59DC-C5AD-486B-A3CB-AA7076F5ABE5

New Japanese name. *Sankaku-ashitarazu-uminanafushi-zoku*

Diagnosis. Eyes present. Pereonite 7 reduced and hidden laterally. Pleonites 1–5 fused but with sutures. Pleonite 6 entirely fused dorsally to telson; pleotelson triangular, without statocyst. Mandible acute, with 3-articulate palp. Maxilliped with 4-articulate palp; endite present. Pereopod 7 absent on non-manca individuals. Uropodal exopod elongate triangular, tapering.

Type species. *Deltanthura palpus* Shiraki, Shimomura & Kakui, by original designation.

Etymology. The generic name is a combination of the Greek letter *delta* (δέλτα), which is triangular in shape, referring to the shape of pleotelson, prefixed to *anthura*, from Greek *anthos* (a flower) and *oura* (a tail). The gender is feminine.

Remarks. Like *Pseudanthura* and *Paranthura*, *Deltanthura* has an acute mandible with a 3-articulate palp, but it differs from the former two genera in having pereonite 7 reduced and in lacking pereopods 7. *Deltanthura* and four paranthurid genera share neotenous characters (reduced pereonite 7 and pereopods 7 lacking), but in *Deltanthura* the mandible is acute, with a 3-articulate palp and maxillipedal endites present, characters that are unique among the neotenous paranthurid genera (Table 1).

Deltanthura gen. nov. does not fit well within the clade (*Paranthura* + neotenous clade) (cf. Poore 2001), as it has a maxillipedal endite. Rather, *Deltanthura* seems to be more closely related to *Pseudanthura*, as these two share multiple character states such as a triangular pleotelson; elongate triangular, tapering uropodal exopod; and maxillipedal endite. If this latter hypothesis is correct, the neotenous condition in Paranthuridae may not have had a single origin. In addition to the five neotenous genera now known in Paranthuridae, three neotenous genera are known in anthuroid isopods (Poore 2009): the monotypic genera *Exallanthura* Kensley, 1980 and *Leipanthura* Poore, 2009 in Anthuridae Leach, 1814; and the genus *Curassanthura* Kensley, 1981 in Leptanthuridae Poore, 2001. We note that Poore (2009) pointed out that the *Exallanthura* females *sensu* Kensley (1980) may actually have been manca individuals.

The neotenous species *Califanthura minuta* Kensley & Heard, 1991 from the British West Indies may belong in *Deltanthura* gen. nov. It has the triangular pleotelson and tapering uropodal exopod (Kensley and Heard 1991) that occur in *Deltanthura* but not in other *Califanthura* species. However, as the shape of mandible and the presence or absence of the maxillipedal endite (characters diagnostic for *Deltanthura*) are unknown for *C. minuta*, we refrain from transferring it to *Deltanthura*.

Deltanthura palpus sp. nov.

http://zoobank.org/290406E3-4688-4CC7-8A3F-DC104E7C7BBF

[New Japanese name: *Sankaku-ashitarazu-uminanafushi*]

Figs 1–4

Material examined. *Holotype*. Japan • 1 female lacking oostegites, body length 7.03 mm, body width 0.91 mm; Mie prefecture, off the southern coast, Shima Spur, Stn. SM-01-(1); 34°00.83'N, 136°53.79'E to 34°01.42'N, 136°51.80'E; depth 805–852 m; 4 Mar. 2008; Tadashi Akiyama leg.; SMBL-V0645, 12 slides and 1 vial.

Etymology. The specific name, *palpus* (Latin: palp), is a singular noun in the nominative case, referring to the presence of a mandibular palp, a unique trait in paranthurid neotenous genera.

Description of holotype female. Body relatively slender (Figs 1, 2A–C), length 7.69 times width. Head (Fig. 2A) length 1.02 times head width, roughened, irregular dorsally; rostrum protruding as much as anterolateral lobes; eyes dorsolateral, with scattered ommatidia. Pereonites 1–7 (Fig. 2A, B) roughened, irregular dorsally, with length ratio 1.00:1.02:1.26:1.19:1.08:0.78:0.18; pereonite 7 (Fig. 2B, C) reduced, hidden laterally, lacking pereopod 7. Pleonites 1–5 (Fig. 2B, C) fused but with sutures, length 0.06 times body length. Pleonite 6 entirely fused dorsally to telson (Figs 2B, C, 4H); pleotelson triangular, length 1.04 times width, with four dorsal and six apical simple setae.

Antennula (Fig. 2D) with three peduncular and six flagellar articles. Peduncular article 1 with one inner and two outer plumose sensory setae; article 2 with inner simple seta; article 3 with three inner and one outer simple setae. Flagellar articles 1 and 2 naked; article 3 with distal aesthetasc and three distal simple setae; article 4 with distal aesthetasc; article 5 with distal aesthetasc and simple seta; article 6 with four distal simple setae.

Antenna (Fig. 2E) with five peduncular and nine flagellar articles. Peduncular article 1 with outer simple

Table 1. Comparison of selected characters among the seven genera in Paranthuridae.

Characters	Pseudanthura Richardson, 1911	Paranthura Bate & Westwood, 1866	Califanthura Schultz, 1977	Colanthura Richardson, 1902	Cruranthura Thomson, 1946	Cruregens Chilton, 1882	Deltanthura gen. nov.
Eyes	Absent	Present/absent	Present	Present	Present	Absent	Present
Pereonite 7	Not hidden laterally	Not hidden laterally	Hidden laterally	Hidden laterally	Not hidden laterally	Not hidden laterally	Hidden laterally
Pleonites 1–5	Fused	Free or fused	Fused	Indicated by folds	1 free, 2–5 fused	Free	Fused
Pleonite 6 and telson	Fused dorsally	Not fused dorsally	Not fused dorsally	Not fused dorsally	Not fused dorsally	Not fused dorsally	Fused dorsally
Mandible	Acute	Acute	Blunt	Blunt	Blunt	Blunt	Acute
Mandibular palp	3-articulate	3-articulate	Absent	Absent	Absent	Absent	3-articulate
Maxillipedal endite	Present	Absent	Absent	Absent	Absent	Absent	Present
Pereopod 7 in non-manca individuals	Present	Present	Absent	Absent	Absent	Absent	Absent
Uropodal exopod	Tapering	Oval	Oval	Oval	Oval	Oval	Tapering
References	Poore and Lew Ton (1986)	Frutos et al. (2011), Poore (2001)	Poore (2001)	Poore (2001)	Poore (2001)	Poore (2001)	Present study

Figure 1. *Deltanthura palpus* sp. nov., holotype, female, lateral view of fixed specimen. Scale bar: 1 mm.

seta; article 2 with two distal simple setae; article 3 with two inner simple setae; article 4 with two distal plumose sensory setae and three simple setae; article 5 with four distal plumose sensory setae and four inner simple setae. Flagellar articles 1–9 with four, four, seven, four, three, three, two, four and zero distal simple setae, respectively.

Mandible (Fig. 2F) with 3-articulate palp. Palp article 1 naked; article 2 with distal simple seta; article 3 with eleven simple setae. Molar absent. Incisor acute.

Maxilla (Fig. 2G) slender, with twelve teeth and narrow lamella.

Maxilliped (Fig. 2H) with 4-articulate palp. Palp articles 1 and 2 long, 3 and 4 short, with one, four, one, and three simple setae, respectively. Endite present, reaching middle of article 2, with distal simple seta. Epipod oval.

Pereopod 1 (Fig. 3A) subchelate, robust. Basis with three dorsal plumose sensory setae and ventrodistal seta (tip broken). Ischium with one outer and one ventrodistal simple setae. Merus with two dorsal, one outer, and one ventral simple setae. Carpus strongly protruding ventrodistally, with three inner mid-ventral spiniform setae and four simple setae. Propodus broad, with two inner proximal spiniform setae, and one outer, four dorsal, and one distal simple setae. Palm with five outer spiniform setae and seven simple setae. Dactylus and unguis fused, with two ventral and five middle simple setae.

Pereopod 2 (Fig. 3B) narrow. Basis with two dorsal plumose sensory setae, two simple setae, and dorsal seta (tip broken). Ischium with three simple setae. Merus with two dorsal and two ventrodistal simple setae. Carpus triangular, longer than wide, with three ventrodistal simple setae and ventrodistal seta (tip broken). Propodus with dorsal plumose sensory seta, three ventral spiniform setae, and two dorsal and three ventral simple setae. Dactylus with ventrodistal thick seta and three ventral, three ventrodistal, and four inner distal simple setae. Unguis naked.

Pereopod 3 (Fig. 3C) similar to pereopod 2 except in number of setae.

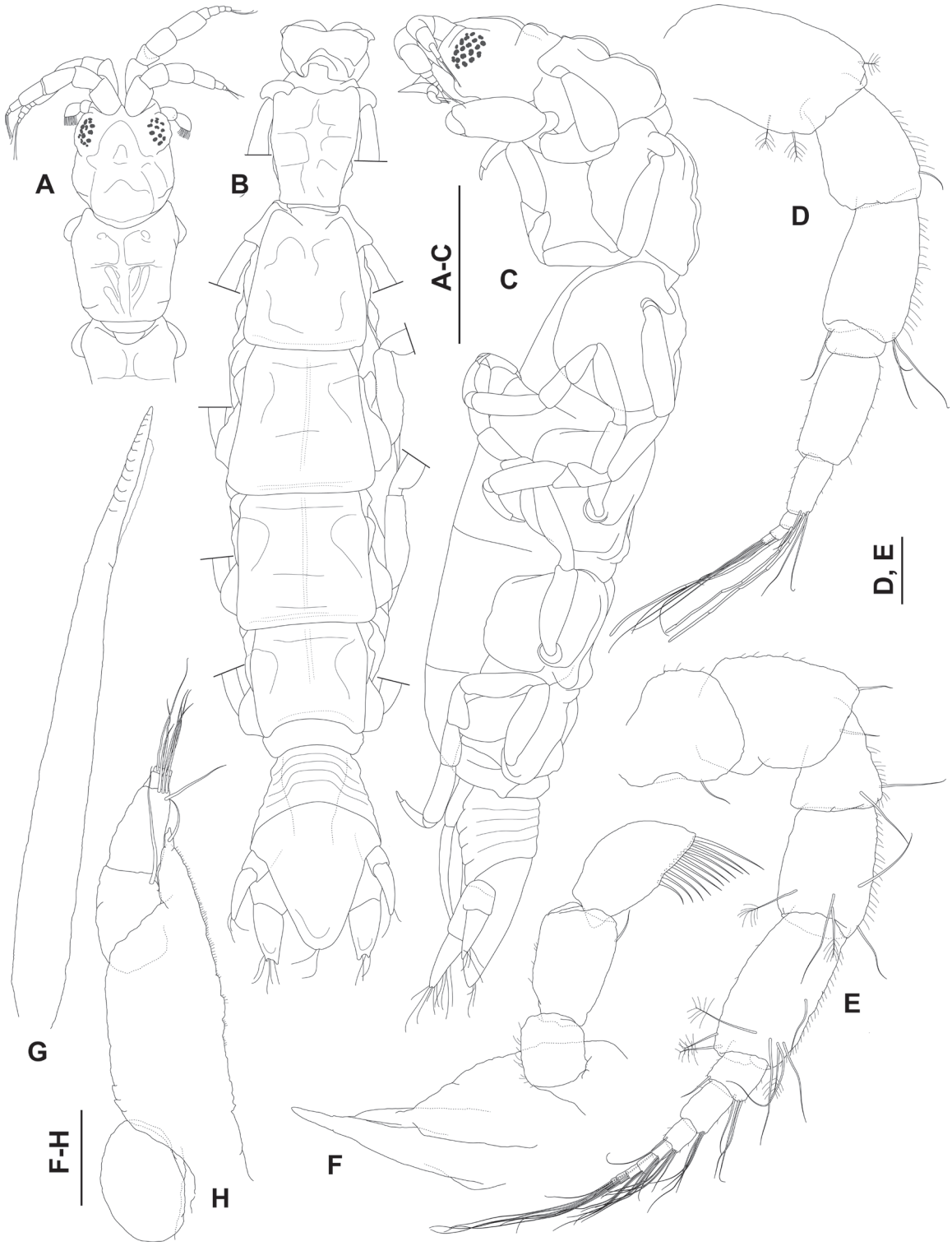

Figure 2. *Deltanthura palpus* sp. nov., holotype, female. **A.** Dorsal view of head and pereonite 1; **B.** Dorsal view from pereonite 2 to telson; **C.** Lateral view; **D.** Left antennula; **E.** Left antenna; **F.** Right mandible; **G.** Right maxilla; **H.** Right maxilliped. Scale bars: 1 mm (**A–C**); 100 µm (**D–H**).

Pereopods 4–6 (Fig. 3D–F) narrower than pereopod 2, but similar to it except in number of setae and shape of carpus. Carpus rectangular, with ventrodistal spiniform seta.

Pleopod 1 (Fig. 4A) protopod with inner simple seta and outer seta (tip broken). Exopod operculiform, distal margin serrate, with 15 marginal plumose setae and four simple setae on surface. Endopod 0.53 times longer than exopod, with three distal simple setae.

Pleopods 2–5 (Fig. 4B–E) similar to one another. Protopod with one or two simple setae. Exopod with five to seven distal plumose setae and outer simple (pleopods

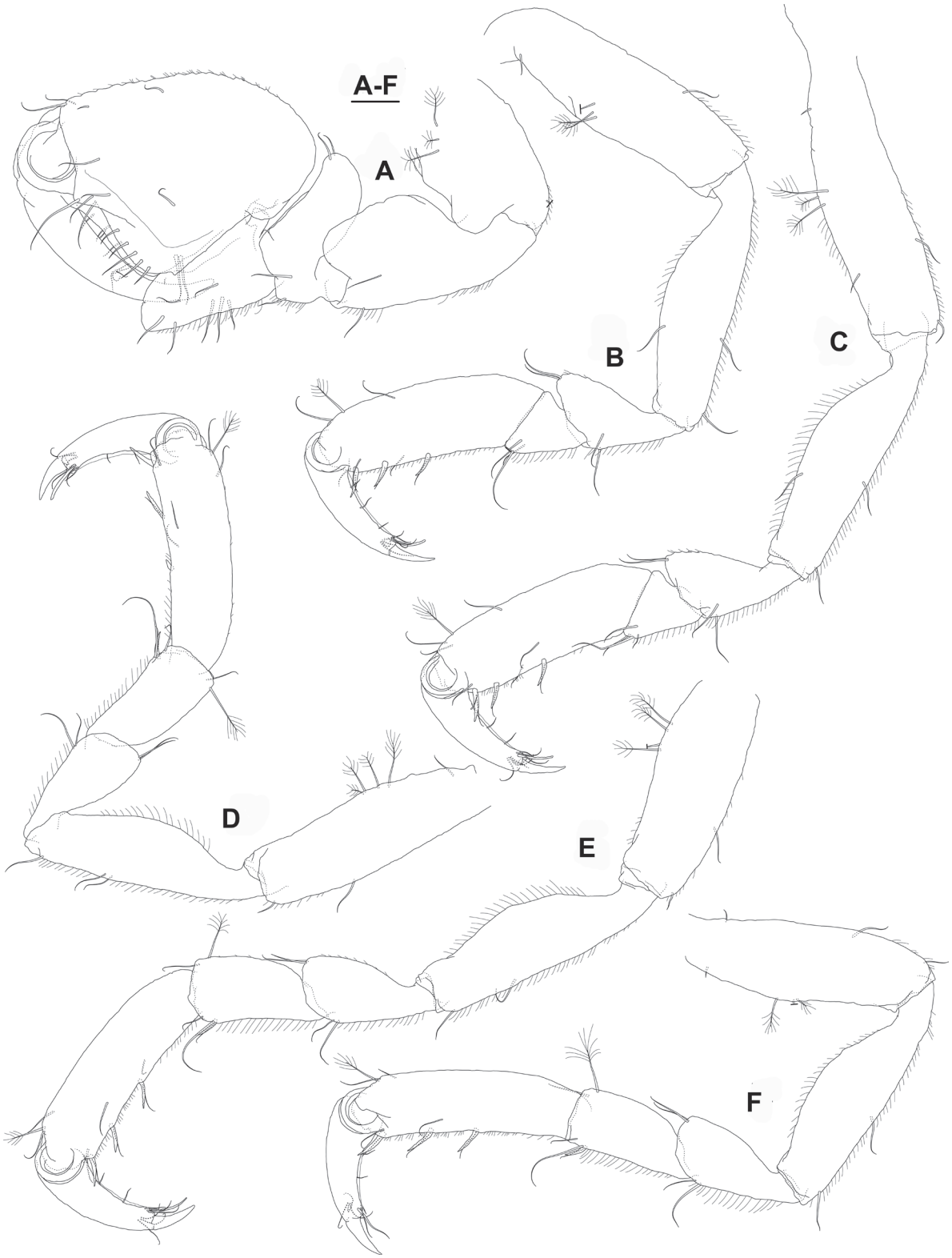

Figure 3. *Deltanthura palpus* sp. nov., holotype, female. **A–F.** Left pereopods 1–6. Scale bar: 100 μm.

2–4) or plumose (pleopod 5) seta. Endopod with three distal plumose setae.

Uropod (Fig. 4F, G) with protopod bearing two outer and one inner plumose setae and outer simple seta. Exopod elongate triangular, tapering, with five (right) and 10 (left) simple setae. Endopod with two distal projections, five outer and three distal plumose sensory setae, and 12 distal simple setae.

Remarks. Our specimen lacks oostegites and an appendix masculina, but its pereon is expanded ventrally (Fig. 1), leading us to conclude that it is a female prior to spawning, rather than a manca-stage individual. The

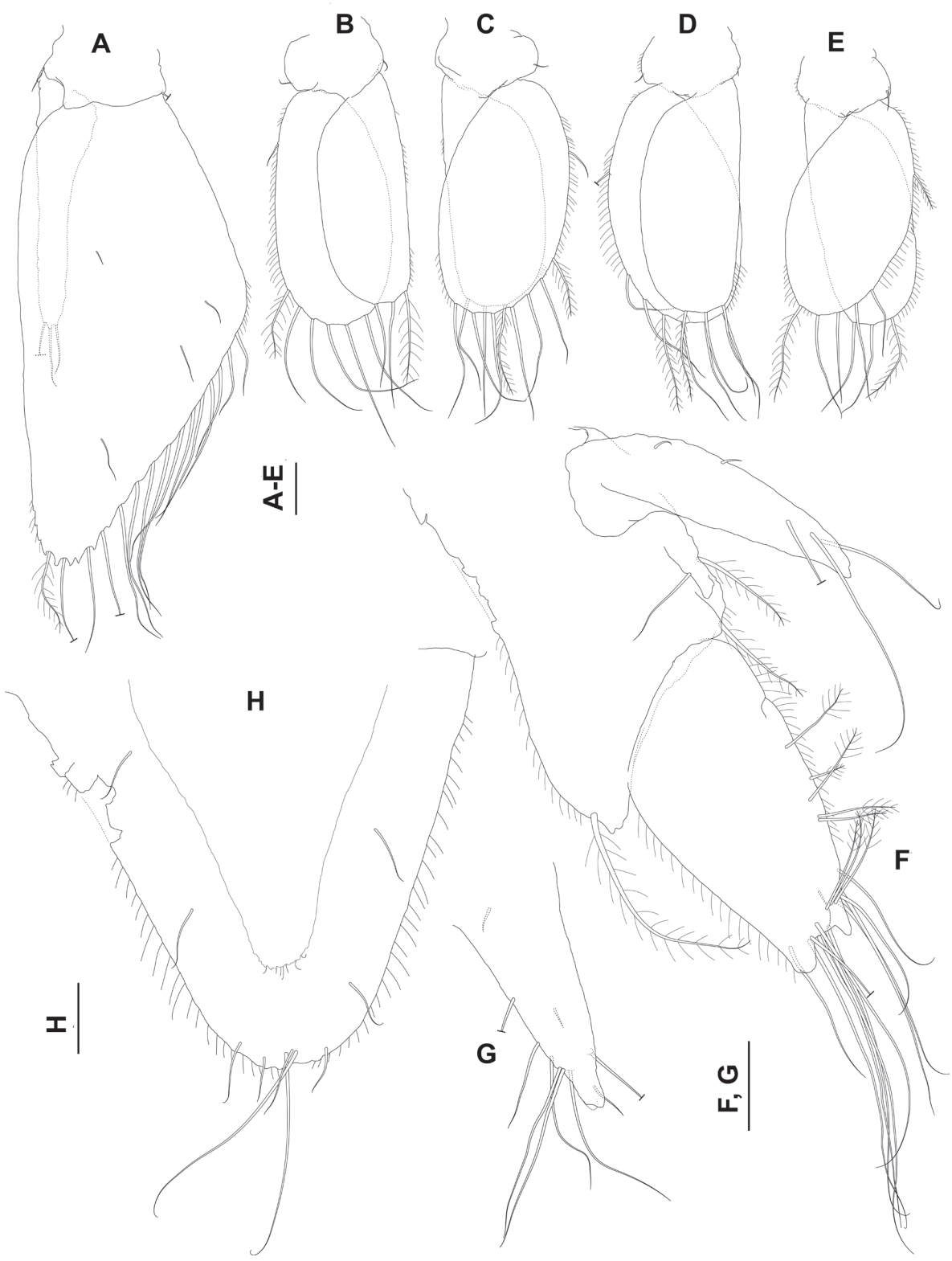

Figure 4. *Deltanthura palpus* sp. nov., holotype, female. **A–E.** Left pleopods 1–5 (most setal ornamentation omitted); **F.** Right uropod; **G.** Left uropodal exopod; **H.** Telson. Scale bars: 100 μm.

strongly reduced pereonite 7 also supports this conclusion; this segment is not as reduced as in the mancae of non-neotenous species (cf. Frutos et al. 2011: fig. 2C, D; Wägele 1981: fig. 9M). This is the fifth neotenous genus known in Paranthuridae.

Deltanthura palpus gen. et sp. nov. differs from *Califanthura minuta*, which may belong in *Deltanthura* (see Remarks above for the genus), in the following characters (character state of *C. minuta* in parenthesis): body length 7.03 mm (1.60 mm); carpus of pereopod 1 strongly protruding ventrodistally (not protruding); endopod of pleopod 1 short, about half length of exopod (elongate, slightly shorter than exopod); and uropodal endopod with two distal projections (no projections).

Key to the genera in Paranthuridae, modified from Poore (2001)

1 Pereopod 7 present in non-manca individuals 2
– Pereopod 7 lacking in non-manca individuals 3
2 Pleonite 6 marked off dorsally from telson; uropodal exopod linear or leaf-shaped ..... *Paranthura*
– Pleon and telson fused into single segment; uropodal exopod extremely reduced ..... *Pseudanthura*
3 Pleonite 6 entirely fused dorsally to telson; pleotelson tapering, triangular; mandible acute, with 3-articulate palp ..... *Deltanthura* gen. nov.
– Pleonite 6 marked off dorsally from telson; pleotelson oval; mandible blunt, without palp 4
4 Pereonite 7 hidden laterally; head as long as wide 5
– Pereonite 7 not hidden laterally; head longer than wide 6
5 Pleonites 1–5 separated by integumental folds dorsally; pleonite 1 twice as long as pleonite 2 ..... *Colanthura*
– Pleonites 1–5 fused, rarely with integumental folds dorsally; pleonites 1 and 2 similar in length ..... *Califanthura*
6 Pleonites 2–5 fused; marine or estuarine; eyes present ..... *Cruranthura*
– Pleonites all free; hypogean or freshwater; eyes lacking ..... *Cruregens*

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