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A new species and depth record of bopyrid (Crustacea, Isopoda) from a squat lobster in the Kuril-Kamchatka Trench

Jason D. WILLIAMS [1,*], Christopher B. BOYKO [2] & Ivan N. MARIN [3]

[1,2] Department of Biology, Hofstra University, Hempstead, New York 11549, USA.
[2] Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th St., New York, New York 10024, USA.
[3] A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia.

[*] Corresponding author: biojdw@hofstra.edu
[2] Email: cboyko@amnh.org
[3] Emails: coralliodecapoda@mail.ru, vanomarin@yahoo.com

[1] urn:lsid:zoobank.org:author:88CDDC0F-C48D-45DF-9F8B-34020FEC39D1
[2] urn:lsid:zoobank.org:author:2932972A-E5DF-4C4D-A834-8D8A6835357E
[3] urn:lsid:zoobank.org:author:B26ADAA5-5DBE-42B3-9784-3BC362540034

Abstract. The branchial parasitic isopod *Pleurocryptella altalis* sp. nov. (Bopyridae: Pseudioninae) is described from the squat lobster host *Munidopsis petalorhyncha* Baba, 2005. The new species is morphologically similar to *Pleurocryptella formosa* Bonnier, 1900 and *P. wolffi* Bourdon, 1972b but can be distinguished based on male characters (differences in head, pleon and uropods) and female characters (differences in barbula, pleopods and pleotelson). The parasite specimens (a female and male pair) were collected with the squat lobster host at a depth of 5060–5130 m from the Kuril-Kamchatka Trench, representing the deepest record for any of the 850+ described bopyrid isopod species and for any record of an infested host. Dichotomous identification keys to females and males of *Pleurocryptella* species and subspecies are provided.

Keywords. Ectoparasite, Epicaridea, *Pleurocryptella*, NW Pacific, *Munidopsis*.

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Introduction

The genus *Pleurocryptella* Bonnier, 1900 is generally considered to be the most primitive genus in Bopyridae Rafinesque, 1815 (Shiino 1965; Bourdon 1979; Markham 1986; Boyko & Williams 2009, 2010). Females of species in this genus all possess fully developed oostegites on pereomeres 1–5 and a rudimentary oostegite on each of pereomeres 6 and 7, whereas all other bopyrids lack oostegites on the posterior two pereomeres. Some families of isopods (e.g., Aegidae White, 1850 and Cymothoidae Leach, 1818) that may be basal to bopyrids (Boyko *et al*. 2013) contain species that possess seven oostegites.

However, the oostegite number and morphology is not thought to be useful in systematic analyses at higher phylogenetic levels (Brusca & Wilson 1991) and the presence of oostegites on pereomeres 6 and 7 could actually be a derived feature in *Pleurocryptella*, but further analysis, ideally using molecular data, is needed.

Although in many genera of bopyrids female characters are of primary taxonomic importance, males of *Pleurocryptella* provide taxonomically important characters at the genus and species levels. Males of all species of *Pleurocryptella* have well-developed pleopods, either small and rounded or broad and subquadrate or conical, and articulated uropods; uropods occur on males in only a few other bopyrid genera (e.g., *Gigantione* Kossmann, 1881; *Parapleurocryptella* Bourdon, 1972a). Both males and females of species in *Pleurocryptella* have biarticulated maxilliped palps. While unusual, this condition also occurs in a few other genera (e.g., males and females in species of *Parapleurocryptella*; males in the species of *Goleathopseudione* Román-Contreras, 2008 and *Pagurocryptella* Boyko & Williams, 2010). To date, ten species and subspecies have been described in *Pleurocryptella* from galatheid and paguroid hosts (Boyko *et al*. 2008 onwards), but *P. paguri* Bourdon, 1979 was transferred to the genus *Pagurocryptella* (see Boyko & Williams 2010: table 1 for distribution, depth and host records). Most species of *Pagurocryptella* and *Pleurocryptella* are known from deep waters (ca 200–4500 m; Boyko *et al*. 2012), with only *Pleurocryptella infecta infecta* Nierstrasz & Brender à Brandis, 1923 being known from shallower depths (55–183 m; Shiino 1937). Examination of the morphology of all nine described species and subspecies of *Pleurocryptella*, based on published and unpublished descriptions and illustrations, particularly of males, suggests that more than one phylogenetic lineage is present in the genus. The type species, *P. formosa* Bonnier, 1900, and *P. wolffi* Bourdon, 1972b appear to be more closely related to species of *Paragigantione* Barnard, 1920 than to the other taxa currently placed in *Pleurocryptella.* In the present paper, we describe a new species of *Pleurocryptella* that is closely related to *P. formosa* and *P. wolffi*. It is not only the deepest identified bopyrid ever reported, but it is from deeper water than all reported bopyridiform swellings on any decapod hosts.

Material and methods

The host specimen of *Munidopsis petalorhyncha* Baba, 2005 and the parasitic isopods were collected in the Kuril-Kamchatka Trench (45°18′ N, 156°00′ E) during the 39th cruise of the R/V '*Vityaz*' by Sigsbee trawl at abyssal depths of 5060–5130 m in August 1966 (Birstein & Zarenkov 1970) and deposited in the collection of the Zoological Museum of Moscow State University (ZMMU), Moscow, Russia. The original fixative used was not recorded; however, according to the museum staff, primary fixation was made with formalin followed by storage in 70% ethanol that allowed for preservation of the samples in very good condition for a long period of time. For the present study, the parasitic isopods (female and attached male) were carefully extracted from the host's branchial cavity and their morphology was drawn using a *camera lucida* attached to an Olympus SZX10 light microscope. Measurements were taken to 0.1 mm with a caliper: the size of the isopods is given as total length (TL) from the front edge of the head to the posterior edge of the pleotelson (exclusive of uropods); carapace length (CL) (with rostrum) and carapace width (CW) are provided for the host specimen (see Komai *et al*. 2017). The isopod type material and their host are deposited in ZMMU. For those taxonomic authorities not specifically cited in the text, we herein refer the reader to them for ease in locating original descriptions of the taxa (Rafinesque 1815; Latreille 1817; Kossmann 1881; Bonnier 1900; Barnard 1920; Nierstrasz & Brender à Brandis 1923; Codreanu 1967; Bourdon 1972a, 1972b, 1976, 1981; Markham 1974; Román-Contreras 2008).

Results

Order Isopoda Latreille, 1817
Family Bopyridae Rafinesque, 1815
Subfamily Pseudioninae Codreanu, 1967
Genus *Pleurocryptella* Bonnier, 1900

Pleurocryptella altalis sp. nov.
urn:lsid:zoobank.org:act:65006984-C3F1-4C31-ABEF-8225A15F921E
Figs 1–3

"С паразитической изоподой под карапаксом" – Birstein & Zarenkov 1970: 423, fig. 1.
"parasitic isopod" – Birstein & Zarenkov 1972: 442, fig. 1.
"bopyrid parasite" – Boyko *et al*. 2012: 25, table 1. — Marin 2020: 2, figs 1a, 17f.

Etymology

Combination of Latin words '*altum*' ('deep') and '*alis*' ('pertaining to') in reference to its occurrence at the greatest depth known for any bopyrid species.

Type material

Holotype
KURIL-KAMCHATKA TRENCH • ♀ (10.4 mm TL) from right branchial chamber of ♂ *Munidopsis petalorhyncha* Baba, 2005 (21.0 mm CL, 15 mm CW, ZMMU Ma 3504); 39th cruise of R/V '*Vityaz*', stn 5621, Sigsbee trawl; 45°18′ N, 156°00′ E; depth 5060–5130 m; 17 Aug. 1966; ZMMU Mc 1420.

Allotype
KURIL-KAMCHATKA TRENCH • 1 ♂ (4.3 mm TL); same collection data as for holotype; ZMMU Mc 1421.

Description

Female (Figs 1B, 2)
Body length 10.4 mm, maximum width 6.8 mm across pereomere 3, head length 1.9 mm, head width 3.0 mm. Body ovoid, pereon very slightly deflexed dextrally (Figs 1B, 2A), all body regions and pereomeres distinctly segmented. Head subrectangular, broader than long, with frontal lamina extending beyond pereomere 1 and rounded extensions laterally (Fig. 2A), eyes lacking. Barbula with two long, thin, tapering lateral lobes, subequal in length (Fig. 2C). Antennules of three articles each, terminal article minute, setose; antennae of five articles each, terminal article setose (Fig. 2D). Maxilliped (Fig. 2E) with minute setae, most prominent on distal margin, short subacute spur; segmented subcylindrical palp present, with stout setae. Oostegite 1 (Fig. 2F–G) proximal lobe ovate, distal lobe approximately 50% narrower than proximal lobe, internal ridge smooth (Fig. 2G).

Pereon of seven pereomeres (Fig. 2A), broadest across pereomere 3, gradually tapering anteriorly and posteriorly; pereomere 1 with convex posterior margin corresponding with posterior margin of head; pereomeres 2–4 straight, pereomeres 5–7 wavy, with progressively greater median concavity and crenulate margins (Fig. 2A). Coxal plates and dorsolateral bosses on pereomeres 1–5 (Fig. 2A), pereomeres 2–3 with weakly produced tergal projections on right side (Fig. 2A). Oostegites incompletely enclosing marsupium (Fig. 2B), last two pairs of oostegites reduced, plate-like, with setae on margins (Fig. 2L). Pereopods subequal (Fig. 2F–K), with small dactyli and broad bases, setae on all articles except bases; first pair at sides of head, others evenly spaced.

Fig. 1. Micrographs of *Pleurocryptella altalis* sp. nov. and host *Munidopsis petalorhyncha* Baba, 2005 (ZMMU Ma 3504). **A**. *Munidopsis petalorhyncha*, ♂, with swelled right branchial chamber from *Pleurocryptella altalis* sp. nov. **B**. *Pleurocryptella altalis* sp. nov., holotype, ♀, dorsal view (ZMMU Mc 1420) with attached allotype, ♂ (ZMMU Mc 1421). **C**. *Pleurocryptella altalis* sp. nov., allotype, ♂, oblique ventral view (ZMMU Mc 1421).

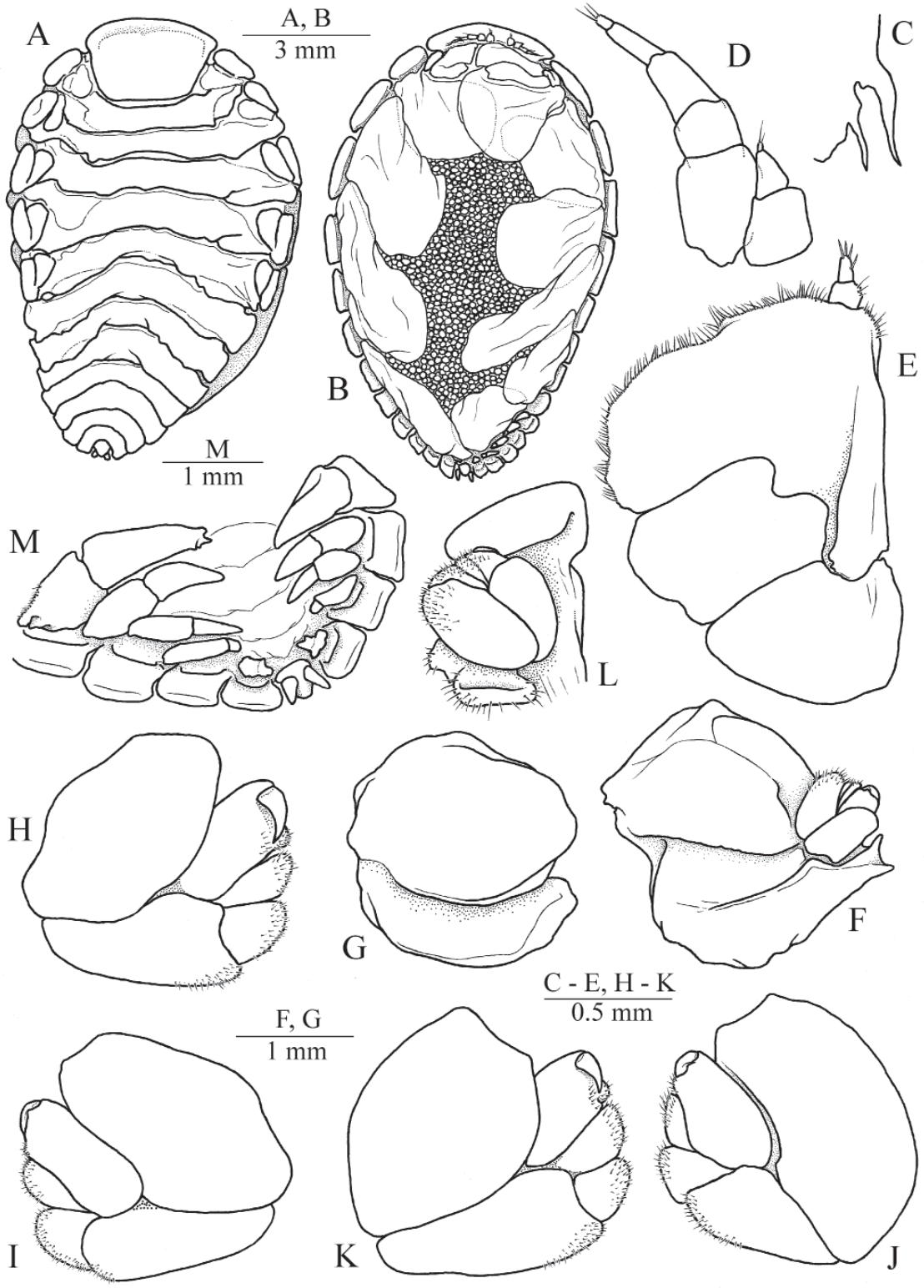

Fig. 2. *Pleurocryptella altalis* sp. nov., holotype, ♀ (ZMMU Mc 1420). **A**. Dorsal view. **B**. Ventral view. **C**. Left barbula. **D**. Right antennule and antenna. **E**. Left maxilliped, external view. **F**. Left oostegite 1, external view with pereopod 1 attached. **G**. Left oostegite 1, internal view. **H**–**I**. Left pereopod 1, lateral view. **J**–**K**. Left pereopod 7, lateral view. **L**. Left pereopod 7 and oostegite, lateral view. **M**. Pleon, ventral view.

Pleon with six pleomeres including pleotelson (Fig. 2B, M). Pleomeres 1–4 with biramous, digitiform pleopods, appearing as two stacked articles; pleomere 5 with uniramous, irregularly shaped pleopods; uropods (Fig. 2M) uniramous, tapering distally, directed distolaterally, extending just beyond anal cone.

Male (Figs 1B–C, 3)
Length 4.3 mm, maximum width 1.7 mm, head length 0.5 mm, head width 1.3 mm, pleon length 1.2 mm. Head hemispherical, widest at posterior margin, distinct from pereomere 1 (Figs 1B–C, 3A–B), eyes lacking. Antennules of three articles each, terminal article setose (Fig. 3C); antennae of five articles each, basal three articles with rounded extensions, distal three articles setose (Fig. 3D). Maxilliped bisegmented (Fig. 3E), basal segments small, subrectangular, distal segment elongate with two short, stout setae and four longer, thinner setae on distal end.

Pereomere 4 broadest, others tapering slightly anteriorly and posteriorly (Figs 1B–C, 3A–B). Pereomeres 1–4 approximately straight, pereomeres 5–7 directed posterolaterally, distolateral margins of all pereomeres rounded. Pereopods 1 and 2 (Fig. 3A, F) each with long, curved dactylus extending to carpus; propodus large, broad; carpus and merus small, rounded; ischium and basis elongate; all articles, except dactylus and basis, with small setae. Pereopods 3–7 (Fig. 3A, G–H) subequal, all with shorter dactyli than pereopods 1 and 2, other articles similar to pereopods 1 and 2, bases with slight distal bulge.

Pleon (Figs 1C, 3A, I) of six pleomeres, pleomeres 5–6 curved anteriorly, sides of all pereomeres curled ventrally and overlapping. Broad midventral tubercles on pleomeres 1–4, reduced one on pleomere 5 (Fig. 3A, I), small, low, rounded pleopods on pleomeres 1–5, mostly obscured by curled lateral margins of pleomeres (Fig. 3I). Pleotelson bearing articulated, triangular-shaped uropods (Fig. 3A, I) extending beyond anal cone.

Note on host identification

The host was originally identified as the holotype of *Munidopsis subsquamosa latimana* Birstein & Zarenkov, 1970, but, because that name is a junior homonym of *M. latimana* Miyake & Baba, 1966, Baba (2005) proposed the replacement name *M. petalorhyncha* Baba, 2005.

Remarks

The new species appears most closely related to *Pleurocryptella formosa* and *P. wolffi*. Males of these three species all have low, broad midventral tubercles on pleomeres 1–4 that cover nearly all of the space between the pleopods, whereas males of all other species in the genus have small, semispherical tubercles on the pleomeres that do not cover the space between the pleopods. Both sexes of *Pleurocryptella altalis* sp. nov. are distinguishable from those of *P. formosa* and *P. wolffi*. Males of *P. altalis* sp. nov. have the lateral margins of the pleomeres curled laterally and covering the pleopods in ventral view (also curled in *P. wolffi*, but splayed laterally and pleopods visible in ventral view in *P. formosa*), the head nearly as broad as pleomere 1 (also as broad in *P. wolffi* but much narrower than pleomere 1 in *P. formosa*), and the uropods larger than pleopod 5 (uropods smaller than pleopod 5 in *P. wolffi* and the same size as pleopod 5 in *P. formosa*). Females of *P. altalis* sp. nov. have the barbula with two acute, slender lobes of approximately the same length (barbula with outer lobe tapered but much broader, inner lobe much shorter than outer and rounded in *P. wolffi* and *P. formosa*), pleopod 5 less than half as large as pleopod 4 and uniramous (pleopod 5 more than half as large as pleopod 4 and biramous in *P. wolffi* and *P. formosa*), and pleomeres smoothly curved with pleomere 5 not surrounding pleotelson (pleomeres smoothly curved, but surrounding pleotelson in *P. wolffi* and not smoothly curved (angular middle portion) and not surrounding pleotelson in *P. formosa*).

Key to females of species of *Pleurocryptella* Bonnier, 1900 *

1. Uropods surrounded by distolateral margins of pleomere 5..... ***P. wolffi*** Bourdon, 1972b
– Uropods not surrounded by distolateral margins of pleomere 5..... 2

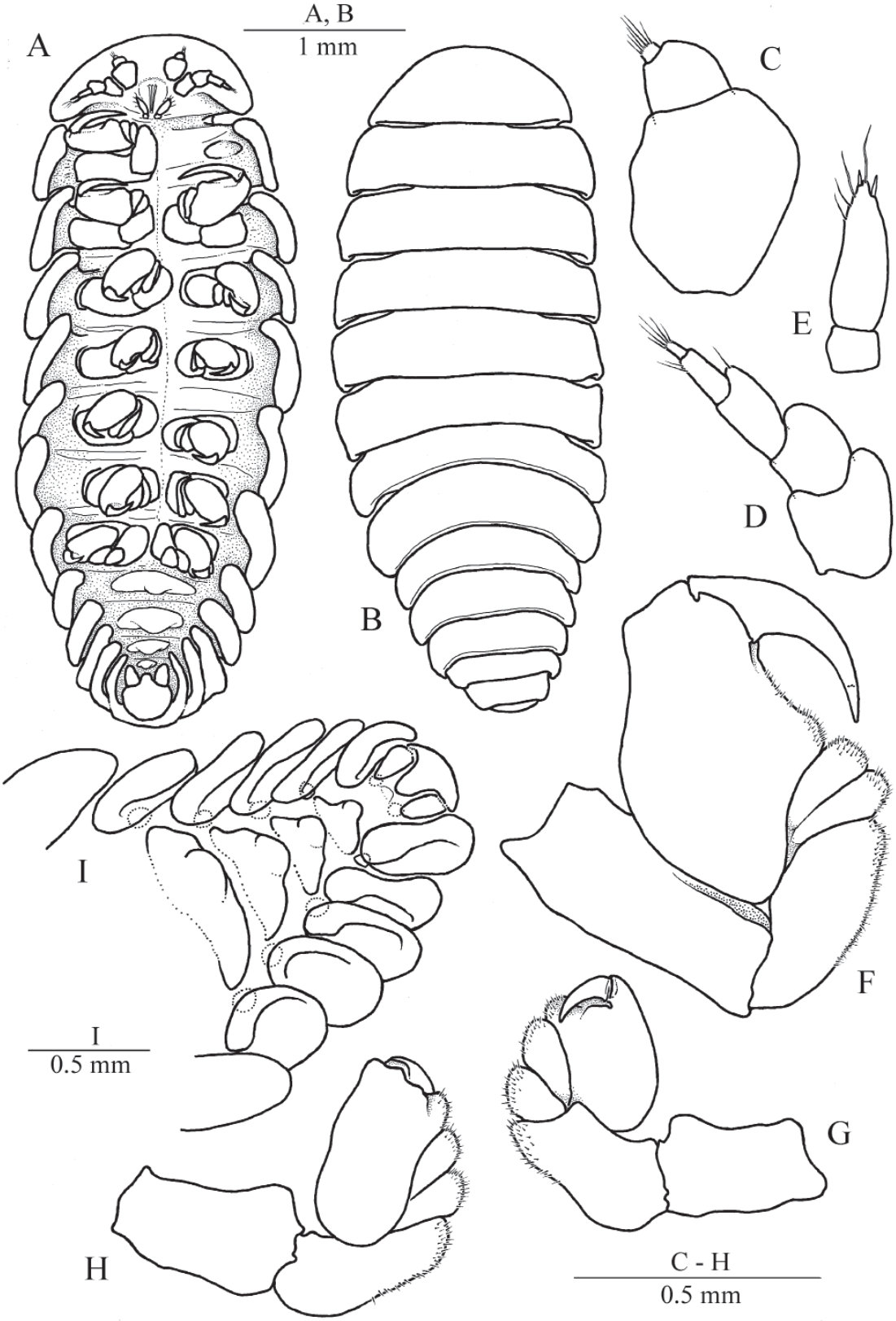

Fig. 3. *Pleurocryptella altalis* sp. nov., allotype, ♂ (ZMMU Mc 1421). **A**. Ventral view. **B**. Dorsal view. **C**. Right antennule. **D**. Right antenna. **E**. Right maxilliped. **F**. Right pereopod 1, lateral view. **G–H**. Left pereopod 7, lateral view. **I**. Pleon, ventral view (pleopods shown in dashed lines).

2. Uropods shorter than pleotelson, scarcely projecting beyond distolateral margins of pleomere 5 ... 3
– Uropods longer than pleotelson, projecting well beyond distolateral margins of pleomere 5 5

3. Total body length and width subequal; pronounced digitations on pereomeres of long side ..... ***P. formosa*** Bonnier, 1900
– Body much longer than wide 4

4. Posterior margins of all pereomeres smooth ..... ***P. fimbriata*** Markham, 1974
– Posterior margins of pereomeres 5–7 wavy ..... ***P. altalis*** sp. nov.

5. Antenna with 6 segments ..... ***P. crassandra*** Bourdon, 1976
– Antenna with 5 segments 6

6. Body strongly tapering from anterior to posterior, head not extending beyond anterolateral margins of pleomere 1 7
– Body gradually tapering from anterior to posterior, head extending beyond anterolateral margins of pleomere 1 8

7. Lobes of barbula distally acute, outer lobe approximately three times as long as inner lobe ..... ***P. laevis*** (Richardson, 1910)**
– Lobes of barbula distally rounded, outer lobe approximately twice as long as inner lobe ..... ***P. superba*** Bourdon, 1981

8. Pleotelson and uropods ventral to pleomere 5; pronounced digitations (tubercles) on pereomeres of short side ..... ***P. infecta tuberculata*** Bourdon, 1976
– Pleotelson and uropods between pleomere 5 in ventral view; lacking pronounced digitations (tubercles) on pereomeres ..... ***P. infecta infecta*** Nierstrasz & Brender à Brandis, 1923

* *Pleurocryptella latimellaris* (Nierstrasz & Brender à Brandis, 1931) not included in the key.
** Data for *P. laevis* based on Bourdon (unpublished MS).

Key to males of species of *Pleurocryptella* Bonnier, 1900*

1. Midventral tubercle on pleomere 7 ..... ***P. wolffi*** Bourdon, 1972b
– No midventral tubercle on pleomere 7 2

2. Midventral tubercles low, broad and extending between pleopods on pleomeres 1–4 3
– Midventral tubercles small, semispherical and medially situated 4

3. Lateral margins of pleomeres strongly curled ventrally, covering pleopods ..... ***P. altalis*** sp. nov.
– Lateral margins of pleomeres slightly curled ventrally, not covering pleopods ..... ***P. formosa*** Bonnier, 1900

4. Midventral tubercles only on pleomeres 1–3 ..... ***P. laevis*** (Richardson, 1910)** & ***P. infecta tuberculata*** Bourdon, 1976***
– Midventral tubercles on more than pleomeres 1–3 5

5. Midventral tubercles on pleomeres 1–4 ..... ***P. fimbriata*** Markham, 1974
– Midventral tubercles on pleomeres 1–5 6

6. Pleon markedly narrower than pereon ..... ***P. infecta infecta*** Nierstrasz & Brender à Brandis, 1923
– Pleon not markedly narrower than pereon 7

7. Antenna with 7 segments..... ***P. crassandra*** Bourdon, 1976
– Antenna with 5 segments..... ***P. superba*** Bourdon, 1981

* *Pleurocryptella latimellaris* (Nierstrasz & Brender à Brandis, 1931) not included in the key.
** Data for *P. laevis* based on Bourdon (unpublished MS).
*** Based on published and unpublished data, the males of *P. laevis* and *P. infecta tuberculata* are indistinguishable.

Discussion

In light of the marked differences between the males of the various species of *Pleurocryptella*, a thorough revision of the genus is warranted. Richardson (1910) incompletely described and figured *P. laevis*, but Bourdon (unpublished) later redescribed it on the basis of the types and other material. Fortunately, one of us (CBB) was given a copy of Bourdon's MS during a visit to the Muséum national d'histoire naturelle (MNHN) in 2002, which has aided in the production of our key to species (see above). Likewise, *Pseudione latilamellaris* was incompletely described and illustrated by Nierstrasz & Brender à Brandis (1931) and was placed in *Pleurocryptella* by Bourdon (1979) without comment as to the reason for this placement. Several characters of the male and female of *P. latilamellaris* suggest that this species is not congeneric with the other species of *Pleurocryptella*, even if the females possess the rudimentary oostegites on pleomeres 6 and 7.

Pleurocryptella altalis sp. nov. represents the deepest record for any bopyrid parasite, including all described species and unidentified bopyridiform swellings on hosts. Although the depth of the host's collection has previously been given as 5035–5210 m (Birstein & Zarenkov 1970, 1972; Baba 2005) or 5025–5210 m (Boyko *et al*. 2012), the actual depth is 5060–5130 m (Komai *et al*. 2017; Marin 2020). The host species, *Munidopsis petalorhyncha*, is also recorded from the east slope of the Iwaki Seamount off the coast of Japan at greater depths (5353–5380 m; see Komai *et al*. 2017), and it is possible that the bathymetric and geographic ranges of the parasite are similar to those of its host, although parasites often occur only in a portion of the range of a host species (Pielou 1974). Boyko & Williams (2010: table 1) provided depth and host records for the described species and subspecies of *Pleurocryptella* and related genera.

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