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Research article

On the genus *Halirages* (Crustacea, Amphipoda), with the description of two new species from Scandinavia and Arctic Europe

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Abstract. A new common deep-sea species of *Halirages* Boeck, 1871 closely related to *H. qvadridentatus* G.O. Sars, 1877, *H. cainae* sp. nov., is described after specimens collected in the Norwegian Sea during the MAREANO 2009-111 cruise. Examination of the syntypes of *H. elegans* Norman, 1882 demonstrates that Norman's species is a junior synonym of *H. qvadridentatus* G.O. Sars, 1877 and that the species usually named *H. elegans* in literature was actually undescribed. The name *H. stappersi* sp. nov. is proposed for that species. A key to and a checklist of *Halirages* species is given.

Key words. *Halirages*, Amphipoda, Arctic, Atlantic, deep-sea.

Introduction

According to Barnard & Karaman (1991), the amphipod genus *Halirages* Boeck, 1871 includes 7 shallow- and deep-water species, all from Arctic and sub-Arctic Seas: *H. caecus* Kamenskaya, 1980, *H. elegans* Norman, 1882, *H. fulvocinctus* (M. Sars, 1859), *H. gorbunovi* Gurjanova, 1946, *H. mixtus* Stephensen, 1931, *H. nilssoni* Ohlin, 1895 and *H. qvadridentatus* G.O. Sars, 1877, but in many respects this genus remains imperfectly studied. During the second leg of the MAREANO 2009-111 cruise (29 Sep. 2009-11 Oct. 2009) on the eastern slope of the Norwegian deep Sea, a large crimson *Halirages* species was observed with the video platform Campod (see e.g. Anonym 2006; Buhl-Mortensen *et al.* 2009) and collected in several trawl and sledge hauls. That common species proved to be closely related to, albeit distinct from, the well-known Scandinavian bathyal species *Halirages qvadridentatus*. At first it was assumed that the taxon at hand could be *H. elegans*, a species inadequately described after specimens from bathyal Faeroe waters (Norman 1882). However, examination of the type specimens of *H. elegans* revealed that they consisted of characteristic *H. qvadridentatus*, as already assumed by Della Valle (1893) and Stebbing (1906). The crimson *Halirages* also exhibited some similarities with two further deep-sea species from the Arctic Ocean: *H. gorbunovi* from the eastern part of the

Nansen Basin and *H. caecus* from the Canadian Basin. The published accounts of these two species from distant seas are poor and based on badly mutilated specimens, but did not fit with the crimson *Halirages* from the Norwegian Sea. Therefore the latter is described herein as a new species, *H. cainae* sp. nov. A further consequence of the synonymization of *H. elegans* with *H. qvadridentatus* is that the North-European species reported as *H. elegans* by Stappers (1911) and Stephensen (1931) actually belongs to another species, which has no valid name. That species is named herein *H. stappersi* sp. nov. Finally, a key to and a checklist of *Halirages* species is given.

Material and Methods

The specimens and appendages were examined with a Wild 181300 dissecting microscope, and a DML Leica compound microscope, both equipped with a drawing tube. Pencil drawings were scanned and afterwards inked with the software Adobe® Illustrator® 11.0 on an A3 drawing table (Wacom® Intuos3 12x19), using the method described by Coleman (2003, 2009). A complete description is given for *H. cainae* sp. nov., which was a previously unknown species. A description of the parts of the syntypes of *H. elegans* visible without further dissection is provided to demonstrate its identity with *H. qvadridentatus*. A description of *H. stappersi* sp. nov. expanding the account of Stappers (1911 under the name of *H. elegans*) with further information is given, but no further dissection of the unique type specimen was carried out, because this was considered unnecessary and destructive. A reproduction of all the figures of Stappers (1911) including those of lost appendages is also given. These figures are no longer under copyright. Jean Hubert Louis Stappers was Belgian and his book was published by the 'Imprimerie Scientifique Charles Bulens' in Belgium. The Belgian law on copyright and related rights of 30 Jun. 1994, art. 2 (http://www.wipo.int/wipolex/en/text.jsp?file_id=125150 [accessed 24 Nov. 2011]) states that the term of protection for copyrighted material expires 70 years after the death of the author. Jean Hubert Louis Stappers died on 30 Dec. 1916 (http://www.hasel.be/nl/subjects/976/stappers-louis-1883-1916.html [accessed 24 Nov. 2011]), i.e. more than 70 years ago. The following abbreviations are used in the lists of material examined, keys and in the captions of the table and the figures: A1 = antenna 1; A2 = antenna 2; Ep1-Ep3 = epimeral plates 1-3; Gn1-Gn2 = gnathopods 1-2; Md = mandible; Mx1 = maxilla 1; Mx2 = maxilla 2; Mxp = maxilliped; P3-P7 = pereiopods 3-7; U1-U3 = uropods 1-3. A numerical name is given for the articles of the palp of mouthparts: articles 1-3 for mandibular palp, articles 1-2 for palp of maxilla 1, articles 1-4 for palp of maxilliped. In the description, the term 'tooth' is used for non-articulated, pointed ectodermic structures, the term 'spine' for stout, articulated inflexible structures, and the term 'seta' for slender, articulated flexible structures (see d'Udekem d'Acoz 2010). The setae of the mandibular palp are named according to the nomenclature proposed by Lowry & Stoddart (1993). Concerning measurements, the body length is given from tip of rostrum to tip of telson. When station depths are originally given in fathoms, the original unit is retained but a conversion in metres is given between brackets, in assuming that the fathoms were international fathoms (1.8288 metres). However different kinds of fathoms were in use in the nineteenth century, so that the real depth in metres may possibly be slightly different. The following abbreviations and acronyms are used for research programs and scientific institutions: MAREANO = Marine AREAdatabase for NOrwegian coast and sea areas; NHM: the Natural History Museum, London, UK (previously British Museum, Natural History); RBINS: Royal Belgian Institute of Natural Sciences, Brussels, Belgium; ZMBN, Zoologisk Museum, Universitetet i Bergen, Naturhistorie, Bergen, Norway.

Results

Order Amphipoda Latreille, 1816
Superfamily Eusiroidea Stebbing, 1888
Family Calliopiidae G.O. Sars, 1893

Genus ***Halirages*** Boeck, 1871

Halirages Boeck, 1871: 114.

Halirages – Boeck 1876: 337. — G.O. Sars 1893: 435. — Stebbing 1906: 290. — Stephensen 1931: 263. — Gurjanova 1951: 605. — Barnard 1969: 177. — Bousfield 1973: 80. — Barnard & Karaman 1991: 322. — Bousfield & Hendrycks 1997: 45.
Halirhages – Stuxberg 1880: 23, 27, 28, 47, 68 (erroneous spelling).

Etymology

The name derivation as proposed by Boeck (1876: 337) is: 'άλς (hav) [= sea, ocean], ρήγνύμι (bryder) [= breaker]'. A more accurate derivation would be: άλς = salt (noun) [prefix άλι- = related to the sea (which is salted)], ρήγνύμι = to break, to break asunder, to shiver, to shatter (verb).

Gender

Halirages is considered as masculine in older literature, but often as feminine in recent faunistic papers. There is no apparent reason for this change and the issue needs clarification. The second part of the name is a (very liberal) derivation from the Greek (see section etymology), so this case should be decided under Article 30.1 of ICZN (1999), which concerns the gender of names formed from Latin or Greek words. Article 30.1.4.2. states that a genus-group name that is or ends in a word of common or variable gender (as it is the case of words ending in -es) is to be treated as masculine unless its author, when establishing the name, stated that it is feminine or treated it as feminine in combination with an adjectival species-group name. Since Boeck (1871) gave masculine adjectival names to *H. bispinosus* (Spence Bate, 1857), *H. tridentatus* Bruzelius, 1859 and *H. fulvocinctus* (M. Sars, 1859) (and an adjectival name, which can be either masculine or feminine to *H. borealis* Boeck, 1871), *Halirages* should be treated as masculine.

Type species

Amphithoë fulvocincta M. Sars, 1859, designated by Boeck (1876: 337).

Composition

Halirages caecus Kamenskaya, 1980; *H. cainae* sp. nov.; *H. fulvocinctus* (M. Sars, 1859) (= *H. tricuspis* Stimpson, 1863, = *H. bispinosus* Stephensen, 1917); *H. gorbunovi* Gurjanova, 1946; *H. mixtus* Stephensen, 1931; *H. nilssoni* Ohlin, 1895; *H. qvadridentatus* G.O. Sars, 1877; *H. stappersi* sp. nov. There is also a *Halirhages* [*sic.*] *maculatus* Stuxberg, 1880, which is a *nomen nudum* (Stuxberg 1880, 1882).

Description

Body gammaromorphic, compressed. Rostrum small; anterior lobe of head not acute, posteriorly followed by narrow sinus; ventral lobe of head medium-sized, pointing forward, neither serrate nor crenulate, acute (most species) or rounded (*H. mixtus*). Eyes variable in shape, with ommatidia well-developed to indistinct, said to be absent in some deep-sea species. Antennae subequal, flagella long, peduncular articles of antenna 1 progressively shorter; article 1 of primary flagellum ordinary, accessory

flagellum absent; calceoli present in adult males. Upper lip entire, sub-rounded, broader than long, epistome unproduced. Lower lip with inner lobes present, of variable development. Mandible: molar triturative, striated, columnar; articles 2 and 3 of palp slender; article 3 of palp as long as article 2, with posterior border regularly concave and lined by row of setae on distal 0.8, with or without proximal transverse row of setae. Maxilla 1: inner plate with 8-10 setae; outer plate with 8-10 spines; palp long, asymmetrical: left article 2 with row of long styliform marginal spines and margino-facial setae; right article 2 with row of stout conical marginal spines (more or less fused with article 2), with 2 longer anterodistal freely articulated spines, with margino-facial row of setae. Maxilla 2: plates narrow; inner plate neither broader nor longer than outer plate, with facial row of setae and with medial row of setae. Maxilliped with inner and outer plates broad and subequal; palp of 4 articles, article 4 shorter than article 3. Coxae of pereiopods medium-sized, ordinary in shape, coxa 1 slightly produced anteriorly or not produced, coxa 4 posteriorly excavate. Gnathopods alike, similar in both sexes, subchelate, feeble; carpus and propodus narrow (or at least not broad); carpus without posterior lobe, with numerous long posterior setae; palm oblique; dactylus toothed along inner margin. Pereiopods 3-7 ordinary, slender; dactyli long, without spines or setae. Epimeron 3 posteriorly serrate, either rounded or angular. Uropods 1-2: outer ramus shorter than inner ramus; rami marginally spiny and terminated by 4 spines. Uropod 3 large, with peduncle elongate, with rami spinose/setose on both sides, lanceolate, subequal, or inner ramus slightly longer than outer one. Telson elongate (less in *H. mixtus* than in other species), pointed or emarginate, with or without lateral subdistal teeth.

Fig. 1. *Halirages cainae* sp. nov., paratype, sex unknown, about 40 mm, MAREANO 2009-111, R-station 488, sample 379, habitus.

Distribution

Arctic and sub-Arctic Seas; 0-3530 m.

Remarks

The species accepted in *Halirages* are the two new species described herein and those included by Barnard & Karaman (1991). The latter authors transferred *Halirages bungei* Gurjanova, 1951 to *Paracalliopella* Tzvetkova & Kudrjaschov, 1975, *H. megalops* (Buchholz, 1874) to *Apherusa* Walker, 1891, and *H. huxleyanus* (Spence Bate, 1862), *H. batei* (Cunningham, 1871) and *H. regis* (Stebbing, 1914) to *Austroregia* Barnard, 1989. Stephensen (1931) pointed out that the borderline between the genera *Halirages* and *Apherusa* is fuzzy. His remark remains more pertinent than ever, and a more consistent delimitation and definition of Arctic and sub-Arctic calliopiid genera would be more than welcome.

Halirages cainae sp. nov.
Figs 1-7

? *Halirages elegans* – Oldevig 1959: 65 (*pro parte*).

Etymology

Caina (Divine Comedy, Canto XXXII, verse 58): first round of the ninth circle of Dante's Inferno, which the poet describes as a frozen lake. The name alludes to the deep basin of the Norwegian Sea, which is the habitat of the species. With its negative temperatures, this body of icy abyssal water, trapped under a layer of warmer Atlantic waters is not unlike the frozen lake of Dante's Inferno. The vernacular noun in medieval Italian is Latinized as *caina*, *-ae* and is a genitive.

Type material

MAREANO 2009-111 cruise, RV *G.O. Sars*, R-station 487, sample 157, 69°04'N 012°28'E, 2589-2615 m, RP-sledge, mud, 8 Oct. 2009: 5 specimens [holotype subadult ♂ mounted on 26 slides in Euparal (ZMBN 87795) and 4 paratypes (ZMBN 87796) of which one is a 40 mm long ovigerous ♀, coll. C. d'Udekem d'Acoz]; MAREANO 2009-111 cruise, RV *G.O. Sars*, R-station 488, sample 379, 69°44'N 015°11'E, 2241-2245 m, mud, beam trawl, 10 Oct. 2009: 2 adult paratypes, RBINS, I.G. 31227, INV. 100853, coll. C. d'Udekem d'Acoz.

Description

Head. (Figs 1, 2, 3A) Rostrum feeble; anterior lobe of head very bluntly subquadrate (almost rounded), posteriorly followed by narrow sinus; ventral lobe of head acute, pointing forward, not denticulate; eye present, rather small, subreniform, without defined ommatidia, unpigmented in alcohol.

Antennae. (Figs 1, 2, 3A-B) Typical for the genus *Halirages*; article 1 of peduncle with 2 normally developed ventrolateral distal teeth.

Upper lip. (Fig. 3C) Apically rounded.

Lower lip. (Fig. 3D) With narrow mandibular processes and broad outer lobes.

Mandible. (Fig. 3E-F) Incisor process with 4 very blunt teeth; left lacinia mobilis with 4 blunt teeth (left one well developed, right one reduced); molar ridged, lateral margin, with a row of narrow spines, left molar with 2 anterolateral longer setae; palp article 1 short, with 1 D1-seta and 3 short F1-setae; article 2 and 3 equal in length; article 2 stout (3.2 x as long as wide), with row of D2-setae and row of A2-setae

Fig. 2. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157, habitus, left side; pereiopods illustrated in leveled position; gnathopods (except coxae) illustrated after right legs.

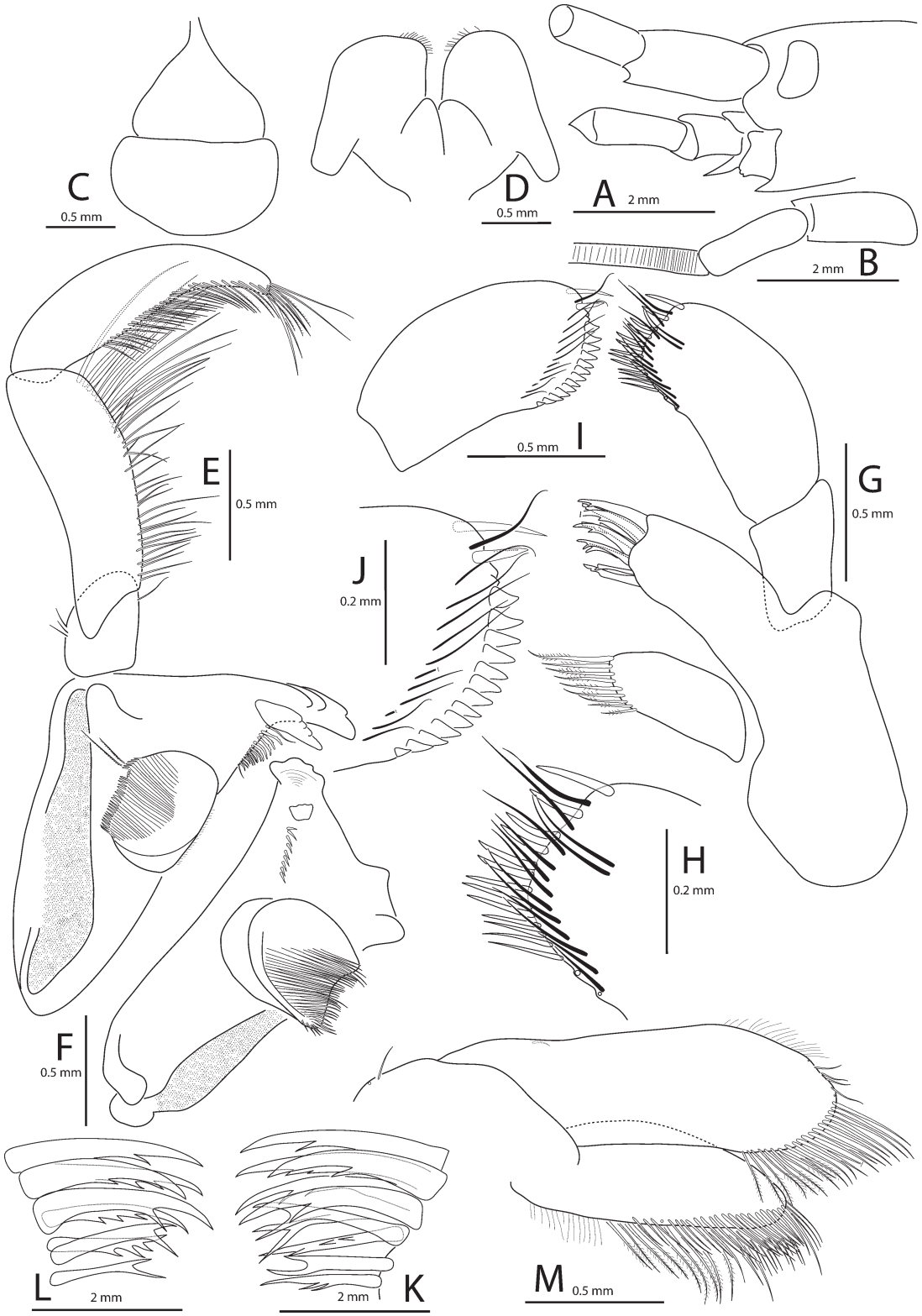

Fig. 3. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157. **A**. head and remaining parts of left antennae. **B**. right A2. **C**. upper lip and epistome. **D**. lower lip. **E**. left Md. **F**. right Md. **G**. left Mx1. **H**. tip of palp of left Mx1. **I**. article 2 of palp of right Mx1. **J**. tip of palp of left Mx1. **K**. tip of upper plate of left Mx1 (spines for next intermoult inside old cast). **L**. tip of upper plate of right Mx1 (spines for the next intermoult inside old cast).

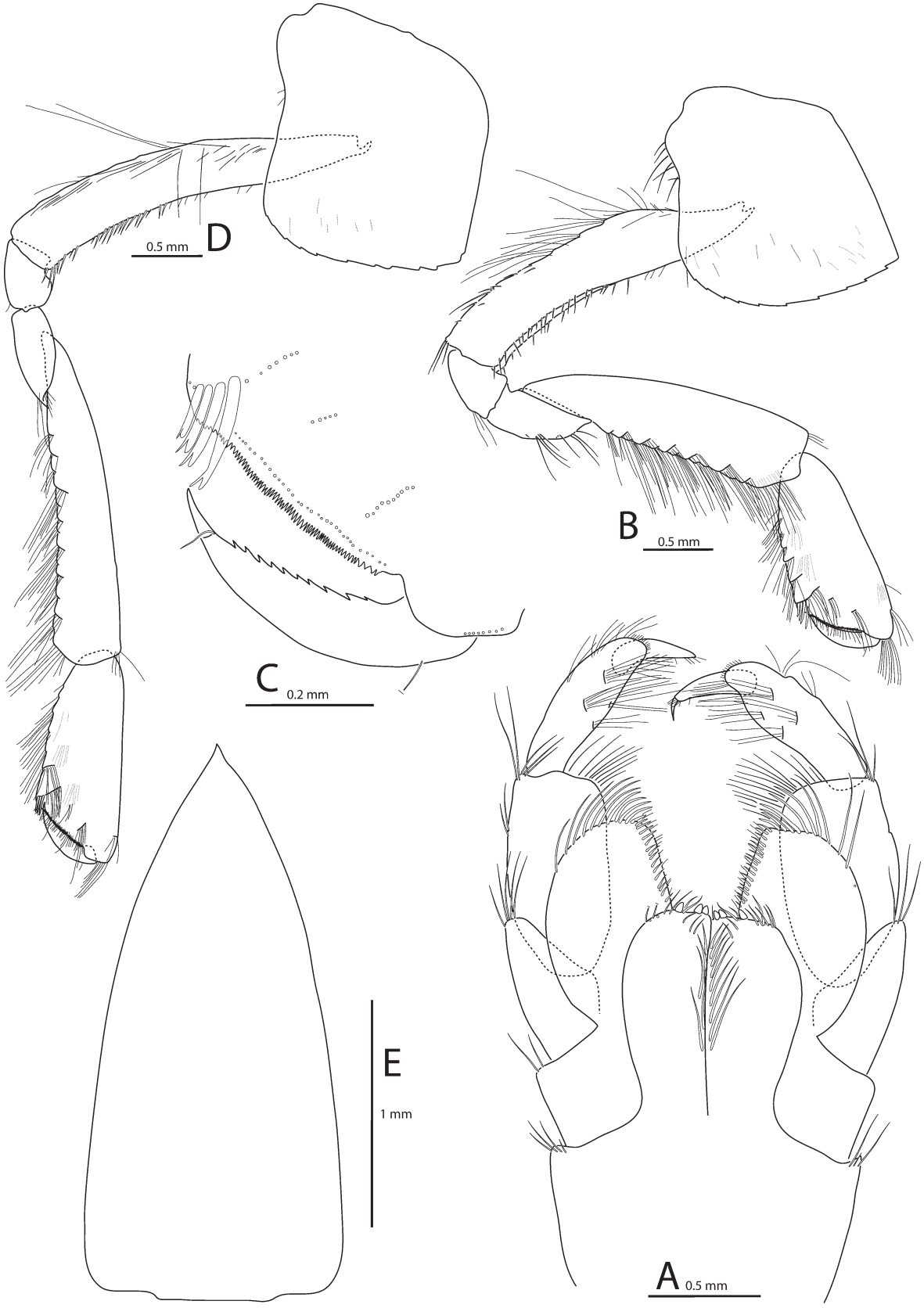

Fig. 4. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157. **A**. Mxp. **B**. right Gn1. **C**. tip of chela of right Gn1. **D**. right Gn2. **E**. telson.

becoming strong and narrowly spaced near tip; article 3 falciform, with row of D3-setae on distal 0.8 of posterior border, with apical tuft of E3-setae.

Maxilla 1. (Fig. 3G-L) Inner plate with 9 plumose setae, of which the length significantly increases towards tip; outer plate with 10 spines on left side and 8 on right side (they include deeply bifurcate spines and spines with 1-3 strong denticles on posterior border); palp well developed, with broad article 2; left article 2 with row of long styliform marginal spines and margino-facial setae (most of them forming a row); right article 2 with row of stout conical marginal spines (partly fused with article 2), with 2 longer anterodistal spines (most upper one arising medially), with margino-facial row of setae.

Maxilla 2. (Fig. 3M) Basal part with 2 short anterior setae (one is lost on illustrated Maxilla 2); plates rather narrow; inner plate with marginal and margino-facial row of setae respectively on distal 0.7 and 0.6 of posterior border, with microtrichs on proximal 0.3 of posterior border; outer plate with upper border straight, with one tiny anteroproximal medial seta, with microtrichs on upper subdistal border, with about 6 short anterodistal setae (2 are lost on illustrated Maxilla 2), with double row of strong distal setae.

Maxilliped. (Fig. 4A) Typical for the genus *Halirages*.

Gnathopod 1. (Fig. 4B-C) Coxa with anteroventral corner forming a square angle (not produced into a tooth pointing forwards), with 10 weak crenulations along ventral margin; carpus 3.8 x as long as wide, as long as basis, anterior border not setose (except for distal tuft of seta); propodus 2.3 x as long as wide, 0.71 x as long as carpus; palm sharply denticulate, with marginolateral row of thin setae; palmar part of propodus 0.31 x as long as propodus; dactylus dentate all along its posterior border.

Gnathopod 2. (Fig. 4D) Coxa square, with 10 weak crenulations along ventral margin; carpus 5.0 x as long as wide, as long as basis, with anterior border scarcely setose to glabrous (except for distal tuft of seta); propodus 2.5 x as long as wide, 0.63 x as long as carpus; palm sharply denticulate, with marginolateral row of thin setae; palmar part of propodus 0.25 x as long as propodus; dactylus dentate all along its posterior border.

Pereiopod 3. (Fig. 5A) Coxa square with about 10 weak and in some cases indistinct crenulations; leg weakly spinose/setose; basis anteriorly distinctly concave and posteriorly distinctly convex, with setae on its two borders; carpus 8.9 x as long as wide, 1.8 x as long as merus; propodus 12.6 x as long as wide, 2.1 x as long as merus; dactylus 0.41 x as long as propodus, 0.88 x as long as merus.

Pereiopod 4. (Fig. 5B-C) Coxa broad and posteriorly produced into a bluntly triangular protrusion, with ventral margin with 10 weak crenulations; leg weakly spinose/setose, slightly longer than pereiopod 3; basis anteriorly concave and posteriorly convex, with setae on its two borders; carpus 9.0 x as long as wide, 1.8 x as long as merus; propodus 13.5 x as long as wide, 2.2 x as long as merus, 1.2 x as long as propodus of pereiopod 3; dactylus 0.39 x as long as propodus, 0.87 x as long as merus.

Pereiopod 5. (Fig. 6A-B) Pereiopod 5 < pereiopod 6 < pereiopod 7; posterior lobe of coxa distinctly longer than anterior lobe; leg weakly spinose/setose; basis elliptic, 1.3 x as long as wide, anterior border with 8 styliform spines and sparse thin setae, distally without tooth, posterior border with 9 very low crenulations, posterodistal border rounded and smooth, with 2 long styliform posterodistal medial spines; ischium without anterodistal tooth; carpus 11.6 x as long as wide, 1.7 x as long as merus; propodus 19 x as long as wide, 1.9 x as long as merus; dactylus 11 x as long as wide, 0.33 x as long as propodus, 0.63 x as long as merus.

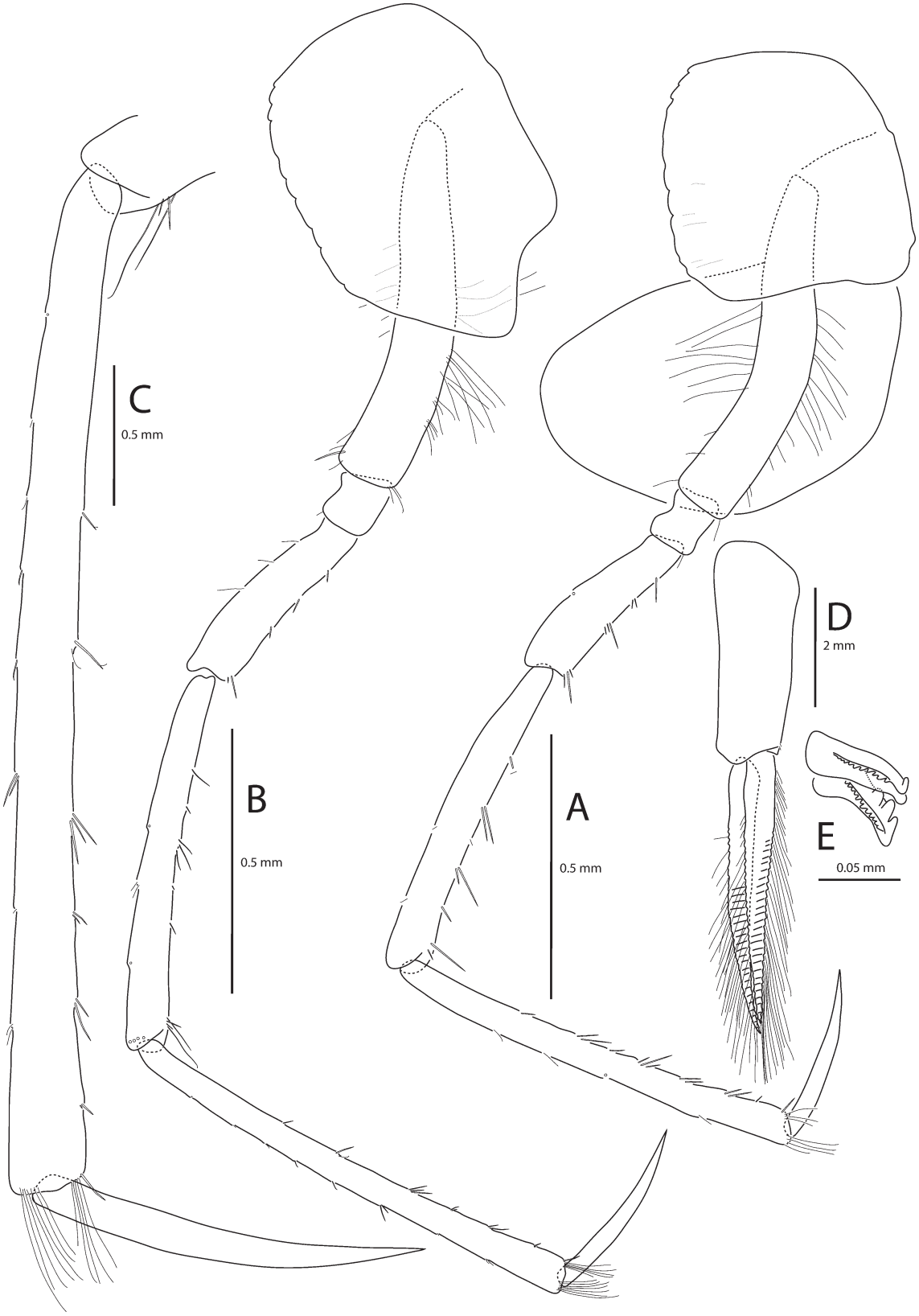

Fig. 5. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157. **A**. left P3. **B**. left P4. **C**. propodus and dactylus of left P4. **D**. left pleopod 1. **E**. coupling hooks of left pleopod 1.

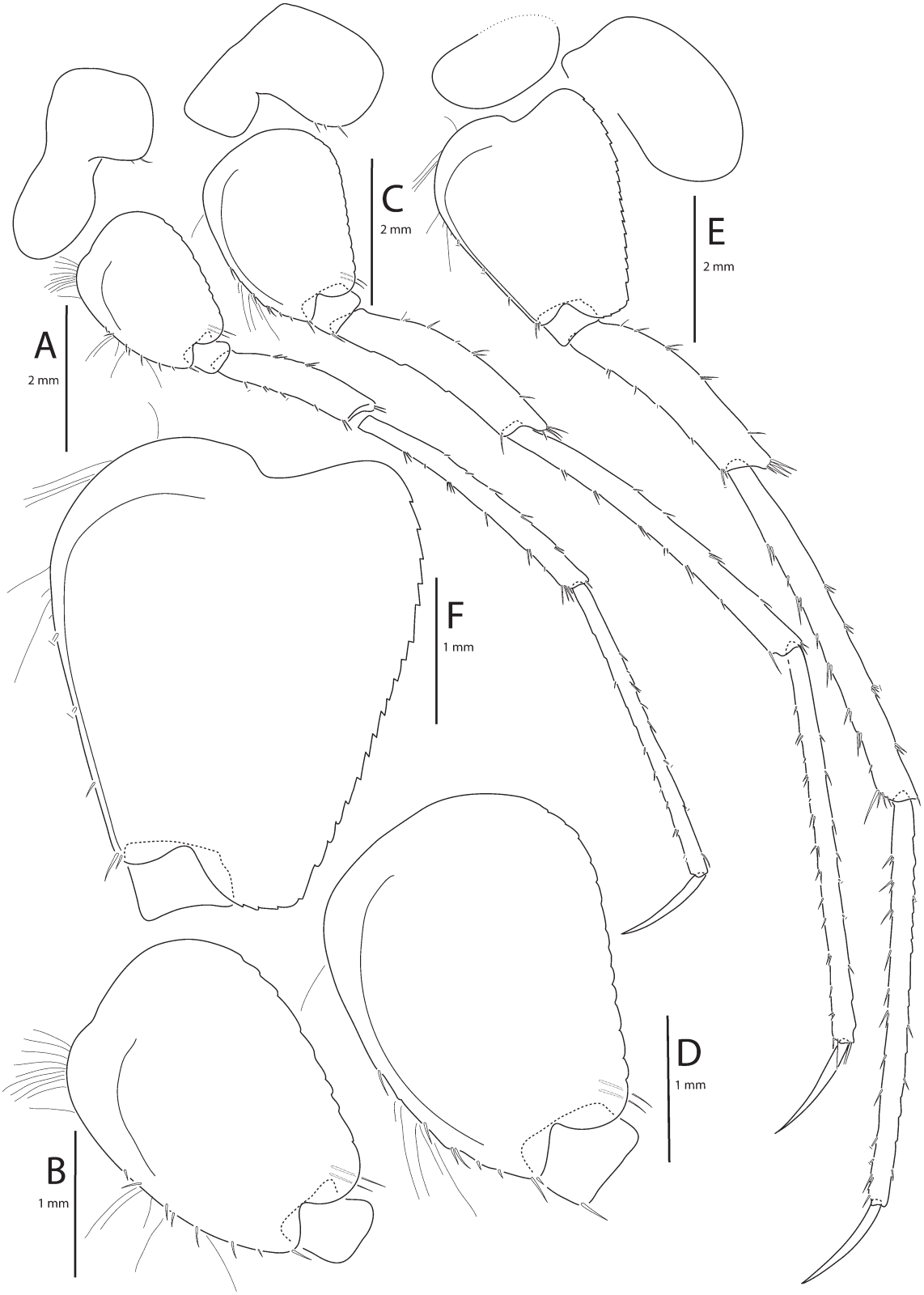

Fig. 6. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157. **A**. left P5 (basis drawn after right leg). **B**. basis and ischium of right P5 (inverted). **C**. left P6 (basis drawn after right leg). **D**. basis and ischium of right P6 (inverted). **E**. left P7. **F**. basis and ischium of left P7.

Pereiopod 6. (Fig. 6C-D) Posterior lobe of coxa considerably longer than anterior lobe; leg weakly spinose/setose; basis elliptic, 1.3 x as long as wide, anterior border with 9 styliform spines (one rubbed off on illustrated basis) and sparse thin setae, distally without tooth, posterior border with 14 very low crenulations, posterodistal border rounded and smooth, with 2 long styliform posterodistal medial spines; ischium without anterodistal tooth, with anterodistal spine; carpus 11.5 x as long as wide, 1.6 x as long as merus; propodus 19 x as long as wide, 1.7 x as long as merus; dactylus 13 x as long as wide, 0.29 x as long as propodus, 0.51 x as long as merus.

Pereiopod 7. (Fig. 6D-E) Coxa small and elliptic; large coxal gill present; leg weakly spinose/setose; basis with anterior and posterior border straight and converging towards tip, 1.2 x as long as wide, anterior border with 5 styliform spines and a few thin setae, distally without tooth, posterior border with 18 serrations, posterodistal border with 3 serrations; junction between posterior and posterodistal border bluntly angular; ischium without anterodistal tooth; carpus 11.2 x as long as wide, 1.6 x as long as merus; propodus 18.4 x as long as wide, 1.8 x as long as merus, 1.02 x as long as propodus of P6, 1.30 x as long as propodus of P5; dactylus 12 x as long as wide, 0.28 x as long as propodus, 0.49 x as long as merus.

Dorsal ornamentation. (Figs 1-2) Pereionite 7 and pleonites 1-2 with strong posterodorsal tooth; pereionite 6 without posterodorsal tooth.

Epimeron 1. (Fig. 7A) With facial carina, with 2 isolate margino-facial spines, with very weak posteroventral tooth, with posterior border rounded and smooth.

Epimeron 2. (Fig. 7B) With facial carina, with 4 isolate margino-facial spines, with very weak but acute posteroventral tooth, with posterior border straight and smooth.

Epimeron 3. (Fig. 7C) Without facial carina, with 7 isolate margino-facial spines, with weak posteroventral tooth, with posterior border weakly rounded and weakly serrate.

Urosomite 1. (Fig. 7D) With 4 ventrolateral spines and 1 posteroventral spine.

Uropod 1. (Fig. 7D) Peduncle with 24 dorsolateral slender irregular-sized spines, with 22 dorsomedial slender irregular-sized spines; outer ramus 0.72 x as long as inner ramus, with 15 dorsolateral irregular-sized spines, with at least 8 dorsomedial spines, with 4 apical spines; inner ramus as long as peduncle, with 25 dorsolateral spines (5 lost on illustrated uropod), with 41 dorsomedial slender irregular-sized spines; medial border of inner ramus minutely serrate.

Uropod 2. (Fig. 7E) Peduncle with 12 dorsolateral slender irregular-sized spines, with 13 dorsomedial slender irregular-sized spines; outer ramus 0.53 x as long as inner ramus, with 8 dorsolateral irregular-sized spines, with at least 3 dorsomedial spines, with 4 apical spines, border of ramus minutely serrate; inner ramus 1.2 x as long as peduncle with 19 dorsolateral spines (2 lost on illustrated uropod), with 21 dorsomedial slender irregular-sized spines, with 4 apical spines; medial border of inner ramus minutely serrate.

Uropod 3. (Fig. 7F) Peduncle with 4 distolateral dorsal spines, with dorsomedial and ventromedial border spinose; outer ramus 0.93 x as long as inner ramus, with about 47 lateral irregular-sized (most small and slender) spines (several lost on illustrated uropod), with at least 46 medial irregular-sized (most small and slender) spines; inner ramus 2.1 x as long as peduncle, without distinct medio-proximal bulging, with 49 lateral spines (most small and slender; some lost on illustrated uropod) and at least 15 plumose setae, with 49 medial slender irregular-sized spines (most small and slender; some lost on illustrated uropod) and at least 9 plumose setae.

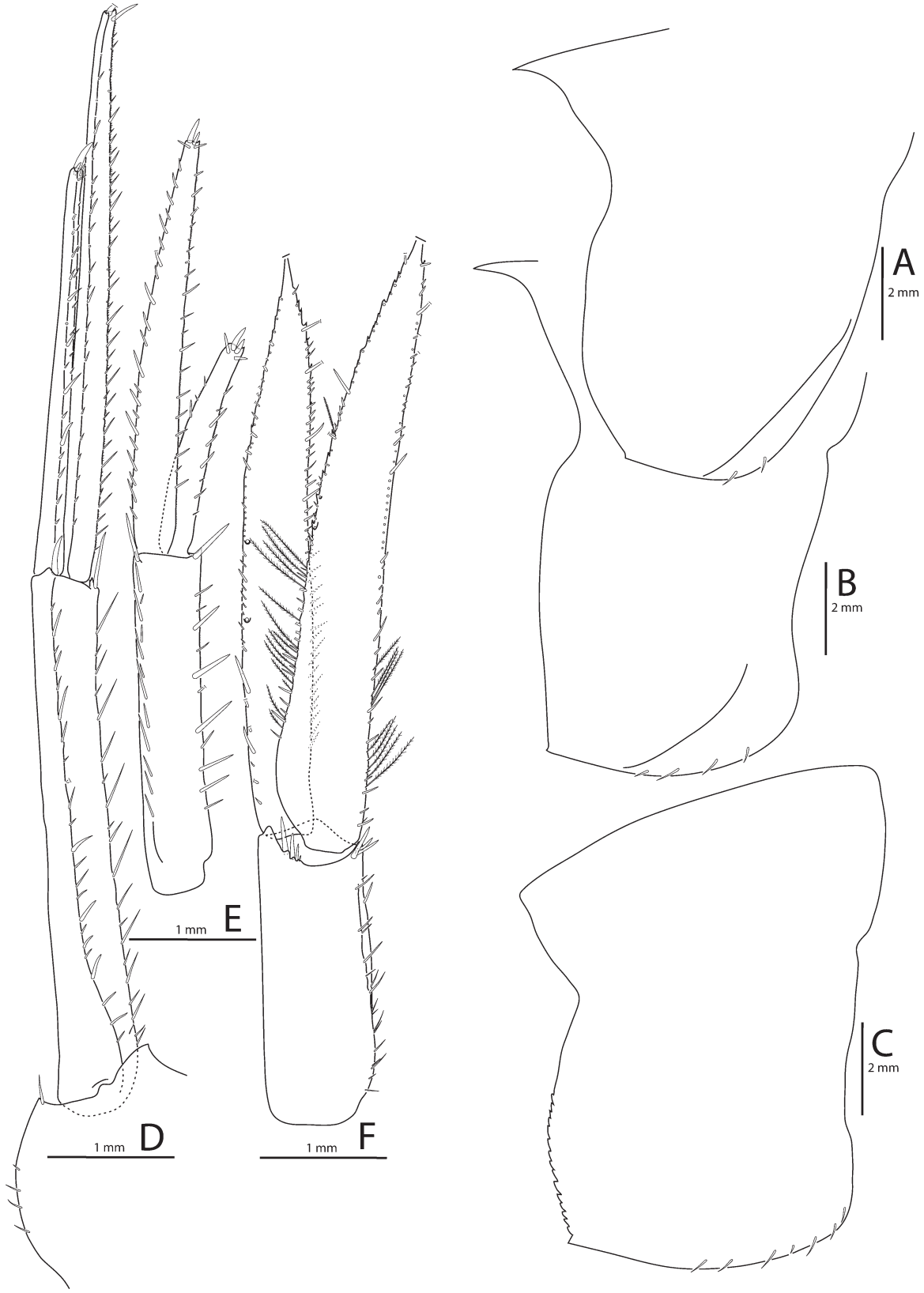

Fig. 7. *Halirages cainae* sp. nov., holotype ♂, 40 mm, Norwegian Sea, MAREANO 2009-111, R-station 487, sample 157. **A**. pleonite 1. **B**. pleonite 2. **C**. pleonite 3. **D**. ventrolateral part of urosomite 1 and right U1 (apical cluster of spines of outer ramus drawn after left U1). **E**. left U2. **F**. right U3.

Telson. (Fig. 4E) Triangular, with border convex, distally produced into a single tooth, without setules.

Colour pattern. (Fig. 1) Uniformly crimson, eyes dull reddish pink. In alcohol, the red pigment persists longer on the oral field and the gnathopods.

Body length. 40 mm.

Distribution

Norwegian Sea, west of Norway, 2589-2615 m. Besides the type series listed above, several other specimens of *H. cainae* sp. nov. from the Norwegian deep Sea were found during the workshop 'Deepwater amphipods of the Norwegian Sea, Skibotn Feltstasjon, August 2nd-9th, 2009', and were at that time provisionally identified as *H. caecus* Kamenskaya, 1980. These specimens, which were not re-examined in this study, should have been deposited in the Zoological Museum of Bergen. In addition to the collected specimens, large red *Halirages*, which were presumably also *H. cainae* sp. nov., were observed on muddy bottoms with the video platform Campod (see e.g. Anonym 2006; Buhl-Mortensen *et al.* 2009 for description) during the MAREANO 2009-111 cruise. *H. cainae* sp. nov. is a species associated with the deep-sea Arctic water mass with negative temperature of the Norwegian Sea (Tomczak & Godfrey 2003). Like almost all other organisms collected in that sea during the second leg of the MAREANO 2009-111 cruise, they were already dead when arriving on deck, after crossing the warmer upper water mass of Atlantic origin.

Remarks

Halirages cainae sp. nov. belongs to the *Halirages* species of the group *qvadridentatus*, together with *H. qvadridentatus* G.O. Sars, 1877, *H. gorbunovi* Gurjanova, 1946 and *H. caecus* Kamenskaya, 1979. The accounts given by G.O. Sars (1885) and Stephensen (1931) provide a clear picture of the diagnostic characters of the North-European species *H. qvadridentatus*, while the descriptions of the two other species (from the Arctic Ocean) are very deficient. The differences between the four species are described in the next section and are summarized in table 1.

H. cainae sp. nov. can be separated from *H. qvadridentatus* by the following characters. The eye is small, reniform to subreniform in *H. cainae* sp. nov., whilst it is large and quadrato-elliptic in *H. qvadridentatus* (see G.O. Sars 1885, plate 14 fig. 4). In *H. cainae* sp. nov., the junction between the anterior and ventral borders of coxa 1 forms a square angle, while in *H. qvadridentatus* it forms a tooth pointing forwards. The ventral border of coxa 1 and 2 bears about 10 weak crenulations in *H. cainae* sp. nov. vs. about 20 pronounced serrations in *H. qvadridentatus*. *H. cainae* sp. nov. has a posterodorsal tooth on the seventh pereionite and the first and second pleonite, never on the sixth pereionite (the dorsal dentition was also checked in the specimens seen during the workshop 'Deepwater amphipods of the Norwegian Sea'). In adult and subadult *H. qvadridentatus*, there is always a tooth on the seventh pleonite, and usually also a tooth on the sixth pereionite. On the posterior margin of the basis of pereiopods 5-7, the number of crenulations or serrations is lower in *H. cainae* sp. nov. (9, 14, 18) than in *H. qvadridentatus* (17, >22, 22-37). The posteroventral angle of the basis of pereiopod 7 is less angular in *H. cainae* sp. nov. than in *H. qvadridentatus*. The carpus and merus of pereiopod 7 are longer and more slender in *H. cainae* sp. nov. than in *H. qvadridentatus*. The carpus is 11.5 x as long as wide and 1.6 x as long as posterior border of basis in *H. cainae* sp. nov., whilst these ratios are 8.8 and 1.3 in *H. qvadridentatus*, respectively. The propodus is 18.4 x as long as wide and 1.8 x as long as posterior border of basis in *H. cainae* sp. nov., whilst these ratios are 13.0 and 1.4 in *H. qvadridentatus*, respectively. Finally, the tip of the telson has a single tooth in *H. cainae* sp. nov., whilst it is tridentate in *H. qvadridentatus*.

H. gorbunovi is very inadequately described but exhibits the following differences with the present species. In *H. cainae* sp. nov. the crenulations of the ventral border of coxa 1 and coxa 2 are weaker than

Table 1. Character states of *Halirages* species of the group *qvadridentatus*.

Taxa / characters	*H. cainae*	*H. caecus*	*H. gorbunovi*	*H. qvadridentatus*
Eyes	small and subreniform	absent	absent	large and broad, quadrato-elliptic
Robustness of article 2 of Md palp	stout	slender	unknown	stout
Setation of article 2 of Md palp	strongly setose all along posterior border	posterior border sparsely setose	unknown	strongly setose all along posterior border
Md palp article 3	distally narrow	distally broad	unknown	distally narrow
Coxa 1 anteroventral corner	square	pointing forwards	pointing forwards	pointing forwards
Coxa 1 ventral ornamentation	about 10 weak crenulations	smooth or nearly so	about 10 pronounced serrations	about 20 pronounced serrations
Coxa 2 ventral crenulations	about 10 weak crenulations	smooth or nearly so	about 8 pronounced serrations	about 16 pronounced serrations
Posteroventral corner of basis of P6	rounded	unknown	angular	rounded
Posteroventral corner of basis of P7	bluntly angular	unknown	unknown	Forming a sharp square angle
Ornamentation of posterior border of basis of P7	distinctly serrate (about 18 serrations)	unknown	scarcely crenulate (with 3-4 scarcely noticeable notches)	distinctly serrate (22-37 serrations)
Ratio length/width of carpus of P7	11.5	unknown	unknown	8.8
Ratio length/width of propodus of P7	18.4	unknown	unknown	13.0
Ratio length of carpus / length of posterior border of basis of P7	1.6	unknown	unknown	1.3
Ratio length of propodus / length of posterior border of basis of P7	1.8	unknown	unknown	1.4
Posterodorsal ornamentation of pereion and pleon	pereionite 7 and pleonites 1-2 with posterodorsal tooth	pereionite 7 and pleonites 1-2 with posterodorsal tooth	unknown	pereionite 7 (and usually pereionite 6 in adults) and pleonites 1-2 with posterodorsal tooth
Tip of telson	with single distal triangular tooth	with single distal styliform tooth	unknown	tridentate
Depth range	2589-2615 m	2810-3467 m	2500 m	425-1435 m
Distribution	East of Norwegian Sea	Arctic Ocean: Canadian Basin	Arctic Ocean: East of Nansen Basin	From Baffin Bay to Laptev Sea; Faeroes

in *H. gorbunovi*. In *H. cainae* sp. nov. the posteroventral angle of the basis of pereiopod 6 is rounded, whilst it is distinctly angular in *H. gorbunovi* (see Gurjanova 1946: 288 fig. 21.4). In *H. cainae* sp. nov.. the posterior border of the basis of pereiopod 6 has about 9 crenulations vs. about 5 scarcely distinct crenulations in *H. gorbunovi*. The Russian text also indicates that the basis of pereiopods 5 and 7 have an almost smooth posterior border, while *H. cainae* sp. nov. has small, but distinct serrations on the posterior border of the basis of pereiopod 7. Finally, *H. cainae* sp. nov. has eyes (which disappear only after a long preservation period), whilst *H. gorbunovi* is said to have none. This absence of eye will have to be confirmed when fresh specimens of *H. gorbunovi* will be available to study. It must be noted that the pleon of the two syntypes of *H. gorbunovi* is missing and that they are small juveniles: 6.5 mm from the tip of the rostrum to the end of the pereion (the largest *H. cainae* sp. nov. is 40 mm long). An adequate characterization of *H. gorbunovi* would only be possible when topotypical specimens from a wide size range will be available for study.

The description of *H. caecus* is also very deficient but includes the following differences with the new species. In *H. cainae* sp. nov., article 2 of mandibular palp is stout and is densely setose, all along its medial margin, whilst it is slender and sparsely setose in *H. caecus*. In *H. cainae* sp. nov., article 3 of mandibular palp is apically broader than in *H. caecus*. In *H. cainae* sp. nov., the anteroventral corner of coxa 1 forms a square angle, whilst in *H. caecus* it forms a tooth pointing forward. It must be pointed out that pereiopods 5-7 of the types of *H. caecus* were neither illustrated nor described and were possibly missing in all specimens. Finally, *H. caecus* is said to be eyeless whilst *H. cainae* sp. nov. does have eyes (which can become indistinguishable after a long preservation period). As for *H. gorbunovi*, the absence of eyes needs confirmation.

Halirages qvadridentatus G.O. Sars, 1877
Figs 8-9

Halirages qvadridentatus G.O. Sars, 1877: 257.
Halirages elegans Norman, 1882: 688.

Halirages qvadridentatus – G.O. Sars 1885: 172, pl. 14 fig. 4. — d'Udekem d'Acoz 2010: 146 (discussion on spelling).
Halirages quadrispinosus – G.O. Sars 1893: 436 (*lapsus calami*).
Acanthozone quadridentata – Della Valle 1893: 611 (*pro parte*), pl. 59 fig. 22.
Halirages quadridentatus – Stebbing 1906: 290, 292. — Stephensen 1931: 268-272, fig. 76; 1933: 32 (variations); 1938: 237, 240. — Gurjanova 1946: 288 (discussion); 1951: 606, 608, fig. 411 (after G.O. Sars 1885). — Yashnov 1948: 641, pl. 78 fig. 8 (after Stephensen 1931). — Kamenskaya 1980: 248 (discussion).
? *Halirages* spez. – Schellenberg 1925: 205.

Type material (syntypes) of *Halirages elegans* Norman, 1882

FAEROE ISLANDS: RV *Knight Errant*, stn 8, 60°04'N 007°37'W, 305 fathoms [= 558 metres], mud, 27 Jul.1880: 3 specimens (none with oostegites) (specimens of lengths 30, 25 and 19 mm), BM(NH) 17375-377; RV *Knight Errant*, stn 8: 1 mandible, in very poor condition BM(NH), slide 1911.11.8.1268; Faeroe Islands, RV *Knight Errant*, stn 8: anterior part of head, right Gn1, right Gn2, left P7, left Ep3, left U3, 2 telsons, BM(NH), slide 1911.11.8.1269; RV *Knight Errant*, 1880, stn 8, label of slides indicating "main organs (mandible from three specimens)": 3 mandibles, 1 upper lip, 1 maxilliped, in poor condition, BM(NH), slide 1911.11.8.1270.

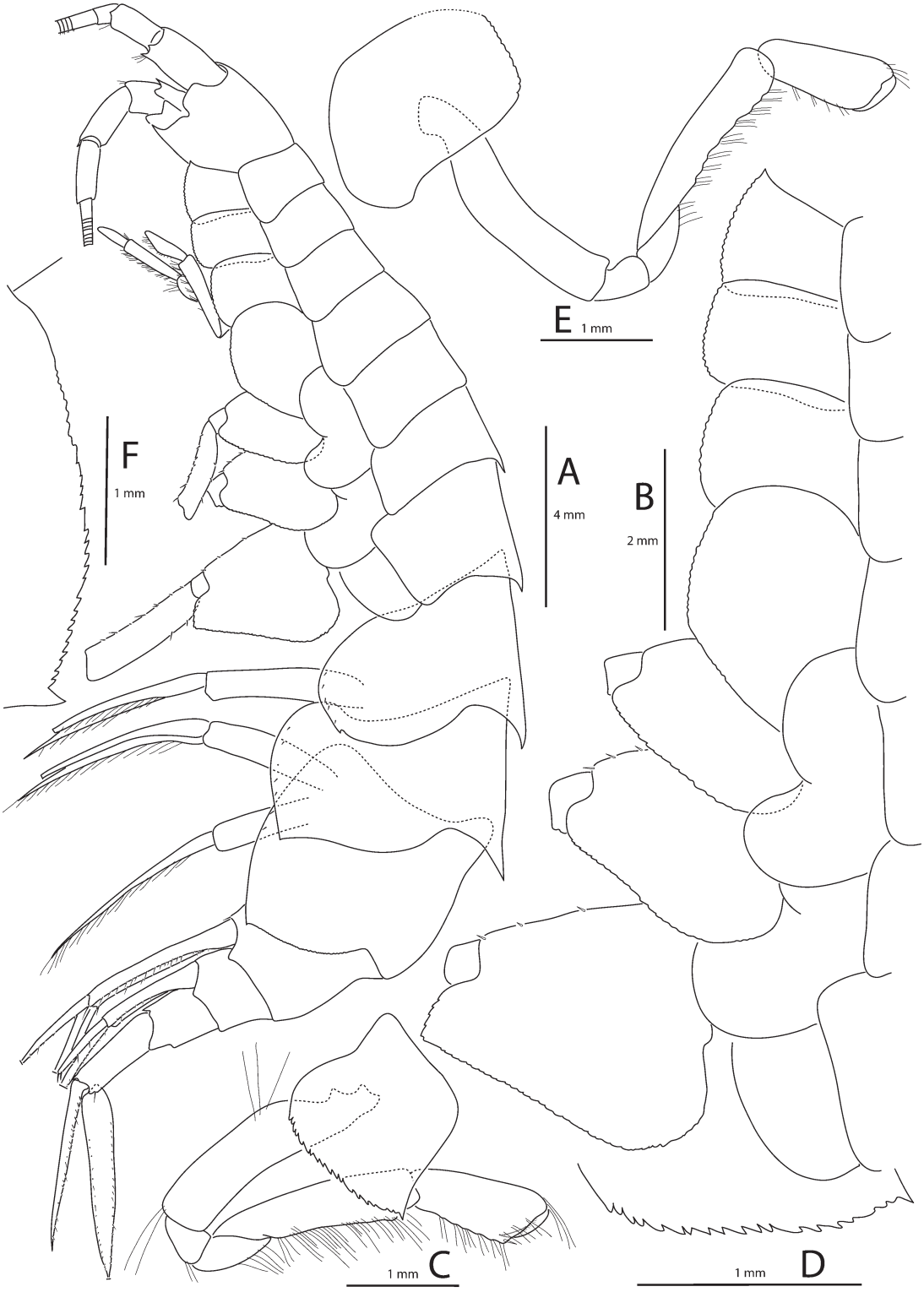

Fig. 8. *Halirages qvadridentatus* G.O. Sars, 1877 (syntypes of *Halirages elegans* Norman, 1882), Faeroe Islands, RV *Knight Errant*, stn 8. **A-B**. largest syntype, ♂ (30 mm); **C-F**. microscopical preparations by Norman. **A**. habitus. **B**. ventral part of pereion with coxal plates and proximal part of posterior pereiopods. **C**. right Gn1 (coxa broken in two parts on slide and reassembled on drawing). **D**. ventral margin of right coxa 1. **E**. right Gn2 (anteroventral corner of coxa indistinct, hidden by varnish on border of microscopical preparation). **F**. posterior border of Ep3.

Description

Head. (Fig. 8A) Rostrum feeble; anterior lobe of head very bluntly subquadrate, posteriorly followed by distinct sinus; ventral lobe of head acute, pointing forward, not denticulate.

Antennae. (Fig. 8A) Typical for the genus *Halirages*; article 1 of peduncle with 2 normally developed ventrolateral distal teeth.

Mouthparts. Typical for the genus but not described for the poor quality of the dissected material.

Gnathopod 1. (Fig. 8B-D) Coxa with anteroventral corner produced into a small tooth pointing forwards, with 18-20 small serrations along ventral margin; carpus 4.4 x as long as wide, as long as basis, anterior border not setose; propodus 2.4 x as long as wide, 0.66 x as long as carpus; palmar part of propodus 0.23 x as long as propodus.

Gnathopod 2. (Fig. 8B, E) Coxa rectangular, with about 16 crenulations along ventral margin; carpus 4.8 x as long as wide, as long as basis, with anterior border not setose; propodus 2.5 x as long as wide, 0.59 x as long as carpus; palmar part of propodus 0.23 x as long as propodus.

Pereiopod 3. Damaged, not suitable for description.

Pereiopod 4. (Figs 8B, 9A) Coxa broad and posteriorly produced, with about 15 crenulations along ventral margin; leg weakly spinose/setose; carpus 7.5 x as long as wide, 1.6 x as long as merus; propodus 11.4 x as long as wide, 1.6 x as long as merus.

Pereiopod 5. (Fig. 8A-B) Pereiopod 5 < pereiopod 6 < pereiopod 7; posterior lobe of coxa distinctly longer than anterior lobe; leg weakly spinose/setose; basis elliptic, anterior border distally without tooth, posterior border with about 17 low crenulations, posterodistal border rounded and smooth; ischium without anterodistal tooth.

Pereiopod 6. (Figs 8A-B, 9B) Posterior lobe of coxa considerably longer than anterior lobe; leg weakly spinose/setose; basis anteriorly convex and posteriorly straight, converging towards tip, 1.3 x as long as wide, anterior border distally without tooth, posterior border with more than 23 low crenulations, posterodistal border rounded and smooth; ischium without anterodistal tooth; carpus 9.5 x as long as wide, 1.4 x as long as merus; propodus 13 x as long as wide, 1.2 x as long as merus.

Pereiopod 7. (Figs 8A-B, 9C-D) Coxa small and elliptic; leg weakly spinose/setose; basis with anterior and posterior border straight and converging towards tip, 1.3 x as long as wide, anterior border with 6 slender spines and no setae, distally without tooth, posterior border with 22-37 serrations, posterodistal border with 3-5 serrations; junction between posterior and posterodistal border sharply angular; ischium without anterodistal tooth; carpus 8.8 x as long as wide, 1.4 x as long as merus; propodus 13 x as long as wide, 1.6 x as long as merus.

Dorsal ornamentation. (Fig. 8A) Pereionite 7 (2 smaller syntypes) or pereionites 6-7 (largest syntype), and pleonites 1-2 with strong posterodorsal tooth.

Epimeron 1. (Fig. 8A) With 5 isolate margino-facial spines, with well-developed posteroventral tooth, with posterior border rounded and smooth.

Epimeron 2. (Fig. 8A) With 5 isolate margino-facial spines, with weak but acute posteroventral tooth, with posterior border sigmoid and smooth.

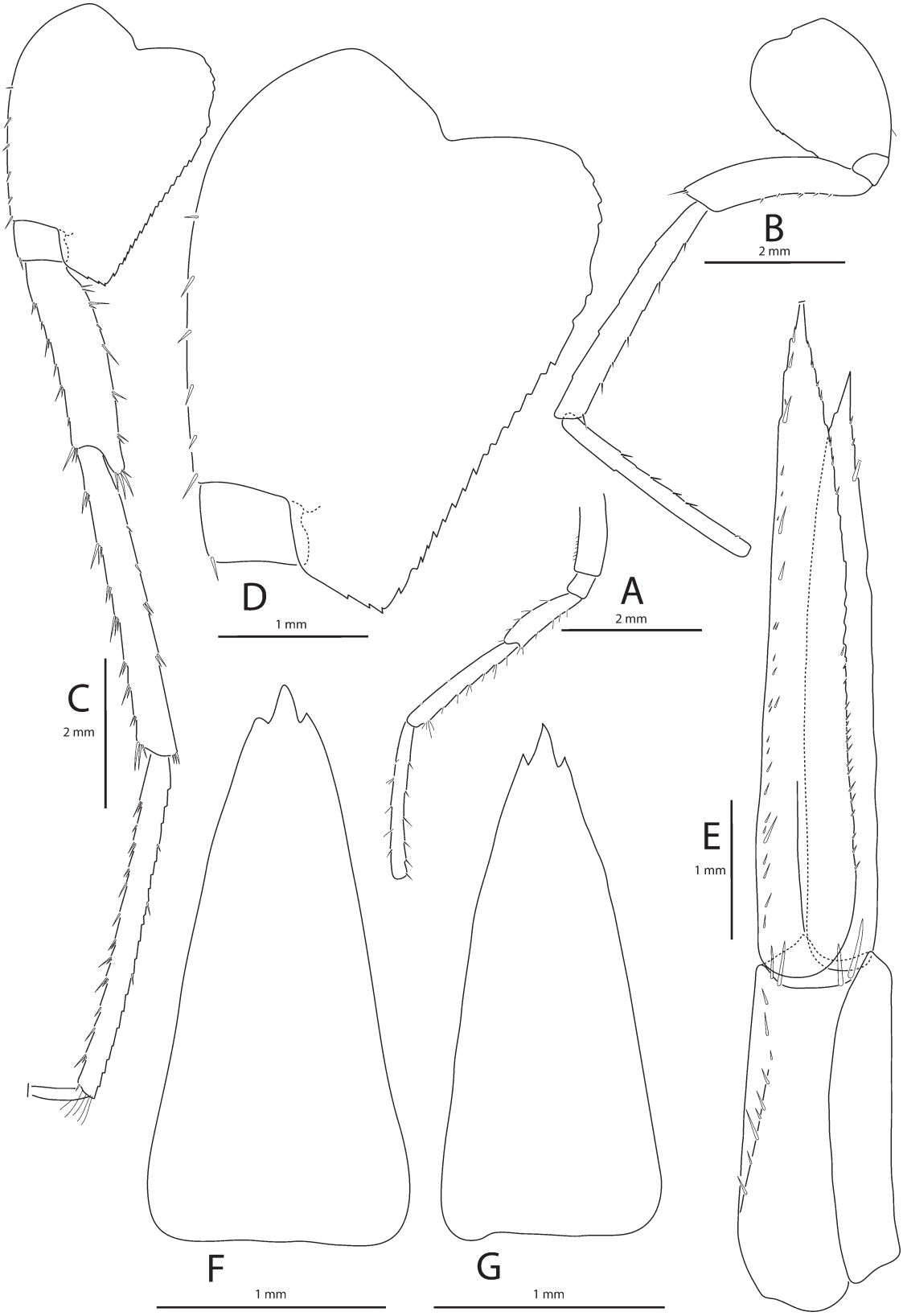

Fig. 9. *Halirages qvadridentatus* G.O. Sars, 1877 (syntypes of *Halirages elegans* Norman, 1882), Faeroe Islands, RV *Knight Errant*, stn 8, microscopical preparations by Norman. **A**. left P4. **B**. right P6. **C**. left P7. **D**. basis and ischium of left P7 (proximal part of posterior border eroded). **E**. left U3. **F-G**. telson.

Epimeron 3. (Fig. 8A, F) With a few isolate margino-facial spines, with weak but acute posteroventral tooth, with posterior border weakly rounded and weakly serrate.

Uropods 1-2. Adequate description impossible without destructive dissection.

Uropod 3. (Figs 8A, 9E) Peduncle with 4 distal dorsal spines, with dorsomedial border spinose; rami with irregularly sized (mostly slender and small) spines; outer ramus 0.88 x as long as inner ramus; inner ramus 1.8 x as long as peduncle, without medio-proximal bulging.

Telson. (Fig. 9F-G) Triangular, with border convex, distally produced into 3 teeth of which the median one is by far the longest, without setules.

Body length. The largest syntype of *H. elegans* is 30 mm long.

Distribution

Baffin Bay, Eastern Iceland, Southeast of Faeroe Islands, Southeast of Jan Mayen (Stephensen 1938), Western Greenland (Stephensen 1933), Northwestern Greenland (Just 1980), Northeastern Greenland (Piepenburg 1988; Brandt 1997), Eastern Greenland (Stephensen 1913; Brandt 1997), Håkon Mosby mud volcano, Norwegian Sea, c. 1250 m (Gebruk *et al.* 2003), Northern and Western Svalbard (Gulliksen *et al.* 1999); 640-1435 m (Stephensen 1938), off Eastern Greenland at less than 425 m (Brandt 1997); Kara Sea (Gurjanova 1936: 152), Barents, Kara and Laptev Seas, Central polar Basin (Sirenko 2001). The much deeper records (2700 and 3200 m) from 'Svenska Djupet' by Oldevig (1959) require confirmation and the specimens of that author could actually be *H. cainae* sp. nov. Similarly, the very shallow records (8 to 500 m) in the Barents Sea by Bryazgin (1997) are considered as suspect. Weisshappel (2001) found *H. qvadridentatus* in Iceland in the Arctic Bottom Water Mass between -0.5°C and -0.6°C and Stephensen (1931) found it at temperatures between +0.8°C and -1.0°C.

Remarks

The original description of *H. elegans*, based on specimens from the Faeroe Islands, was meager and devoid of illustrations (Norman 1882), so that it was impossible to figure out exactly what the species looked like and how it differed from congeners. Stappers (1911), reluctantly followed by Stephensen (1931), applied the name *H. elegans* to a species very distinct from *H. qvadridentatus* and in many respects closer to *H. fulvocinctus*. Examination of the type material of *H. elegans* demonstrated that it consisted of specimens of *H. qvadridentatus*, confirming the assumptions of Della Valle (1893) and Stebbing (1906). A description and figures of these type specimens are given herein to demonstrate their synonymy and a new name is proposed for the species described in Stappers (1911) and Stephensen (1931) in the next section.

Norman (1882: 688) indicated that his specimens came from station 8 of the Knight Errant Expedition, 540 fathoms [= 988 metres]. The real depth of station 8 was 305 fathoms [= 558 metres] (Norman 1882: 650), and it is station 6, which was 540 fathoms [= 988 metres] deep.

Halirages stappersi sp. nov.
Figs 10-12

Halirages elegans – Stappers 1911: 58-61, pl. 3 figs 5-18. — Stephensen 1931: 268-271, fig. 77; Stephensen 1938: 237, (key), 241. — Gurjanova 1946: 287 (discussion). — Yashnov 1948: 641, pl. 78 (after Stephensen 1931). — Gurjanova 1951: 605, 607-608, fig. 410 (after Stappers 1911).

Not *Halirages elegans* Norman, 1882: 688 (= *H. qvadridentatus* G.O. Sars, 1877).
Not *Halirages elegans* – Oldevig 1959: 65.

Etymology

Halirages stappersi sp. nov. is dedicated to the memory of Jean Hubert Louis Stappers (1883-1916), who collected the holotype of the species during the Arctic Campaign of 1907 of the Duc d'Orléans on the RV *Belgica* (see Barr 2010) and described it accurately, but under the name of *Halirages elegans* Norman, 1882. The name is a genitive.

Type material

RV *Belgica*, 1907, Kara Sea, stn 132, 71°03'N 057°48'E, 207 m: 1 ♂ holotype, 20 mm (pieces dissected out by Stappers not present), RBINS, I.G. 8749, INV. 101145.

Description

Head. (Fig. 10A-B) Rostrum feeble; anterior lobe of head very bluntly subquadrate (almost rounded), posteriorly followed by narrow sinus; ventral lobe of head acute, pointing forward, not denticulate; eye large, subquadrate, with fully developed ommatidia, pigmentation retained after being stored in alcohol for a century.

Antennae. (Fig. 10A-C) Typical for the genus *Halirages*; article 1 of peduncle with 2 strong ventrolateral distal teeth.

Lower lip. (Fig. 10D) With narrow mandibular processes and broad outer lobes.

Mandible. (Fig. 10E) Palp article 1 very short, with 2 D1-setae; article 2 and 3 equal in length; article 2 stout (2.9 x as long as wide), with row of D2-setae and subdistal row of A2-setae; article 3 falciform, with row of D3-setae on distal 0.8.

Maxilla 1. (Fig. 10 F-G) Inner plate with 8 plumose setae, the length of which the size significantly increases towards tip; outer plate with 9 denticulate spines; palp well developed, with broad article 2; left article 2 with row of long styliform marginal spines and row of margino-facial setae; right article 2 with distal margin dentate, with 2 freely articulated anterodistal spines, with margino-facial row of well-developed setae.

Gnathopod 1. (Figs 10A, 11A) Coxa with anteroventral corner produced into a tooth pointing forwards, with 12-15 strong serrations along ventral margin; carpus 3.9 x as long as wide, almost as long as basis, anterior border without setae (except for distal tuft of seta); propodus 2.6 x as long as wide, 0.78 x as long as carpus; palm denticulate, with row of thin setae; palmar part of propodus 0.25 x as long as propodus; dactylus dentate.

Gnathopod 2. (Figs 10A, 11B) Coxa broadly rectangular, with about 13 distinct serrations along ventral margin; carpus 3.8 x as long as wide, distinctly shorter than basis, with anterior border setose; propodus 2.6 x as long as wide, 0.74 x as long as carpus; palm denticulate; palmar part of propodus about 0.22 x as long as propodus; dactylus dentate.

Pereiopod 3. (Fig. 11C) Coxa slightly longer than broad, with anterior and posterior border parallel, distally rounded, with ventral border serrate; leg distinctly spinose/setose; basis anteriorly weakly concave and posteriorly weakly convex; carpus 7.0 x as long as wide, 1.3 x as long as merus; propodus 8.0 x as long as wide, 1.5 x as long as merus; dactylus 0.39 x as long as propodus, 0.58 x as long as merus.

Pereiopod 4. (Fig. 10A) Coxa broad and serrate; leg missing but presumably similar to P3.

Pereiopod 5. (Fig. 11D-E) Basis elliptic, with about 28 posterior and posterodistal distinct serrations (distal serrations irregularly shaped), with small but sharp anterodistal tooth; ischium with small but sharp anterodistal tooth; 3 distal articles missing.

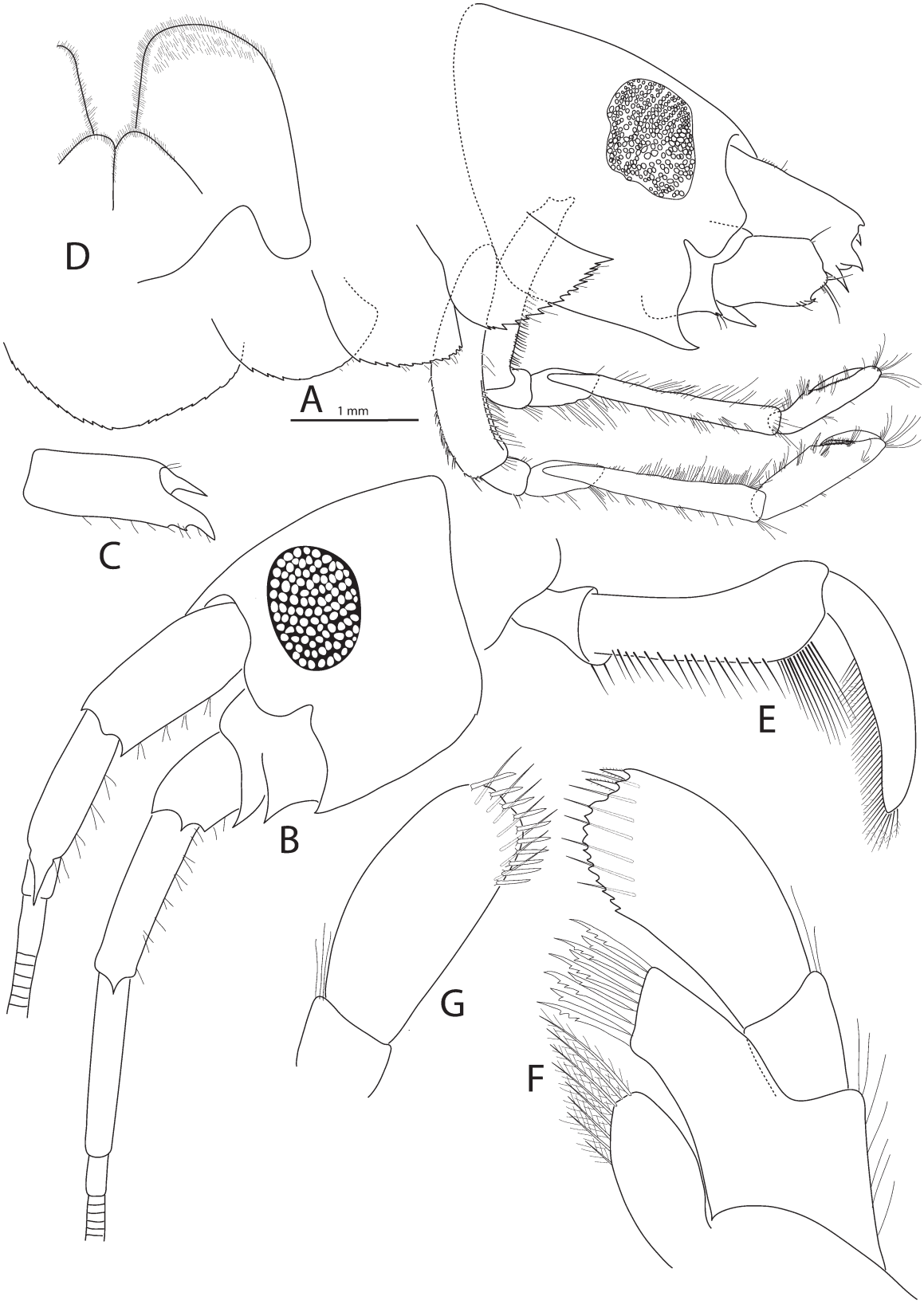

Fig. 10. *Halirages stappersi* sp. nov., holotype ♂, 20 mm, Kara Sea, RV *Belgica* stn 132. **A**. original. **B-G**. after Stappers (1911). **A-B**. anterior part of body. **C**. article 2 of peduncle of left A2. **D**. lower lip. **E**. palp of left Md. **F**. right Mx1 (medial face). **G**. palp of left Mx1 (medial face).

Pereiopod 6. (Fig. 11F) Basis elliptic, with posterior and posterodistal distinct serrations (distal serrations irregularly shaped), with small but sharp anterodistal tooth; ischium with small but sharp anterodistal tooth; 4 distal articles missing.

Pereiopod 7. (Fig. 11G-H) Leg distinctly spinose/setose; basis elliptic, 1.5 x as long as wide, anterior border setose, with small but sharp anterodistal tooth, posterior and posterodistal border with 29 serrations (distal serrations irregularly shaped); junction between posterior and posterodistal border bluntly angular; ischium with small but sharp anterodistal tooth; carpus 5.8 x as long as wide, 0.94 x as long as merus; propodus 13 x as long as wide, 1.2 x as long as merus; dactylus 7 x as long as wide, 0.36 x as long as propodus, 0.44 x as long as merus.

Dorsal ornamentation. (Fig. 12A) Pereionite 7 and pleonites 1-2 with strong posterodorsal tooth.

Epimera 1-2. Examination impossible without destructive dissection.

Epimeron 3. (Fig. 12A) Without facial carina, with 9 strong isolate marginofacial spines and 4 marginofacial setules, with strong posteroventral tooth and strong posterolateral tooth, with posterior border between both teeth concave and serrate/crenulate.

Urosomite 1. (Fig. 12B) With 6 ventrolateral spines and 1 posteroventral spine.

Uropod 1. (Fig. 12B-C) Peduncle with 16-19 dorsolateral slender irregular-sized spines, with 16 dorsomedial slender irregular-sized spines; outer ramus about 0.7 x as long as inner ramus, with 9-11 dorsolateral irregular-sized spines, with at least 7 dorsomedial spines, with 4 apical spines; inner ramus as long as peduncle, with about 10 dorsolateral spines, with about 11 dorsomedial slender irregular-sized spines, with 4 apical spines; border of rami minutely serrate.

Uropod 2. (Fig. 12B) Peduncle with 12 dorsolateral slender irregular-sized spines; outer ramus about 0.6 x as long as inner ramus.

Uropod 3. (Fig. 12C) Peduncle with 6 distal dorsal spines, with dorsomedial border spinose; outer ramus with strong spines on lateral border, with medium-sized spines and plumose setae on medial border; inner ramus 1.4 x as long as peduncle, with medio-proximal bulging distinct, with 16 strong lateral spines, with 21 strong medial spines and 2 proximal plumose setae.

Telson. (Fig. 12E-F) Triangular, distally produced into a distal tooth flanked by 2 pairs of subdistal teeth, with a spinule in each interdental notch.

Body length. 20 mm.

Variations

According to Stephensen (1931, as *H. elegans*), the posterodorsal tooth of pereionite 7 is sometimes lacking.

Distribution

Kara Sea, 207 m (Stappers 1911, as *H. elegans*); Svalbard, South of Jan Mayen, North of Faeroe Islands, Western Iceland, 700 to 1384-1435 m, +0.4°C to +2.0°C (Stephensen 1931, 1938, as *H. elegans*); Northern Iceland, 407-996 m, -0.6°C to +0.1°C, i.e. in the Arctic Shallow Water Mass and the Arctic Bottom Water Mass (Weisshappel 2001, as *H. elegans*); Kara Sea, Laptev Sea, East Siberian Sea (Sirenko 2001). Brandt (1997) also records some 'cf. *Halirages elegans*' from East Greenland between 260 and 2681 m, which possibly include specimens of the present species.

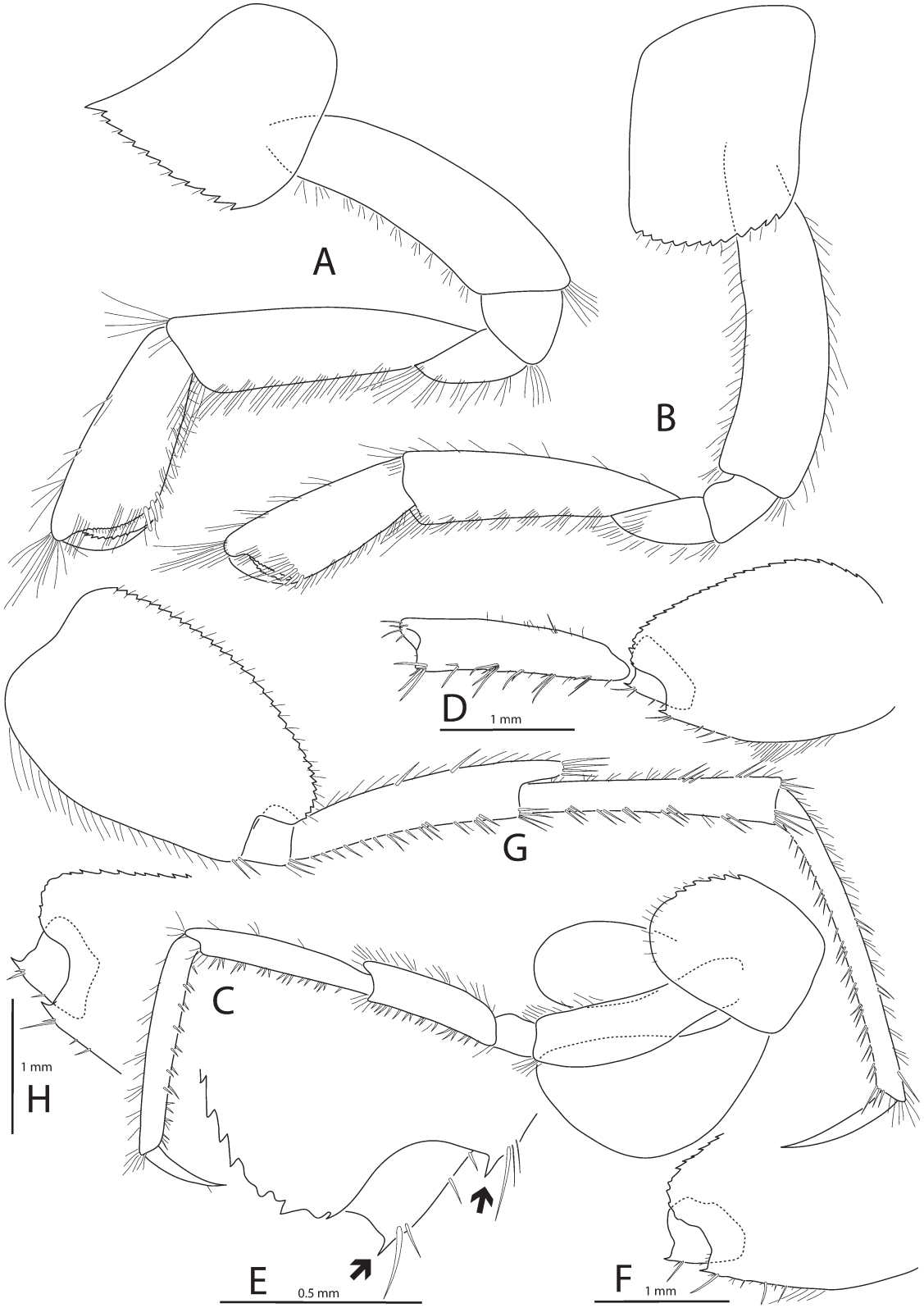

Fig. 11. *Halirages stappersi* sp. nov., holotype ♂, 20 mm, Kara Sea, RV *Belgica* stn 132. **D, E, F, H**. original. **A, B, C, G**. after Stappers (1911). **A**. left Gn1. **B**. left Gn2. **C**. left P3. **D**. right P5. **E**. ischium and tip of basis of right P5. **F**. ischium and tip of basis of right P6. **G**. left P7. **H**. ischium and tip of basis of right P7.

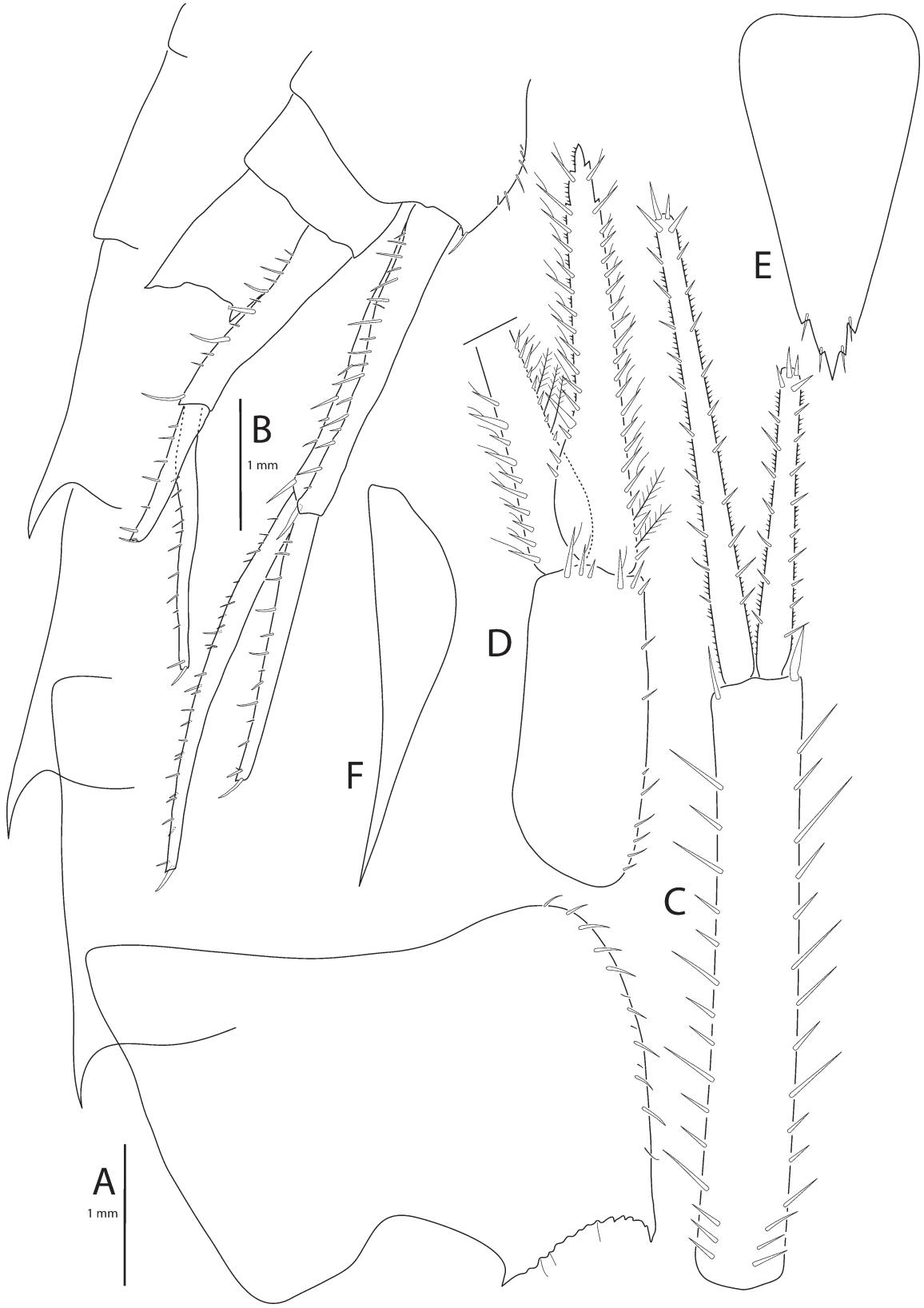

Fig. 12. *Halirages stappersi* sp. nov., holotype ♂, 20 mm, Kara Sea, RV *Belgica* stn 132. **A-B**. original; **C-F**. after Stappers (1911). **A**. medium part of body. **B**. urosome and right U1 and U2. **C**. left U1. **D**. left U3. **E**. telson in dorsal view. **F**. telson in lateral view.

Remarks

Stappers (1911) provided excellent figures of many parts of the holotype and Stephensen (1931) gave further good drawings of the species, so that there is no need for a completely new set of figures, which would require further destructive dissections of the single type specimen. The illustrations of Stappers (1911) are simply reproduced herein, with a few complementary original figures made without dissection. It can be observed that the left rami of uropod 1, as illustrated by Stappers (1911) is shorter than the right rami examined during the present study. The right rami were somewhat distorted and this was possibly also the case of the left rami. So, it is possible that Stappers (1911) made an imperfect reconstruction of the appendage.

Key to *Halirages* species

1. Ep3 with posteromedian and posteroventral tooth (posterior border forming an angular protrusion) (Fig. 12A)..... 2
– Ep3 with posteroventral tooth only (posterior border rounded) (Fig. 7C)..... 4

2. Pereionite 7 with 0-1 posterodorsal tooth; pleonite 1 and 2 with 1 posterodorsal tooth 3
– Pereionite 7 and pleonites 1-2 with 3 posterodorsal teeth ..... ***H. nilssoni*** Ohlin, 1895

3. Telson distally truncated and slightly concave; ventral border of coxae 1-2 smooth; posterior border of basis of P5-7 with very weak crenulations; carpus of Gn1-2 equal to propodus..... ***H. fulvocinctus*** (M. Sars, 1859)
– Telson pointed, with large distal tooth flanked by 2 pairs of small lateral subdistal teeth; ventral border of coxae 1-2 and posterior border of basis of P5-7 distinctly serrate; carpus of Gn1-2 distinctly longer than propodus..... ***H. stappersi*** sp. nov.

4. Ventral lobe of head produced into a sharp tooth; carpus of Gn1-2 about 4 x as long as broad or narrower; at least some segments of pleon with posterodorsal tooth*; telson pointed; bathyal and abyssal species 5
– Ventral lobe of head bluntly subquadrate; carpus of Gn1-2 a bit less than 2 x as long as broad; pleon smooth, segments without posterodorsal tooth; telson truncated; infralittoral species..... ***H. mixtus*** Stephensen, 1931

5. Eyes present 6
– Eyes absent..... 7

6. Eye large and broad; coxa 1 with anteroventral corner pointing anteriorly; ventral border of coxa 1 with about 20 pronounced serrations; posteroventral corner of basis of P7 forming a sharp square angle; pereionite 7 (and often 6) and pleonites 1-2 with posterodorsal tooth; tip of telson tridentate ..... ***H. qvadridentatus*** G.O. Sars, 1877
– Eye small and subreniform; coxa 1 with anteroventral corner forming a square angle; ventral border of coxa 1 with about 10 weak crenulations; posteroventral corner of basis of P7 bluntly angular; pereionite 7 (but never 6) and pleonites 1-2 with posterodorsal tooth; tip of telson with a single distal tooth ..... ***H. cainae*** sp. nov.

7. Ventral border of coxa 1-2 with pronounced serrations..... ***H. gorbunovi*** Gurjanova, 1946
– Ventral border of coxa 1-2 smooth or nearly so..... ***H. caecus*** Kamenskaya, 1980

* The pleon of the type specimens of *H. gorbunovi* (and only known specimens) is missing and its ornamentation is therefore unknown. However, since that species looks very similar to *H. qvadridentatus*, it is assumed that some of the posterior body segments have a posterodorsal tooth.

Checklist of *Halirages* species

***Halirages caecus* Kamenskaya, 1980**

The original spelling *Halirages caecum*, given by Kamenskaya (1980), has to be changed into *H. caecus* because *Halirages* is masculine and *caecus*, *-a*, *-um* is an adjective. Arctic Ocean, 'Drifting Station North Pole 22', stn 10, 81°44'N 121°46'W, 3467 m; stn 14, 81°42'N 126°51'W, 3530 m; stn 29, coordinates missing, 2910-2630 m; stn 34, 79°02'N 127°39'W (including holotype), 3290 m; stn 50, 78°45'N 127°36'W, 2990-2950 m; stn 53, 78°10'N 130°00'W, 2810 m. The table of stations provided by Kamenskaya (1980) indicates that all the stations of the drifting station North Pole 22 are in East longitudes. However, this is clearly a mistake and all these stations were actually in West longitudes. Indeed, Kamenskaya (1980) indicates that her stations are located in the Canadian Basin of the Arctic Ocean, which only fits with West longitudes. Kamenskaya (2001) refers both to positions equivalent to West longitudes (with an unusual coding system) and the Canadian Basin for the same stations. Finally the stations of the drifting station North Pole 22 are plotted on fig. 2 of Afanas'ev and Filatova (1980) and their positions are indeed in the Canadian Basin, which confirms they are in West longitudes.

***Halirages cainae* sp. nov.**

Eastern side of the Norwegian Sea, at 2241-2245 m and 2589-2615 m (present data).

***Halirages fulvocinctus* (M. Sars, 1859)**

Original combination: *Amphithoë fulvocincta* M. Sars, 1859; type specimens collected "near Slaatholmen in the Lofotens and near Tromsø, between 1 and 10 fathoms" [2 and 18 metres] (M. Sars 1859). Synonyms: *Pherusa tricuspis* Stimpson, 1863, type locality: Littleton Island, eastern shore of the Smith Sound, 78.5°N (Stimpson 1863); *Halirages bispinosus* Stephensen, 1917 [≠ *H. bispinosus* (Spence Bate, 1857) in Boeck 1871], type-locality: Bredefjord, South Greenland (Stephensen 1917). A very frequently recorded Arctic and subarctic species with a probably circumpolar distribution, reaching southwards South Iceland and the Skagerrak (Stephensen 1938), and occurring between 5 and 670 m (Oldevig 1959). On the figures of G.O. Sars (1893), which are otherwise excellent, the posterior border of the basis of P5-P7 is illustrated as totally smooth, whilst it is actually very weakly crenulate. In this respect, the figures of Stephensen (1917, as *H. bispinosus*) are more accurate.

***Halirages gorbunovi* Gurjanova, 1946**

According to Gurjanova (1946, 1951), the two type specimens (6.5 mm long juveniles missing pleon) were collected at 2500 m depth in the Arctic Ocean, at Station 100 of the Sedov expedition. The coordinates of the station (not provided by Gurjanova 1946, 1951) are: "stn 100, 8-10 July 1938. RV '*Sadko*'. 81°10'N; 137°17'E; depth 2500 m; sediment, catch conditions and size not known; catch not rich, but satisfactory" (Gorbunov 1946). The station is located in the eastern part of the Nansen Basin.

***Halirages maculatus* Stuxberg, 1880**

Nomen nudum; original spelling: *Halirhages maculatus*. Vega Expedition, stn 95: 68°12'N 176°32'W, 6 fathoms [= 11 metres], stn 99c: 67°07'N 173°24'W, 9-15 fathoms [= 16-27 metres] (Stuxberg 1880, 1882).

***Halirages mixtus* Stephensen, 1931**

East Greenland, shallow water (Stephensen 1931); Ungava Bay, Canadian Eastern Arctic, in plankton samples (Dunbar 1954); Beaufort Sea, in plankton (Horner & Murphy 1985); Hudson Strait (Stewart & Lockhart 2005); Spitsbergen, 10-20 m (Oldevig 1959); Kara and Laptev Seas (Sirenko 2001).

***Halirages nilssoni* Ohlin, 1895**

Baffin Bay, 9-30 m (Ohlin 1895; Stebbing 1906; Gurjanova 1951); Bernard Harbour (Shoemaker 1920); Hudson Bay (Atkinson & Wacasey 1989); Siberian Arctic Ocean, Pitlekaj (Oldevig 1959); Laptev Sea

(Tzvetkova & Golikov 1990); Hudson Bay, Estuary and Gulf of Saint Lawrence (Brunel *et al.* 1998); Barents, Kara, Laptev, East Siberian and Chukchi Seas (Sirenko 2001); Hudson Strait and Foxe Basin (Stewart & Lockhart 2005). Recorded between 9 and 54 m (Gurjanova 1964).

***Halirages qvadridentatus* G.O. Sars, 1877**

Atlantic sector of Arctic and subarctic Seas, 425-1435 m (see descriptive account).

***Halirages stappersi* sp. nov.**

Kara Sea, Laptev Sea, East Siberian Sea, Svalbard, South of Jan Mayen, North of Faeroe Islands, Northern and Western Iceland, 207 to 1384-1435 m (see descriptive account).

General discussion

A complete revision of the genus *Halirages* would have been desirable, but, unfortunately time did not allow for this, leaving pending questions. Small, unidentified, defective *Halirages* specimens were found in recently collected samples from the deep Norwegian Sea. They could either indicate the occurrence of a further species in the area or they could be juveniles of a known taxon. The extensive latitudinal and longitudinal range (circum-arctic / circum-subarctic) of *H. fulvocinctus* raises the question of whether it is a genetically homogeneous species or not. Whilst *H. nilssoni* is a very distinctive species, it was only illustrated by old-fashioned figures (Ohlin 1895), which do no longer meet the required standards. Therefore, better illustrations of that species would be desirable (as for *H. caecus* and *H. gorbunovi*). Finally, and this point is essential, the delimitation of the genus *Halirages* is problematic. Due to the restricted scope of the present paper, the previously accepted composition of the genus has been retained herein. However, it appears that the borderline between *Halirages* Boeck, 1871, *Apherusa* Walker, 1891, and to a lesser extent *Rozinante* Stebbing, 1894 is blurred, an issue entirely disregarded in the revision of *Apherusa* by Krapp-Schickel & Sorbe (2005). With the exception of the alleged presence (*Halirages*) or absence (*Apherusa*) of calceoli in terminal males, a careful comparison of figures of species the two genera does not reveal any stabile differential character states. Character states previously considered as differential as the size and shape of article 3 of mandibular palp, the length of uropods and telson proved to be too variable to be retained. So, taken alone, the significance of the presence/absence of calceoli seems highly dubious for separating the two genera, as Bousfield & Hendrycks (1997: 5) remark that "single-character diagnoses of higher taxonomic groups are inherently risky and unstable". Cladistic analyses of northern calliopiids could possibly reveal the existence of homogeneous clusters of species and call attention to synapomorphies suitable for circumscribing genera more reliably.

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