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Three new harpacticoid copepods for Korea from marine interstitial habitats

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Recent integrative taxonomic research demonstrated a high endemism of Korean copepods, with closest relatives usually in neighboring countries. Although Korean fauna could be considered well-studied, some marginal habitats still provide unexpected discoveries of copepods described from distant parts of the world. Here I report three such examples. Two belong to the family Tetragonicipitidae: *Phyllopodopsyllus thiebaudi santacruzensis* Mielke, 1989 and *Laophontella horrida dentata* Mielke, 1992; one to the family Ancorabolidae: *Laophontodes norvegicus* George, 2018. Scanning electron microscope photographs are provided for the first time for all three species, revealing unknown details of complex three-dimensional structures and ornamentation of somites. *Phyllopodopsyllus thiebaudi santacruzensis* was described from the Galapagos Islands, while *Laophontella horrida dentata* was described from the Pacific Coast of Costa Rica; for both this is the second record, which extends their range into the Western Pacific. *Laophontodes norvegicus* was described from Norway; this Korean record is its first in the Pacific. The first species is represented in my samples by numerous males, females, and juveniles. However, the second one is represented by one adult male and one juvenile female, while the third is represented by a single adult male, which might suggest that the marine interstitial is not their preferred habitat in Korea.

Keywords: Crustacea, cuticular organs, meiofauna, taxonomy, zoogeography

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Introduction

South Korea is an important center of copepod biodiversity, with a large endemic component (Karanovic, 2017; Karanovic and Cho, 2017; Karanovic *et al*., 2018). Copepods are relatively well studied here, as free-living forms in marine (Soh, 2010; Lee *et al*., 2012) and freshwater environments (Chang, 2009; 2010), as well as parasites of other organisms (Kim, 2008). However, utilization of novel taxonomic methods, such as the study of microstructures (Karanovic and Cho, 2012; 2016; 2017; Karanovic and Lee, 2012; Karanovic *et al*., 2013), DNA (Karanovic and Kim, 2014a; 2014b; Karanovic *et al*., 2014; 2015; Kim *et al*., 2014), and survey of marginal and understudied habitats, such as the marine interstitial (Karanovic *et al*., 2012a; 2012b; Karanovic, 2014; Karanovic and Lee, 2016), have resulted in numerous recent additions to the Korean copepod fauna. Some three-quarters of the world's ice-free coastline consists of sandy shores (Brown and McLachlan, 1990) and Korea has 12,478 kilometers of coastline along three seas (Pruett and Cimino, 2000). Like in most developed economies, these ecosystems are under constant anthropogenic pressure and, being a marginal habitat, are rarely included in protected natural reserves. However, the marine interstitial harbors a disproportionate level of biodiversity (Gray, 1997; Thrush *et al*., 2006; Karanovic, 2008), which is yet to be fully appreciated and understood (Armonies and Reise, 2000; Gray, 2002; Zeppelli *et al*., 2015).

The aim of this study was to provide supplementary descriptions of the newly recorded species, both based on observations from compound light microscope (CLM) and scanning electron microscope (SEM). The latter is used for the first time for of all three species in this study. Further research might be necessary in order to compare specimens of these highly disjunct populations, using modern taxonomic methods such as molecular markers and landmark-based geometric morphometrics.

Materials and Methods

All specimens were collected from the intertidal zone

using the Karaman-Chappuis method. This method consists of digging a hole on the beach down to the water level, decanting the inflowing interstitial water, and filtering the water through a plankton net (mesh size 30 μm). All samples were fixed in 99% ethanol, sorted in the laboratory also in 99% ethanol using an Olympus SZX12 dissecting microscope with PLAPO objectives and magnification of up to 200×. Locality data and number of specimens are listed below for each species separately and all material was deposited in the National Institute of Biological Resources (NIBR).

Some specimens were dissected and mounted on microscope slides in Faure's medium (Stock and von Vaupel Klein, 1996), and dissected appendages were then covered by a coverslip. For the urosome, two human hairs were mounted between the slide and coverslip during examination, so it would not be compressed and deformed. All CLM photographs were taken with a digital camera attached to a Leica MB2500 phase-interference compound microscope, equipped with N-PLAN (5×, 10×, 20×, 40× and 63× dry) or PL FLUOTAR (100× oil) objectives. Specimens that were not photographed were examined in glycerol and, after examination, were stored in 99.9% ethanol. Specimens for scanning electron microscopy (SEM) were transferred into pure isoamyl-acetate for two hours, critical-point dried, mounted on aluminium stubs, coated in gold, and observed under a Hitachi S-4700 scanning microscope on the in-lens detector, with an accelerating voltage of 10 kV and working distances between 12 and 13.5 mm. SEM photographs were also taken with a digital camera.

The terminology used for morphological characters follows Huys & Boxshall (1991), except for the numbering of setae on the caudal rami (not used) and small differences in the spelling of some appendages (antennula, mandibula, maxillula instead of antennule, mandible, maxillule); the latter as an attempt to standardise the terminology for homologous appendages in different crustacean groups.

Results and Discussion

Phyllopodopsyllus thiebaudi santacruzensis Mielke, 1989 (Figs. 1–3)

Specimens examined. Four males and six females together on one SEM stub; one female dissected on one slide; and 25 males, 31 females, and 10 copepodids together in alcohol; all from Korea, South Sea, Goseong, Dongdong, small beach, 34°59.620′N 128°25.796′E, 31 March 2013, collected by T. Karanovic.

Supplementary description. Female. Body length, measured from tip of rostrum to posterior margin of caudal rami (excluding caudal setae and appendages) from 575 to 595 μm (585 μm average, n = 12). Colour of preserved specimens yellowish, nauplius eye not visible. Habitus (Figs. 1A, 2A, D) cylindrical, slender, without distinct demarcation between prosome and urosome in dorsal view, but with sharp bend in lateral view; prosome/urosome ratio about 0.9 (in dorsal view); greatest width at posterior end of cephalothorax; cephalothorax 1.5 times as wide as genital double-somite in dorsal view; body length/width ratio about 4.2. Free pedigerous somites without pronounced lateral or dorsal expansions. Integument of all somites relatively well sclerotized, generally smooth, covered with numerous shallow cuticular pits (see Fig. 2B); several irregular rows of minute spinules present on each somite except cephalothorax, their density and size increasing towards posterior end of body. Hyaline fringes of all somites narrow; that of cephalothorax smooth (Fig. 1B), those of free prosomites coarsely serrated (Fig. 1C), those of urosomites (except anal somite) finely serrated (Figs. 1D–F, 2C, E). Surface of all somites, except preanal, with large cuticular sensilla, and some also with cuticular pores.

Rostrum (Fig. 2B) small, weakly demarcated at base from cephalothorax, linguiform, about as wide as long, its anterior tip not reaching beyond anterior margin of lateral wings of cephalothoracic shield, with single dorsal pair of anterior sensilla.

Anal somite (Figs. 1F, 2C, E) narrower and longer than fifth urosomite, almost completely devoid of spinules ventrally and with few minute spinules dorsally and laterally, cleft medially in posterior part, with posterior row of large spinules along ventral margin; anal operculum broad, narrow, and convex, with finely serrated posterior margin, representing about one half of somite's width; anal sinus widely opened, without any chitinous projections, with weakly sclerotized walls and three rows of long, hair-like spinules boarding anus.

Caudal rami (Figs. 1F, 2C, E) strongly sclerotized, slightly longer and wider than anal somite, conical but with particularly inflated anterior dorsal region (with semi crescent lateral keel and median dorsal crater), generally smooth, ornamented with strong spinules along ventral posterior margin, and tuft of slender and long spinules in dorsal crater, slightly longer than wide, armed with seven setae (three lateral, one dorsal, and three apical). Dorsal seta slender and smooth, about 0.7 times as long as ramus, inserted close to posterior margin, triarticulate at base (i.e., inserted on two pseudojoints). Proximal lateral setae inserted very close to each other at about 3/5 of ramus length; ventral one minute, shorter than most sensilla; dorsal one slender and unipinnate, 0.8 times as long as ramus. Distal lateral seta also slender and smooth, inserted close to dorsal seta, and 0.4 times as long as ramus. Innermost apical seta smooth, slender, and small, about 0.3 times as long as ramus. Central (principal) api-

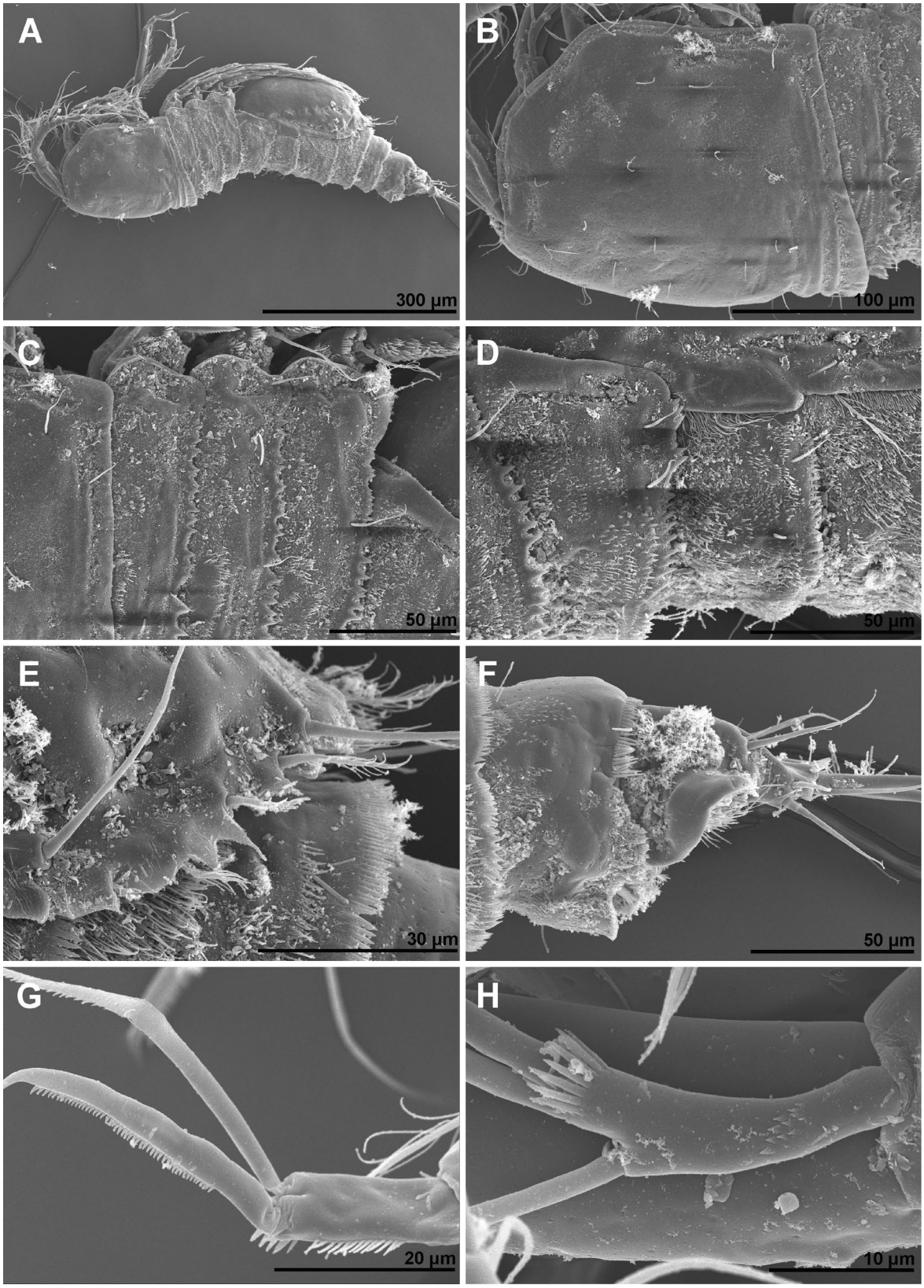

Fig. 1. *Phyllopodopsyllus thiebaudi santacruzensis* Mielke, 1989, SEM photographs, female 1, lateral view: A, habitus; B, cephalothoracic shield; C, tergites of free prosomites; D, genital somite with proximal part of fifth leg; E, distal part of fifth leg; F, anal somite and caudal ramus; G, second endopodal segment of first swimming leg; H, exopod of antenna.

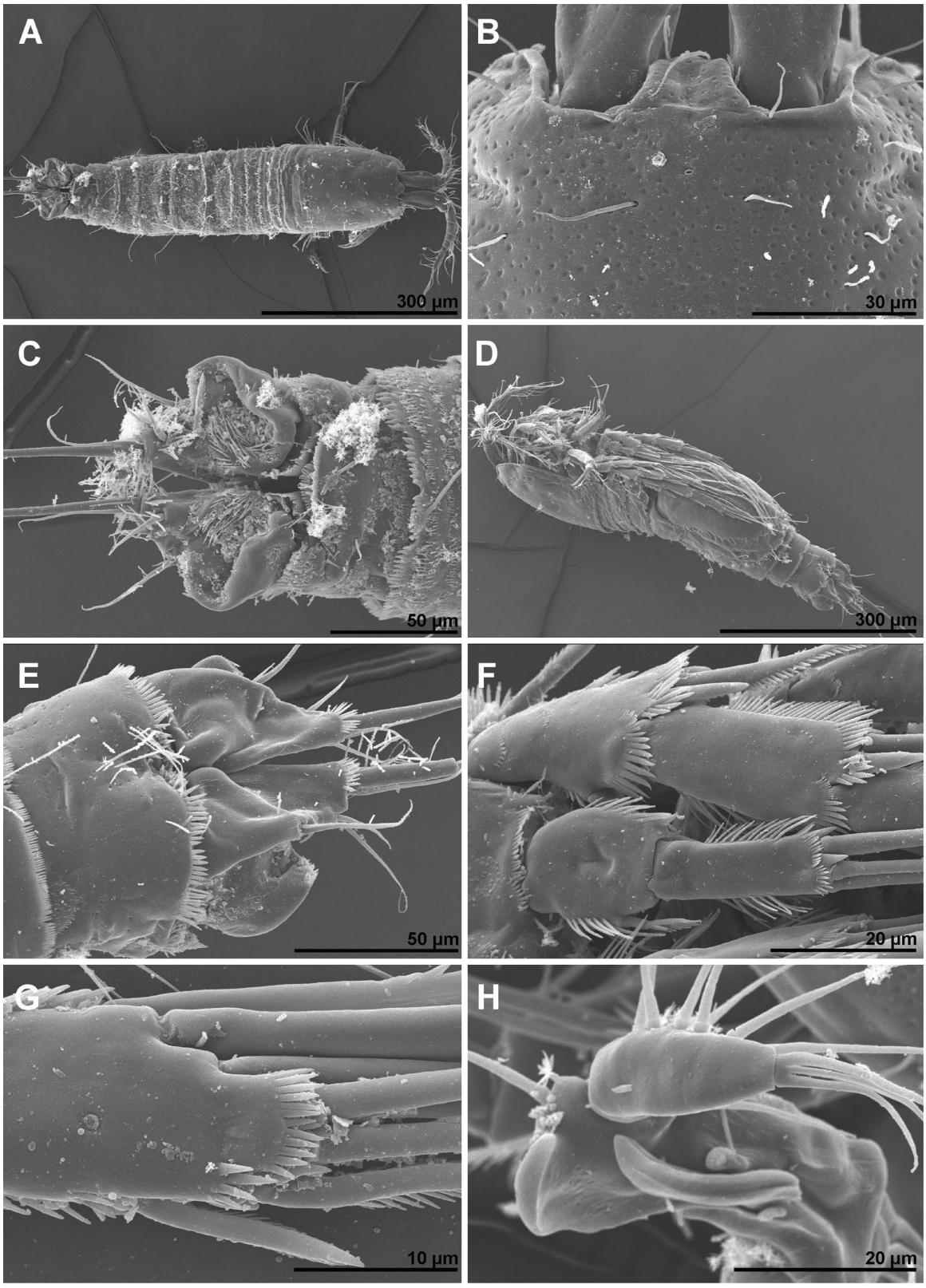

Fig. 2. *Phyllopodopsyllus thiebaudi santacruzensis* Mielke, 1989, SEM photographs; A–C, female 2, dorsal view; D–G, female 3, ventral view; H, male 1, lateral view: A, habitus; B, anterior part of cephalothorax with rostrum and first segment of antennula; C, anal somite and caudal rami; D, habitus; E, anal somite and caudal rami; F, endopod and first two exopodal segment of second swimming leg; G, distal part of third exopodal segment of fourth swimming leg; H, distal part of antennula.

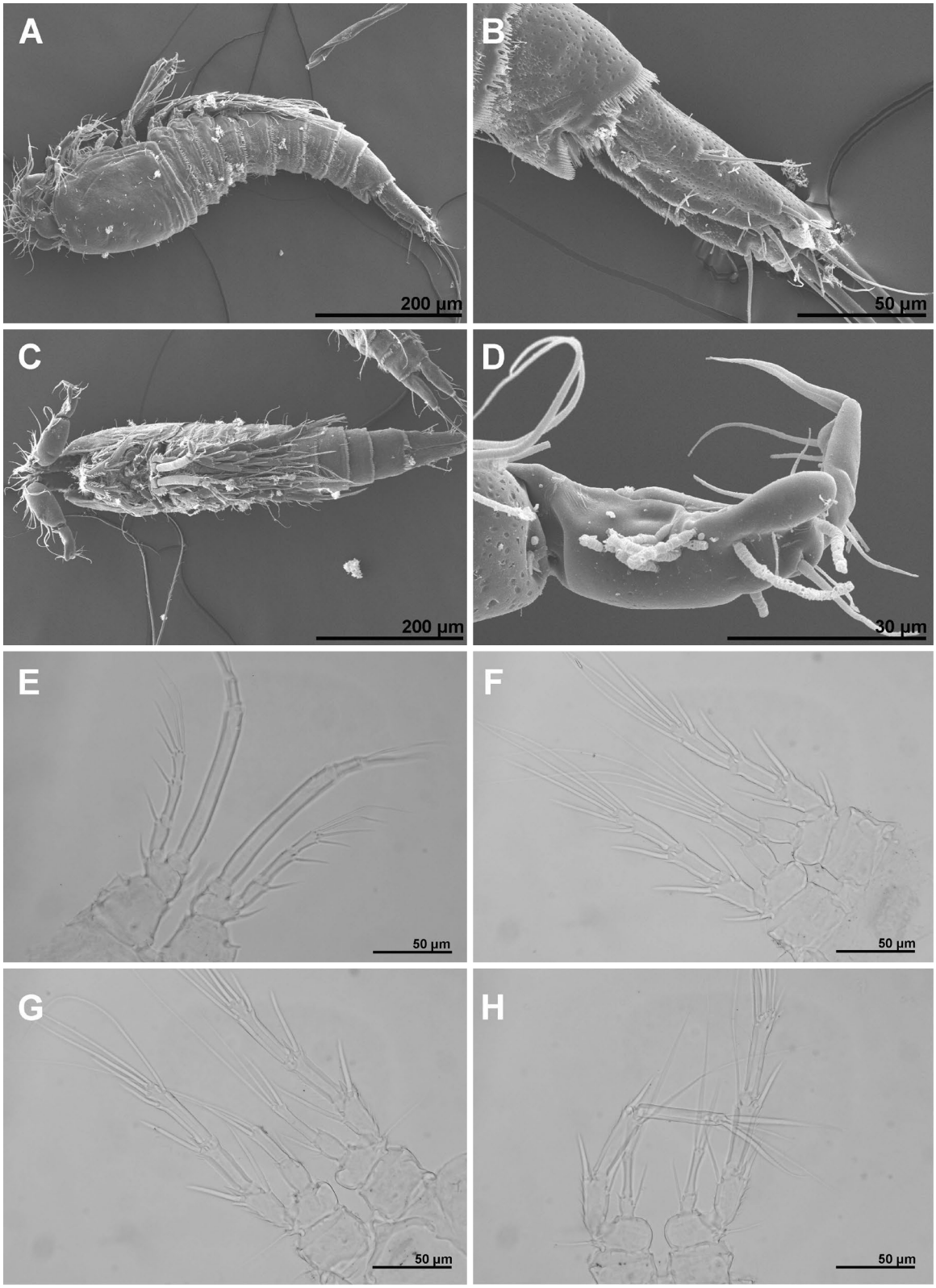

Fig. 3. *Phyllopodopsyllus thiebaudi santacruzensis* Mielke, 1989; A−D, SEM photographs; E−H, CLM photographs; A, B, male 1, lateral view; C, D, male 2, ventral view; E−H, female 4, dissected and mounted on microscope slides, anterior view: A, habitus; B, anal somite and caudal rami; C, habitus; D, distal part of antennula; E, first swimming leg; F, second swimming leg; G, third swimming leg; H, fourth swimming leg.

cal seta without breaking plane, very strong, distally pinnate, about three times as long as caudal ramus, basally fused to outer apical seta. Outer apical seta also without breaking plane, much slenderer than central apical seta, smooth, nearly as long as caudal ramus.

Antennal exopod (Fig. 1H) slender, one-segmented, ornamented with several small spinules in proximal half and row of large spinules along distal margin, armed with one lateral and two apical setae; lateral seta inserted at about 4/5.

All swimming legs (Figs. 1A, G, 2D, F, G, 3E–H) slender, short in comparison to body length and width, composed of small unarmed and unornamented triangular praecoxa, large unarmed but ornamented quadrate coxa, smaller armed basis, three-segmented armed and ornamented exopod, and two-segmented armed and ornamented endopod. Coxae in all pairs of legs connected by unornamented intercoxal sclerite, each with concave distal end and no spiniform protrusions.

First swimming leg (Figs. 1G, 3E) with very long first endopodal segment, which about 1.4 times as long as entire exopod, and nearly five times as long as second endopodal segment; second endopodal segment armed with two apical elements, outer strong spine and inner long and geniculate seta; third exopodal segment slightly shorter than second.

Second swimming leg (Figs. 2F, 3F) with nearly square intercoxal sclerite and much shorter praecoxa than in first leg. Coxa with spiniform process on outer margin as in first leg. Basis armed only with outer spine. Third exopodal segment slightly longer and slenderer than other two; first exopodal segment armed with inner strong seta and outer strong spine; second exopodal segment armed only with outer spine; third exopodal segment armed with two outer strong spines, strong outer apical seta, slender inner apical seta, and slender inner seta. Endopod less than half as long as exopod, both segments ornamented with long spinules along both inner and outer margins; first segment armed with single short inner seta, second with three long apical elements (outermost one shortest, spiniform, and 1.5 times as long as segment).

Third swimming leg (Fig. 3G) very similar to second, except intercoxal sclerite narrower, basis with slender and long outer seta instead of spine, and third exopodal segment somewhat longer.

Fourth swimming leg (Figs. 2G, 3H) relatively similar to third leg, but with wider coxa, shorter basal seta, much shorter first endopodal segment armed with inner seta, slenderer seta on first exopodal segment, second exopodal segment armed with inner seta, and third exopodal segment with three strong inner setae; central inner seta on third exopodal segment exceptionally long and strong.

Fifth leg (Fig. 1A, D, E) typically foliaceous, twice as long as wide, with completely fused baseoendopod and exopod, forming brooding chamber with genital double-somite and anterior part of fourth urosomite, ornamented with row of hair-like spinules between base and basal slender seta and two cuticular pores on anterior surface. Former baseoendopod armed with three slender and pinnate setae, distalmost one longest. Former exopod armed with six setae; most proximal and fifth setae smooth and slender and inserted on anterior surface, others short, plumose, and inserted on distal margin; distal margin between second and third setae and between third and fourth setae transformed into bicuspidate chitinous processes, and between fifth and sixth setae transformed into finely serrated wide hyaline fringe.

Male. Body length from 514 to 560 μm (540 μm average, n = 8). Habitus shape (Fig. 3A, C), body proportions, and segmentation as in female, except second and third urosomites not fused, and caudal rami much more elongated. Ornamentation and shape of cephalothorax, all free prosomites, and most urosomites as in female.

Caudal rami (Fig. 3B) much larger in comparison with anal somite than in female, almost cylindrical but with prominent dorsal ridge and tapering towards posterior end, about 3.2 times as long as wide in ventral view and 1.7 times as long as anal somite; ornamentation and all armature as in female, except no dorsal spinules and proximal lateral setae inserted more anteriorly.

Antennula (Figs. 2H, 3D) strongly chirocer, robust, with almost all segments shorter than in female, with fused segments four and five, as well as seven and eight (resulting in apparent six-segmented state); sixth segment and ancestral segments four and five highly transformed into robust pincers with several chitinous ridges along area of contact; additional armature present on second, third, and ancestral fourth segments, while sixth and ancestral fifth segments with reduced armature (compared to female).

Discussion. *Phyllopodopsyllus thiebaudi* Petkovski, 1955 was described from interstitial habitats in the Mediterranean Sea (Petkovski, 1955), and soon afterwards discovered in numerous other localities in the Mediterranean, as well as in the Atlantic and Indian Oceans (see Lang, 1965; Karanovic, 2006). It has two accepted subjective synonyms (see Kunz, 1984; Bodin, 1997; Karanovic *et al*., 2001), one described by Noodt (1955) from the Atlantic coast of France (as *P. intermedius*), and another by Apostolov (1969) from Bulgaria (as *P. pirgos*). Karanovic (2006) redescribed it from Western Australia.

Mielke (1989) described a new subspecies from the Galapagos Islands, *P. thiebaudi santacruzensis* Mielke, 1989, noticing a different number of armature on the male fifth leg exopod (four vs. five in the nominotypical subspecies). Karanovic (2006) added the length of the first endopodal segment of the first swimming leg as an additional distinguishing feature (much longer in the Pacific subspecies). Korean specimens have four setae on the

male fifth leg exopod and first endopodal segment of the first leg at least 1.4 times as long as the entire exopod, so there is no doubt that they are more closely related to *P. t. santacruzensis* than to *P. t. thiebaudi* (see Fig. 3E). This record implies a wide Pacific distribution of this taxon, which was previously considered to be endemic to the Galapagos. This is the third known species from this genus in Korea, after two new endemics were described by Karanovic (2017), both with close relatives in Japan. Today there are 61 valid species and subspecies in this genus globally (Karanovic, 2017; Walter and Boxshall, 2019).

Phyllopodopsyllus t. santacruzensis has a somewhat similar shape of the caudal rami to the Korean *P. kitazimai* Karanovic, 2017, but the latter species has a slenderer habitus, smooth hyaline fringes of free prosomites, fewer setae on second to fourth swimming legs, fewer spinules on urosomites, and more cuticular organs on some somites (for example, an additional pair of pores is present on the anterior part of cephalothorax; compare Fig. 2B here and Karanovic, 2017: fig. 2C).

Laophontodes norvegicus George, 2018 (Figs. 4 & 5)

Specimen examined. Adult male on one SEM stub from Korea, South Sea, Goseong, Dongdong, Bongam-ri, tiny gravel beach next to a fishing harbor, 34°59.629′N 128° 26.201′E, 4 April 2012, collected by T. Karanovic.

Supplementary description. Male. Body length, measured from tip of rostrum to posterior margin of caudal rami (excluding caudal seate and appendages) about 360 μm. Habitus (Fig. 4A, B) relatively slender, nearly four times as long as wide, tapering posteriorly, slightly dorsoventrally compressed. Cephalothorax slightly longer than wide, representing about 25% of body length. Free prosomites and all urosomites with distal margin extended laterally, forming a wavy line from ventral (or dorsal) view. Hyaline fringes of free prosomites and all urosomites (except anal one) serrated (Fig. 5D). Anal somite (Fig. 5E, F) with ventral row of large spinules at base of caudal rami.

Caudal rami (Fig. 5E–H) cylindrical, very slender, 2.2 times as long as anal somite, and 7.4 times as long as wide; with several spinules at base of lateral setae, one tubular pore ventro-laterally near anterior end and two tubular pores ventrally in posterior part. Proximal lateral setae inserted at about 3/5 of ramus length, dorsal one twice as long as ventral one. Distal lateral seta inserted close to posterior end, in level with larger ventral tubular pore. Dorsal seta inserted close to outer margin in level with distal lateral seta, but triarticulate at base (i.e., inserted on two pseudojoints; distal margin of second pseudojoint reaching distal margin of ramus). Inner apical seta about as long as ventral proximal lateral seta. Outer apical seta about as long as distal lateral seta. Central (principal) apical seta longest and strongest, half as wide as ramus and about five times as long, without breaking planes, pinnate distally.

Antennula (Fig. 4C–F) strong, chirocer, with strongly swollen fourth segment and tuft of spinules between setae on second segment.

Labrum (Fig. 4G) large, with narrow cutting edge and no ornamentation on anterior surface.

Maxilliped (Fig. 5A) with small seta at base of distal claw.

First swimming leg (Fig. 4H) with first endopodal segment about twice as long as entire exopod, nearly five times as long as wide, and 3.7 times as long as second endopodal segment.

Second swimming leg (Fig. 5B, D) with tubular pore on second exopodal segment and smooth inner margin of third exopodal segment (i.e. no inner seta); third exopodal segment slender, about 3.7 times as long as wide, and twice as long as second exopodal segment.

Discussion. *Laophontodes norvegicus* belongs to the *Laophontodes typicus* Scott T., 1894 complex, which was recently revised and split into six species by George (2018). *Laophontodes typicus* was described originally from Scotland (UK) by Scott (1894). Subsequently, it was found in many locations along the European coast (Scott, 1903; 1907; Norman and Scott, 1906; Sars, 1908; Jakubisiak 1933; 1936; Monard, 1935; Lang, 1948; Klie, 1950; Roe 1958; Ventham 2011), in the Arctic (Scott, 1899; Chislenko, 1967; 1977; Kornev and Chertoprud, 2008), but also it was reported from very disjunct locations, such as the Chilean Magellan Region (George, 1999; 2005) and the Great Meteor Seamount (George and Schminke 2002). Not surprisingly, as it is often the case with widely distributed harpacticoids, a great range of intraspecific morphological variability was discovered, which enabled George (2018) to describe some new species even without studying any material. *Laophontodes norvegicus* was one of those, proposed as a new name for specimens studied and illustrated by Sars (1908) from Norway. Unfortunately, Sars (1908) did not illustrate male habitus but only provided illustrations of the male caudal ramus, antennula, fourth leg, and fifth leg (in addition to many female characters), so many details cannot be compared with the Korean male. However, the Norwegian and Korean populations share the very slender caudal rami, slender third exopodal segment of the second leg without inner seta, robust first endopodal segment of the first leg that is about twice as long as the entire exopod, and the habitus shape of the Korean male is not much dissimilar from that of the Norwegian female.

As for other species from this complex, they can be easily distinguished from *Laophontodes norvegicus* by some of the following characters: third exopodal seg-

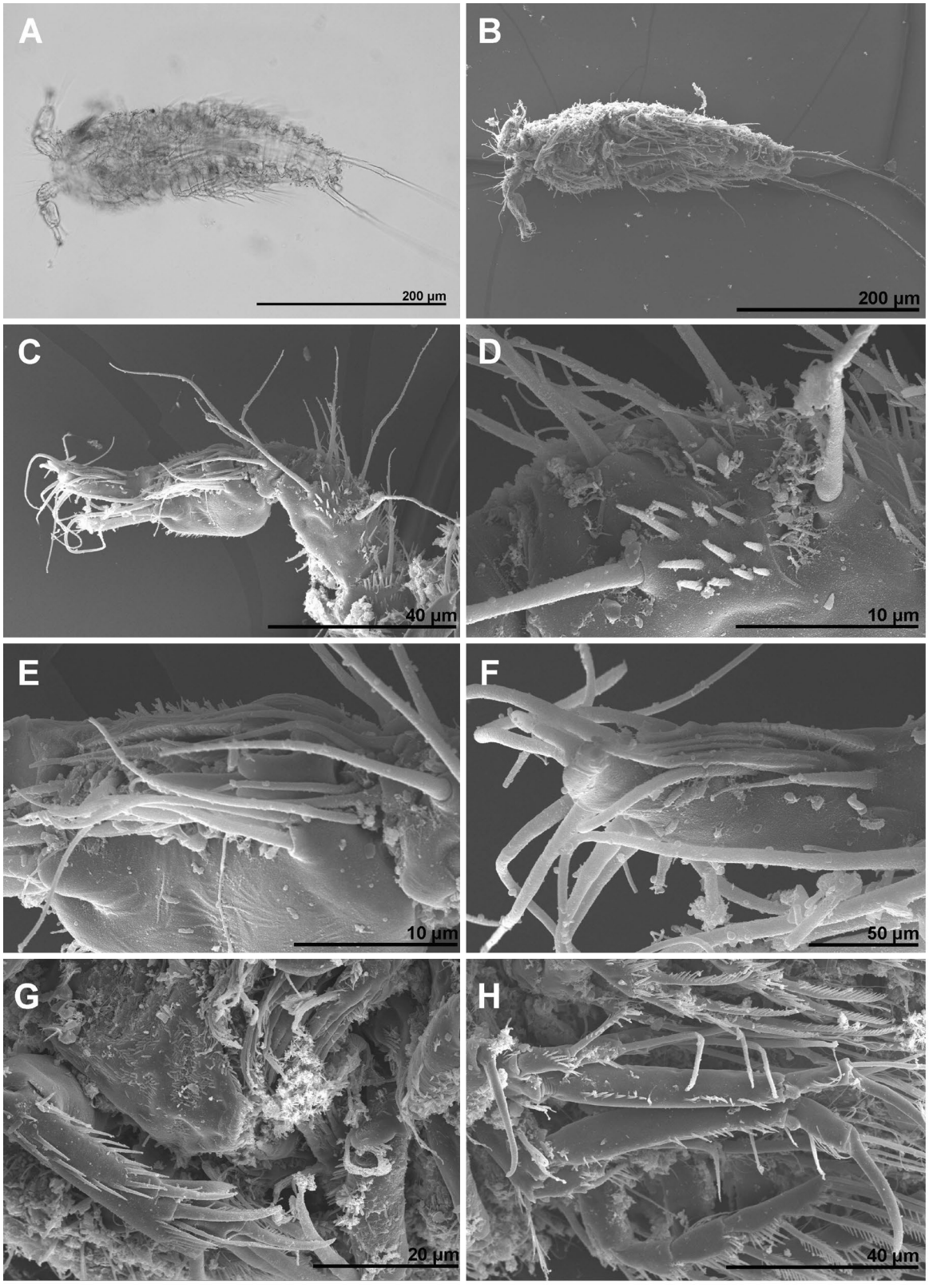

Fig. 4. *Laophontodes norvegicus* George, 2018, male 1, ventral view; A, CLM photograph; B–H, SEM photographs; A, habitus; B, habitus; C, antennula; D, detail of armature and ornamentation of proximal part of antennula; E, detail of armature and ornamentation of central part of antennula; F, detail of armature and ornamentation of distal part of antennula; G, labrum and mouth appendages; H, first swimming leg.

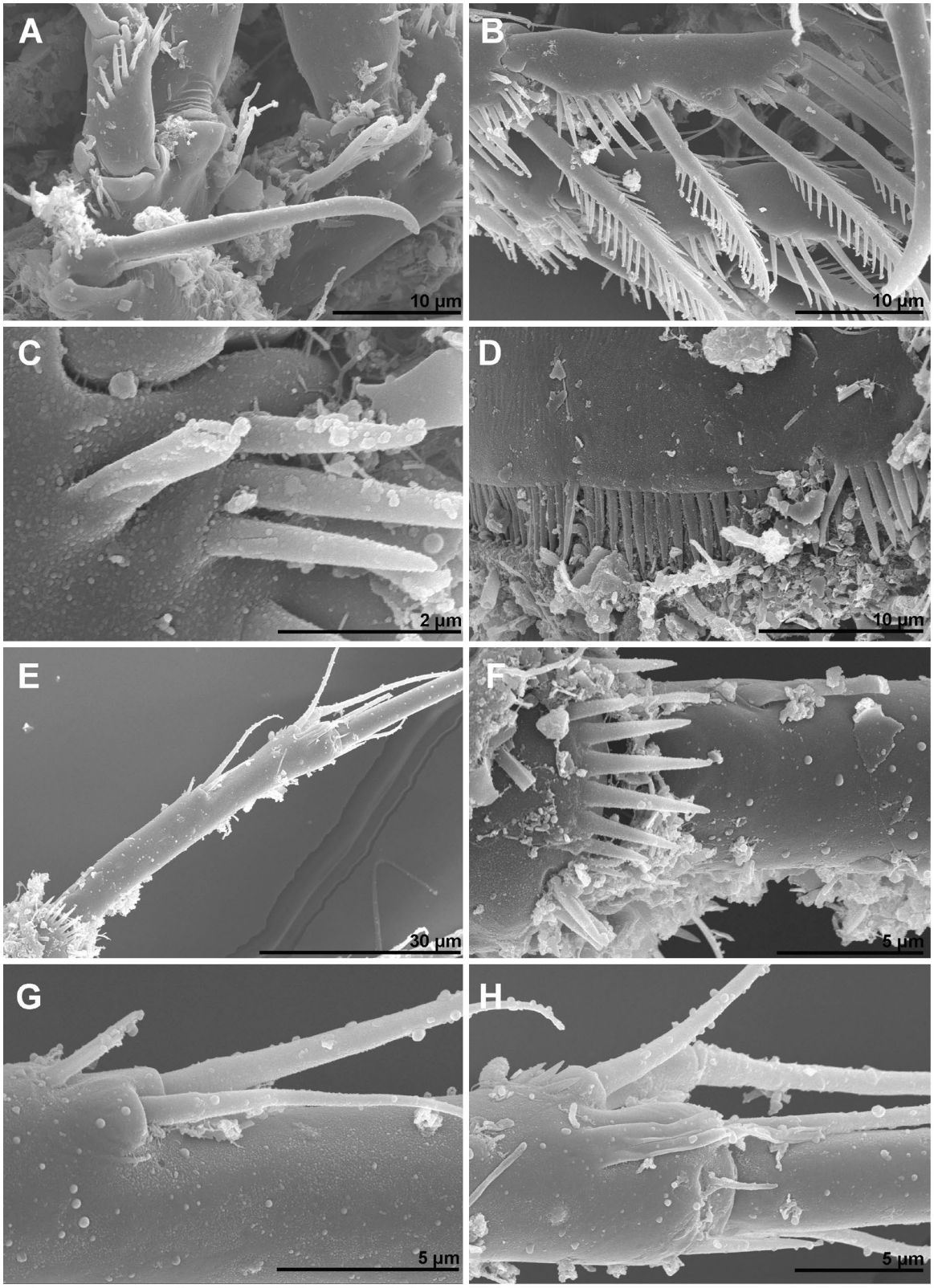

Fig. 5. *Laophontodes norvegicus* George, 2018, male 1, ventral view, SEM photographs; A, distal part of maxilliped and basis of first swimming leg; B, third exopodal segment of second swimming leg; C, tubular pore on second exopodal segment of second swimming leg; D, distal frill of fourth urosomite; E, caudal ramus; F, detail of ornamentation of proximal part of caudal ramus; G, lateral setae on caudal ramus; H, distal part of caudal ramus.

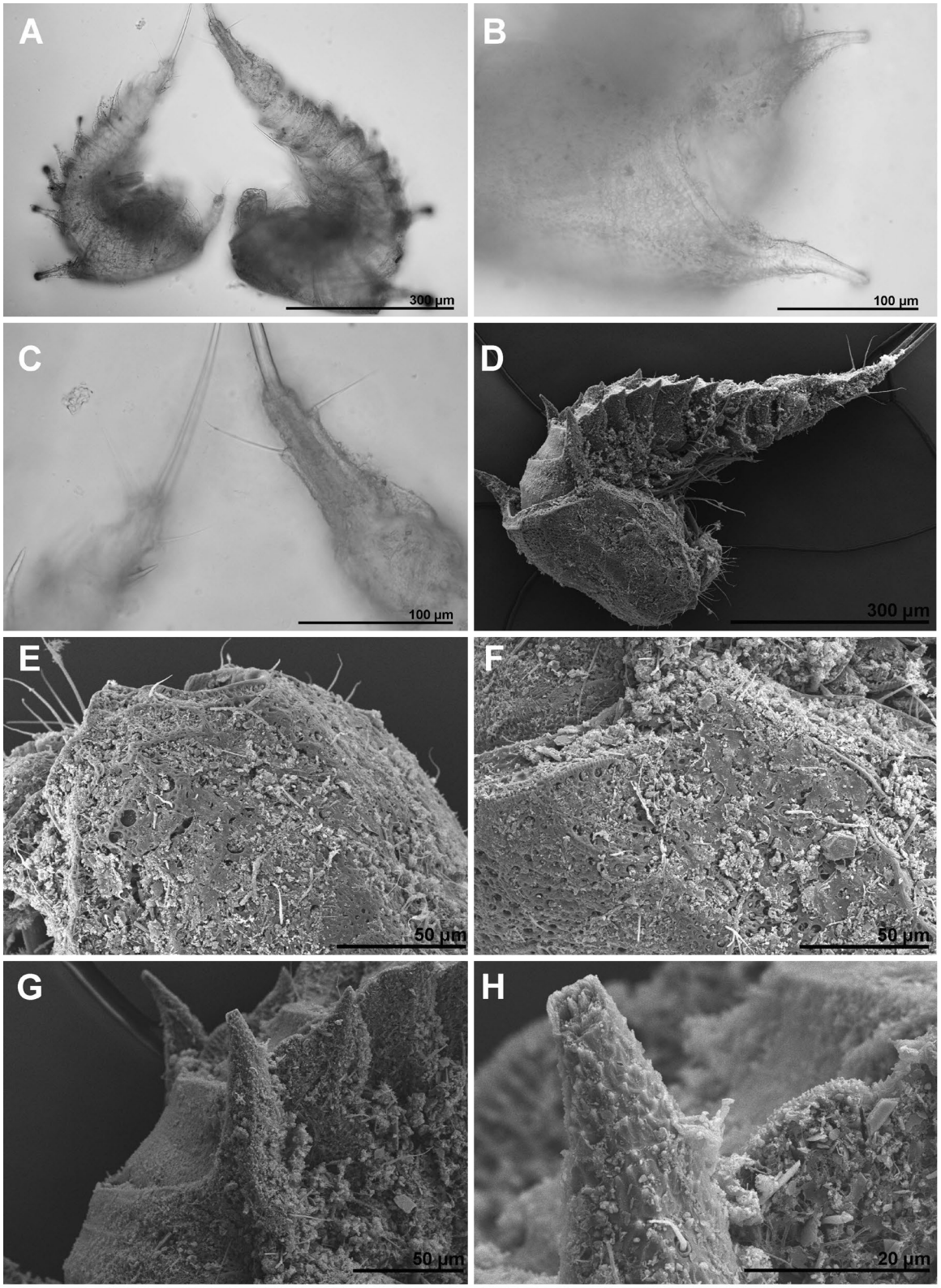

Fig. 6. *Laophontella horrida dentata* Mielke, 1992; A–C, CLM photographs; D–H, SEM photographs, adult male; A, adult male (right) and juvenile (left), habitus, lateral view; B, adult male, postero-lateral processes on cephalothorax and first free prosomite; C, adult male (right) and juvenile (left), caudal rami; D, habitus; E, anterior part of cephalothoracic shield; F, posterior part of cephalothoracic shield; G, postero-lateral processes on free prosomites; H, tip of postero-lateral process on first free prosomite.

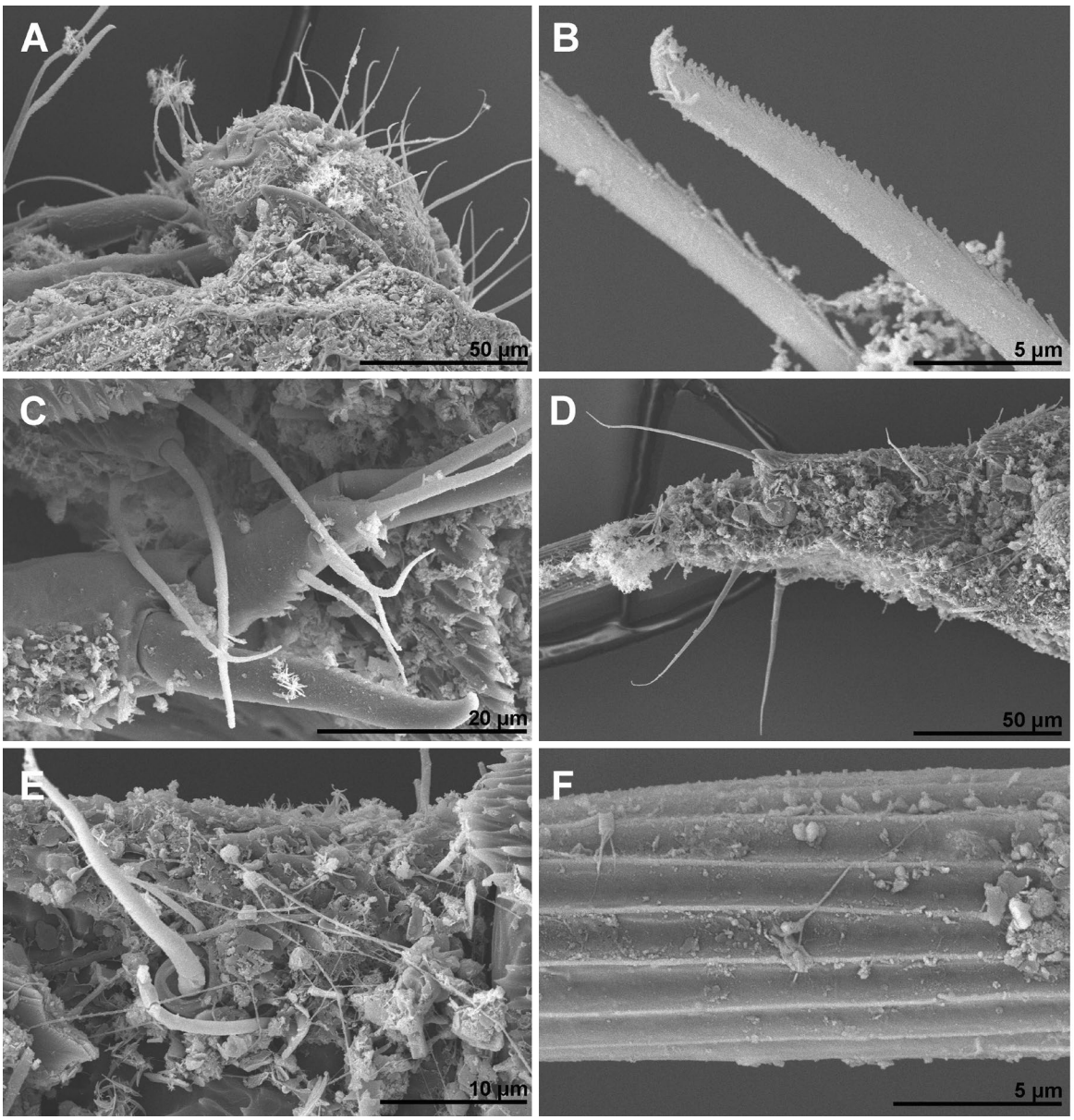

Fig. 7. *Laophontella horrida dentata* Mielke, 1992, SEM photographs, adult male, lateral view; A, anterior part of cephalothorax and first segment of antennula; B, apical setae on first leg endopod; C, sixth leg and last two exopodal segments of fourth swimming leg; D, caudal ramus; E, detail of armature and ornamentation of proximal part of caudal ramus; F, detail of principal caudal seta.

ment of the second leg with inner seta (*L. typicus* and *L. monsmaris* George, 2018), wide habitus (*L. scottorum* George, 2018), or short caudal rami (*L. sarsi* George, 2018 and *L. gertraude* George, 2018).

This record in Korea extends the species range (and the range of the entire complex) into the Pacific Ocean. It remains to be discovered if the species has a disjunct distribution, or if some of the Arctic populations from the *L. typicus* complex belong to it. George (2018) refrained from studying and discussing the Arctic populations, justifying that by the lack of characters provided in some redescriptions (Chislenko, 1977) and some possible errors of observation (Kornev and Chertoprud, 2008). However, this question would be difficult to answer without molecular data, which are still lacking for this complex.

Kim (2014) reported *L. psammophilus* Soyer, 1975 from Korea, but without any illustrations. This species also has long caudal rami, but it differs from *L. norvegicus* by much longer second endopodal segment of the first leg (see Soyer, 1975), and also by the insertion of the lateral seta on the caudal ramus (in anterior third in *L. psammophilus* vs. in posterior half in *L. norvegicus*), so there is

little possibility for confusion. However, Kim's (2014) record would have to be checked and verified by an expert.

Laophontella horrida dentata Mielke, 1992 (Figs. 6 & 7)

Specimens examined. One adult male on one SEM stub and one juvenile female in alcohol from Korea, South Sea, Goseong, Dongdong, Bongam-ri, tiny gravel beach next to a fishing harbor, 34°59.629′ N 128°26.201′ E, 4 April 2012, collected by T. Karanovic.

Supplementary description. Male. Body length, measured from tip of rostrum to posterior margin of caudal rami (excluding caudal seate and appendages) about 800 μm. Habitus (Fig. 6A, D) spindle-shaped, widest at distal part of cephalothorax. Cephalothoracic shield (Figs. 6B, E, F, 7A) strongly chitinized and heavily sculptured, with numerous ridges and deep pits of various sizes among large sensilla, with anterior notch and pointed postero-lateral processes. Free prosomites (Fig. 6G) and all urosomites (Fig. 6D), except anal somite, with postero-lateral processes, becoming smaller towards posterior end. All posterior processes heavily sculptured and with sensilla (Fig. 6H). Anal somite (Fig. 6D) nearly as long as two preceding somites combined, without prominent postero-lateral processes, but with lateral central bulge instead.

Caudal rami (Figs. 6C, 7D–F) conical, about three times as long as wide, 1.3 times as long as anal somite, heavily sculptured and with several small processes, with two proximal lateral setae (one very small, see Fig. 7E) inserted at about 1/5 of ramus length; dorsal seta about as long as distal lateral seta, while larger proximal lateral seta only half as long, and smaller proximal lateral seta only about as big as average sensilla; principal apical seta without breaking planes, very strong, with longitudinal ridges; all setae, except principal apical one, smooth and slender.

Antennula (Fig. 7A) short and strongly chirocer, with numerous small and slender setae.

First swimming leg (Fig. 7B) with comb-like inner margin and smooth outer margin on both apical endopodal setae.

Fourth swimming leg (Fig. 7C) with extremely large and slightly curved outer spine on second exopodal segment; third exopodal segment with two slender and short outer elements, two slender and long apical elements, and one strong and long inner element.

Sixth leg (Fig. 7C) simple cuticular plate, with three slender and smooth setae.

Discussion. *Laophontella horrida* (Por, 1964) was described from Israel by Por (1964) in the newly proposed genus *Willeyella* Por, 1964, which proved to be a junior synonym of *Laophontella* Thompson and Scott A., 1903 (see Lang, 1965: p. 386). The genus today contains only three species, two of them with recognized subspecies (Walter and Boxshall, 2019). *Laophontella horrida* was later also found in other parts of the Mediterranean (Bodiou and Soyer, 1973) and possibly even in the Northern Atlantic (Por, 1984). Mielke (1992) described a new subspecies, *L. h. dentata* Mielke, 1992, from the Pacific Coast of Costa Rica, and Kunz (1994) described another new subspecies, *L. h. namibiensis* Kunz, 1994 from Namibia. Both Mielke (1992) and Kunz (1994) agreed that French specimens, illustrated by Bodin (1964) and reported as "*Phyllopodopsyllus sp*?", belong to the nominotypical subspecies of *L. horrida*. Major differences between these populations were listed in a table by Kunz (1994). Korean specimens agree more with those from Costa Rica than with the other two subspecies, especially in the elongated caudal rami. This is the second record of *L. horrida dentata*, which extends its range into the Western Pacific. Also, this is the first record of the genus in Korea.

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