



## Copepods of the genera *Haplostomella* and *Haplostomides* (Cyclopoida: Ascidiocolidae) associated with ascidians from the White Sea and Russian Far East coastal waters

A. Marchenkov<sup>1</sup> & G. Boxshall<sup>2</sup>

<sup>1</sup>Zoological Institute, Russian Academy of Sciences, 199034 St Petersburg, Russia

<sup>2</sup>The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

Tel: 207-9429-489. Fax: 207-9425-433. E-mail: G.Boxshall@nhm.ac.uk

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### Abstract

A new species of *Haplostomella* Chatton & Harant, 1924, *H. borealis* n. sp., is described from two ascidian hosts taken in the White Sea. This species is most readily distinguished from its congeners by the structure of the mandible which comprises a strong tapering gnathobase and a vestigial palp. Supplementary descriptive notes are provided on *Haplostomella distincta* Ooishi & Illg, 1977, based on new material discovered on the opposite side of the Bering Strait from the original material. Minor geographical variation is exhibited by this species. A new species of the genus *Haplostomides* Chatton & Harant, 1924, *H. sanamyani* n. sp., is also described, based on material collected in the Bering Sea. A key to species is provided to facilitate the identification of the nine species recognised in this genus.

### Introduction

Chatton & Harant (1924a) established the subfamily Haplostomatinae for a group of four closely related genera of ascidian parasites. This subfamily of Ascidiocolidae was revised by Ooishi & Illg (1977), who carefully identified the homology of the reduced mouthparts and provided the first rigorous treatment of the subfamily. In their landmark revision of the Ascidiocolidae sensu lato, Illg & Dudley (1980) repeated Ooishi & Illg's keys to genera and species. Only four genera were recognised by Chatton & Harant (1924a, b): *Haplostoma* Canu, 1886, *Haplostomides* Chatton & Harant, 1924, *Haplostomella* Chatton & Harant, 1924 and *Haplosaccus* Chatton & Harant, 1924. Monniot added a fifth genus *Paulillgia* Monniot, in 1982. The largest genus in the subfamily is *Haplostoma*, currently with fifteen species. *Haplostomella* comprises 10 species, *Haplostomides* only eight species, *Haplosaccus* just two species, and *Paulillgia* is monotypic.

This paper describes new species of both *Haplostomella* and *Haplostomides*, and provides a new zoogeographic record of *Haplostomella distincta* Ooishi & Illg, 1977 from the western side of the North Pacific. The new species of *Haplostomella* was collected during the summers of 1996–2000, by the first author, from a compound ascidian host, using the facilities of the Biological Station of St. Petersburg Government University, and of the Biological Station of the Zoological Institute of Russian Academy of Sciences, at Chupa Bay, Kandalakshskij Zaliv (Gulf) in the White Sea. It exhibits relatively plesiomorphic character states compared with other *Haplostomella* species. The new species of *Haplostomides* and the new material of *Haplostomella distincta* were part of an extensive collection of ascidicolous copepods made along the North Pacific coast of Russia by Karen Sanamyan. *Haplostomella distincta* was originally described from material collected on the west coast of North America, near Friday Harbor, Washington (Ooishi & Illg, 1977). The Russian material from the

opposite coast of the North Pacific presents slight morphological differences and a comparative description of the females is provided here.

## Methods

Adult females were dissected and mounted in lactophenol as temporary slide preparations. All drawings were made using a camera lucida on an Olympus BH-2 microscope equipped with differential interference contrast optics.

## Descriptions

Order Cyclopoida Burmeister, 1834

Family Ascidicolidae Thorell, 1859

Subfamily Haplostomatinae Chatton & Harant, 1924

Genus *Haplostomella* Chatton & Harant, 1924

*Haplostomella borealis* n.sp.

*Type material*: Holotype female and 2 paratype females, deposited in the collections of the Zoological Institute of the Russian Academy of Sciences, Registration Numbers 18017 (Holotype) and 18018–18023 (paratypes); 2 paratype females deposited in the Natural History Museum, London, Registration Numbers BMNH 2002.422–423.

*Type locality*: White Sea, Kandalakshskij Gulf, Chupa Bay.

*Hosts*: The ascidians *Synoicum pulmonaria* (Ellis & Solander, 1786) and *Aplidium glabrum* (Verrill, 1871), taken by dredging from a small boat at a depth of 8–13 m.

*Locality in host*: Matrix.

*Etymology*: The name of the new species reflects the northerly location of the type locality.

*Description of female* (Figs 1–3)

Body (Fig. 1A–C) vermiform, with linear lateral margins in dorsal view but distinctly curved dorsally (Fig. 1C). Mean length of body 2.25 mm (ranging from 1.8 to 2.5 mm, based on 5 specimens), maximum width in region of first pedigerous somite, 0.45 mm. Live specimens with colourless or slightly orange body, red nauplius eye conspicuous. Cephalosome (Fig. 2A) slightly wider than long; posterolateral margins of dorsal cephalic shield defined, but no segmental dorsolateral folds present on metasomal trunk region. Rostrum absent.

Metasome consisting of first to fourth pedigerous somites, each with pair of well-developed biramous legs, plus fifth pedigerous somite bearing fifth legs (Fig. 3C) represented by pair of simple isolated setae located on dorsolateral surface of somite. Intersegmental boundaries indistinct, but marked in ventral view by slight folds in cuticular surface. Genitoabdomen (Fig. 3C) tapering posteriorly, indistinctly segmented. Genital somite bearing paired oviducal apertures dorsolaterally and mid-ventral copulatory pore; oviducal apertures each covered by rounded plate and semicircular fold (Fig. 3D) armed with 3 strong spines. Anal somite (Fig. 3C) with paired caudal rami terminally: anal opening located posterodorsally. Ventral surface of urosome ornamented with numerous transverse rows of setules. Caudal ramus (Fig. 3E) about twice as long as wide, conical at apex, and bearing 5 setae: 3 terminal, 1 subterminal and 1 lateral.

Antennule (Fig. 1D) unsegmented, tapering apically; armed with total of 14 setal elements (13 setae and 1 aesthete-like element (arrowhead)), all elements naked. Three surface sensillae on swollen basal region, near anterior margin.

Antenna (Fig. 1E) indistinctly 3-segmented, slender and slightly curved ventrally: first segment unarmed; second segment short and bearing hirsute seta on posterior margin; third segment with 2 short spines subterminally, 1 terminal seta, plus hemispherical process ornamented with tiny denticles and a seta-like element. Labrum (Fig. 2A) with concave free posterior margin.

Mandible (Fig. 2B) consisting of coxal gnathobase and vestigial triangular palp without defined rami and lacking any setation: coxa drawn out into strongly sclerotized, claw-like gnathobase ornamented with double row of small denticles (or spinules) on medial margin. Maxillule absent. Maxilla (Fig. 2C) indistinctly 2-segmented; first segment unarmed; second with slightly plumose seta at apex and hirsute seta subterminally. Maxilliped (Fig. 2D) consisting of 2 large segments and terminal subchela; medial margin of first segment (syncoxa) noticeably shorter than lateral margin; second segment (basis) narrower than syncoxa and produced into large rounded myxal process at inner distal angle: strong spine present on anterior surface of segment: subchela fitting into space between process and spine when flexed (Fig. 2E).

First to fourth pairs of legs (Fig. 3A) all similar in size and structure; all lacking intercoxal sclerites. Each leg comprising undivided protopod (representing coxa and basis) largely incorporated into body

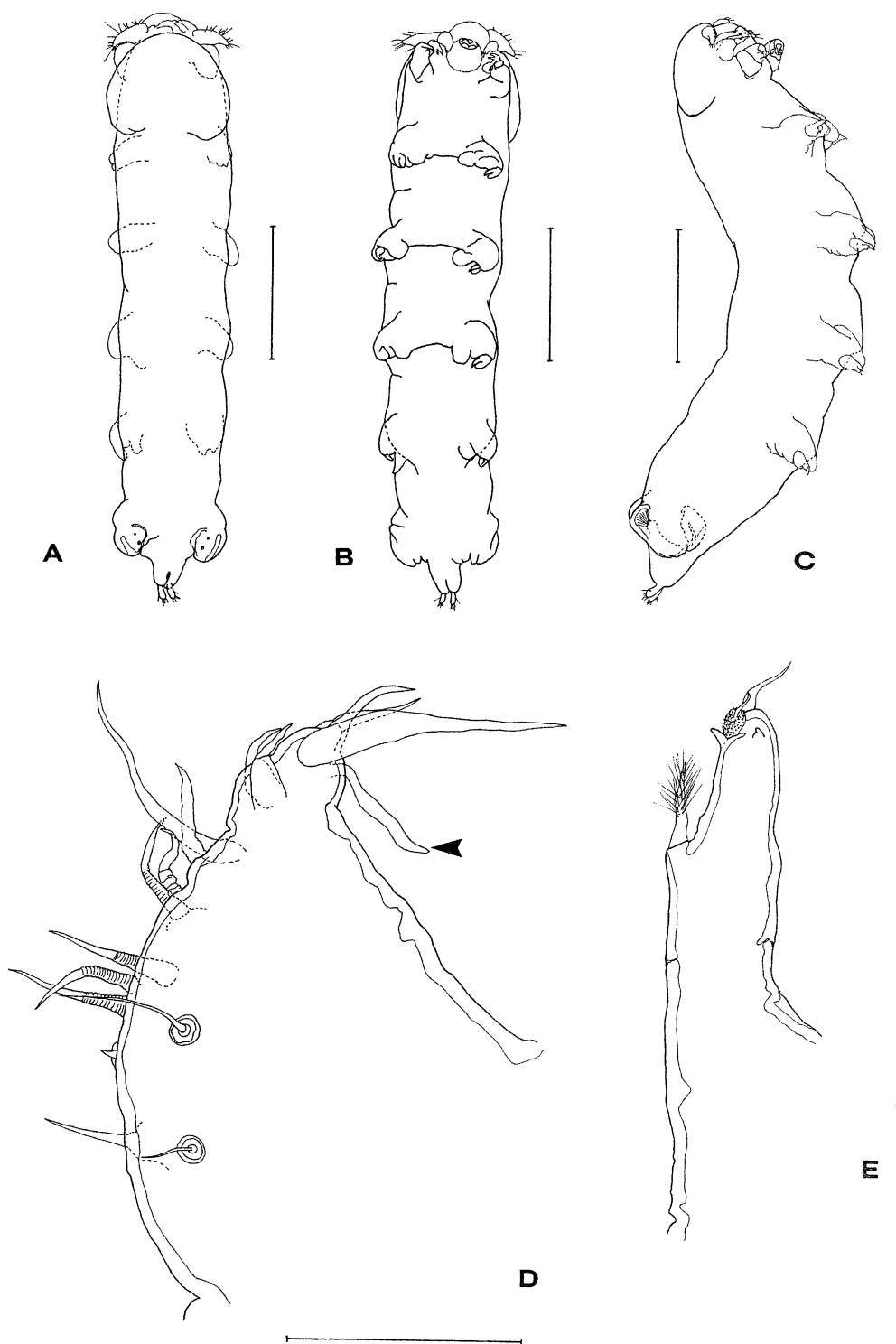


Figure 1. *Haplostomella borealis* n. sp., adult female. (A) habitus, dorsal; (B) habitus, ventral; (C) habitus, lateral; (D) antennule; (E) antenna. Scale-bars A–C, 500  $\mu\text{m}$ ; D–E 50  $\mu\text{m}$ .

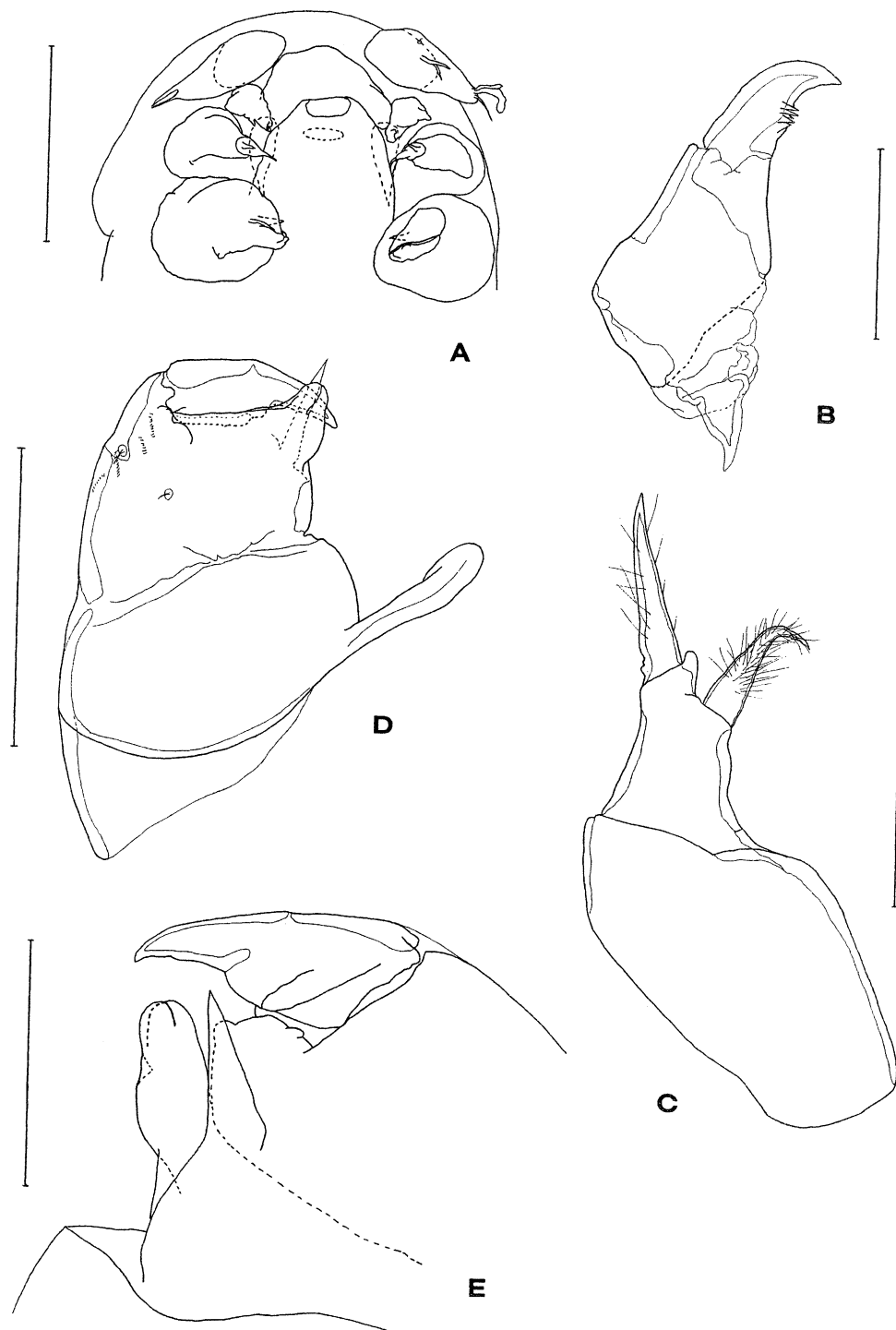


Figure 2. *Haplostomella borealis* n. sp., adult female. (A) cephalosome, ventral; (B) mandible; (C) maxilla; (D) maxilliped; (E) distal part of maxilliped. Scale-bars A, 200  $\mu\text{m}$ ; B, 25  $\mu\text{m}$ ; C, E, 50  $\mu\text{m}$ ; (D) 100  $\mu\text{m}$ .

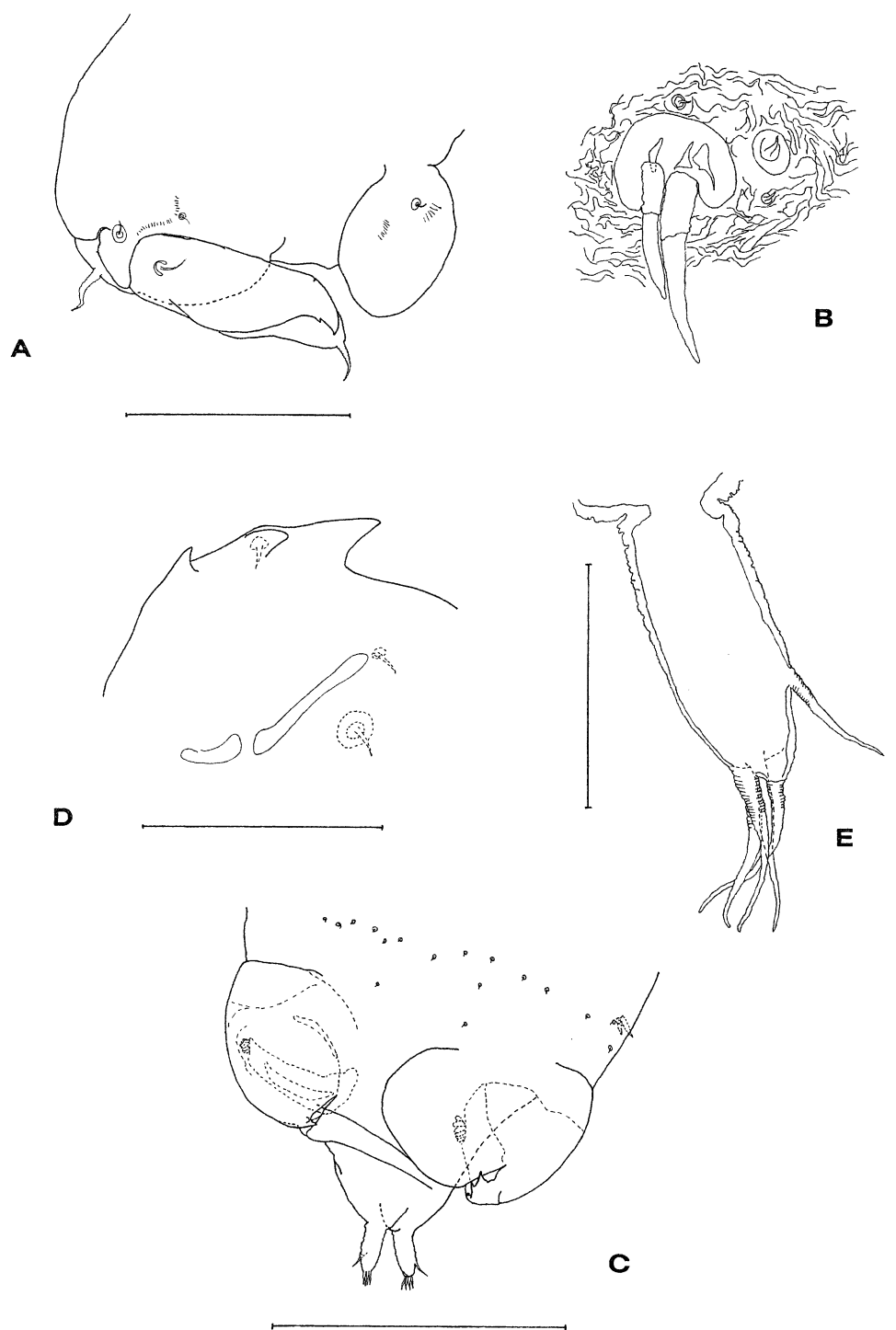


Figure 3. *Haplostomella borealis* n. sp., adult female. (A) leg 1; (B) leg 5; (C) genitoabdomen; (D) opercular plate covering oviduct aperture; (E) caudal ramus. Scale-bars A, 100 μm; B, 25 μm; (C) 400 μm; D–E 50 μm.

somite; armed with slender outer seta. Three sensillae present on anterior surface of protopod, 2 near base of exopod, and 1–2 near base of endopod. Exopod comprising elongate proximal sclerotized part drawn out into tapering, claw-like tip, and posteriorly-located distal part armed with apical seta. Endopod simple rounded lobe, ornamented with single setule.

Leg 5 (Fig. 3B) represented by 2 naked setae originating on weak sclerite; inner seta nearly two thirds length of outer: 3 sensillae located on body surface near sclerite.

Male unknown.

**Biology** A total of 218 colonies of *Synoicum pulmonaria* was investigated for parasitic copepods: only 16 colonies were infected with copepods. Three colonies contained only *H. borealis*, two colonies contained only an as yet undescribed new species of *Botryllophilus* (Marchenkov & Boxshall, pers. obs.), and another six colonies were infected by both species together. The remaining five infected colonies carried within the tunic unidentified harpacticoid copepods. Eight colonies of *Aplidium glabrum* were also studied. One colony was infected by *H. borealis* alone and two colonies were infected by the *Botryllophilus* alone.

**Remarks** The genus *Haplostomella* currently includes ten species of eruciform copepods associated mainly with compound ascidians. Two of these species are described from European waters: *H. malacocera* Chatton & Harant, 1924 and *H. tuberculata* Chatton & Harant, 1924 (both from the Mediterranean coast of France). One species is described from Australia (*H. australiensis* Gotto, 1970), one from Japan (*H. halocynthiae* (Fukui, 1965)), two from South America (*H. magellanica* Chatton & Brement, 1910 and *H. sycozoae* (Salfi, 1926)), and the last four species from western North America, (*H. dubia* Ooishi & Illg, 1977, *H. distincta* Ooishi & Illg, 1977, *H. oceanica* Ooishi & Illg, 1977 and *H. reducta* Ooishi & Illg, 1977).

The new species is easy to distinguish from other *Haplostomella* species by the structure of the mandible. The mandible of the new species consists of a strong tapering coxal gnathobase and a defined, although vestigial palp. The presence of both gnathobase and vestigial palp is unique for *Haplostomella*, species of which are generally characterised by strongly reduced mandibles. The mandible is in the form of a low protuberance with one spiniform apical element in *H. distincta*, it is palp-like with one apical setae in *H. tuberculata*, and has an indication of two

segments with one seta on each in *H. dubia*. In two other species, *H. sycozoa* and *H. reducta*, the mandible is fully reduced, and in *H. halocynthiae* the mandible seems to be represented by the reduced gnathobase only.

The new species differs from *H. australiensis*, *H. halocynthiae*, *H. oceanica* and *H. distincta* in the absence of paired lateral tubercles on the pedigerous somites, arising in association with the leg pairs. It differs from *H. reducta* in having a better developed antennule and in the structure of the fifth leg: the former having two setae inserted on a small sclerite, the latter having a small projection with two setae. It can be distinguished from *H. magellanica*, *H. reducta* and *H. dubia* by the presence of two setae on the maxilla, rather than the single seta found in all three of these species. In both *H. dubia* and *H. tuberculata* the armature of leg 5 comprises three setae as compared with only two setae in the new species. Differences in the structure of the endopods of legs 1–4 serve to distinguish the new species from *H. malacocera* and *H. distincta*: the new species having a simple unilobate endopod rather than a bilobed endopod. Finally, the new species differs from *H. sycozoae* in the presence of a vestigial fifth leg and of setae on the caudal rami.

In their monographic study of the subfamily Haplostomatinae, Ooishi & Illg (1977) discussed the phylogeny of *Haplostomella* species. They accepted the earlier scheme produced by Gotto (1970), and recognised a series of five stages from primitive to most specialised, based on females, represented by the following species: (1) *H. dubia* and *H. tuberculata*, (2) *H. halocynthiae*, *H. australiensis* and *H. distincta*, (3) *H. magellanica*, (4) *H. oceanica*, *H. malacocera* and *H. sycozoae*, and (5) *H. reducta*. The new species described here exhibits a set of relatively plesiomorphic features. For example, the dorsolateral folds, which are typical for copepods associated with compound ascidian hosts, are absent in the new species, as are the rounded protrusions usually located medial to the base of each leg.

#### *Haplostomella distincta* Ooishi & Illg, 1977

**Material:** Three females and posterior part of body of fourth female, collected at depth of 5 m, near Atlasova Island, in the Bering Sea; deposited in collections of the Zoological Institute of the Russian Academy of Sciences, St Petersburg: 1 female in collections of the Natural History Museum, London, Registration number: BMNH 2002.424.

*Host: Aplidium* sp.

*Description of female* (Figs 4 and 5)

Body (Fig. 4A–C) eruciform, with slightly convex lateral margins in dorsal view, distinctly curved dorsally in lateral view. Mean length of body 2.3 mm (ranging from 2.2 to 2.6 mm, based on 4 specimens), maximum width at level of third and fourth metasomal somites, 0.54 mm. Cephalosome slightly wider than long; dorsal cephalic shield weakly developed, but with defined posterolateral angles. Rostrum weakly developed.

Metasome consisting of 5 pedigerous somites: first to fourth each bearing pair of well-developed biramous legs, fifth with vestigial pair of legs represented by small unsclerotized, ventrolateral projections. First to fourth pedigerous somites without protrusions medial to leg bases, intersegmental boundaries marked by slight cuticular folds visible ventrolaterally; bearing well-developed, paired dorsolateral lamellar-like outgrowths (Fig. 4C).

Genitoabdomen tapering posteriorly, consisting of 4 indistinctly defined somites. Genital somite bearing paired oviducal apertures dorsolaterally, each covered by rounded plate and semicircular fold; posterior margin of each fold armed with 3 strong, curved spines plus row of 5 tiny denticles (Fig. 5E). Anal somite with paired caudal rami (Fig. 5G); anus opening posterodorsally. Ventral surface of urosome ornamented with numerous transverse rows of setules. Caudal ramus (Fig. 5G) about twice as long as wide, bearing 5 setae: 3 terminal, 1 subterminal and 1 lateral.

Antennule (Fig. 4D) indistinctly 5-segmented, strongly tapering distally; traces of original segmentation indicated by sclerotized strips retained posteriorly: setal armature consisting of 17 elements, all naked; 3 large sensillae present proximally, near anterior margin. Antenna (Fig. 4E) indistinctly 3-segmented, slightly curved ventrally: first and second segments forming elongate compound segment bearing 1 naked seta at mediodistal corner; distal segment with 2 short, rounded setae subterminally, 1 larger seta terminally, and hemispherical dentate process bearing seta-like element.

Mandible (Fig. 4F) comprising bilobate process representing palp and with sclerotized area near base of lateral lobe possibly representing vestige of gnathobase. Maxillule absent. Maxilla (Fig. 5A) indistinctly 2-segmented, conical but with distal segment set at angle to base; armed with 1 stout, slightly hirsute seta apically. Maxilliped (Fig. 5B) comprising 2 well

developed segments plus distal subchela: syncoxa unarmed; basis narrower than syncoxa, carrying large myxal process at inner distal angle and single strong spine anteriorly: subchela lying between process and spine when flexed.

First to fourth legs (Fig. 5C–D) all similar in size and structure: protopodal part indistinctly delimited from body surface, bearing slender outer seta near base of exopod and ornamented with 1 sensilla near base of endopod and 1 near base of exopod. Endopod bilobed. Anterior surface of protopod and endopod ornamented with rows of tiny setules. Exopod comprising proximal sclerotized lobe with sclerotized claw-like tip, lying anterior to distal lobe bearing 1 seta terminally.

Leg 5 (Fig. 5F) reduced, forming small process with 2 terminal setae.

Male unknown.

*Remarks*

The new material corresponds closely to the original description of *H. distincta* by Ooishi & Illg (1977). However, some details of appendage structure differ sufficiently to justify the brief description of our specimens. The new material was collected from the opposite side of the Bering Sea from the type locality and the comparison may reveal geographic variation.

The female of *H. distincta* with its ‘fusiform’ body was grouped together with *H. australiensis* and *H. halocynthiae* by Ooishi & Illg (1977). These two species parasitize solitary ascidian hosts whereas *H. distincta* was first described from two species of compound ascidian, *Aplidium arenatum* van Name (as *Amaroucium arenatum*) and *Aplidium glabrum* Verrill (as *Amaroucium glabrum*). The new material of *H. distincta* was collected from an unidentified species of *Aplidium*. Ooishi & Illg (1977) drew attention to the presence of the dorsolateral lamelliform expansions on the pedigerous somites, which they regarded as typically well developed in copepods utilizing solitary ascidian hosts. They were relatively reduced in the original *H. distincta* material from *A. arenatum* and *A. glabrum*, and the new Russian specimens share the same reduction.

We observed minor differences from typical *H. distincta* in the antennule, antenna, mandible and maxilla. In the original description the antennules are described as armed with ‘about 14’ (Ooishi & Illg, 1977: 113) elements whereas our specimens have 17. The antenna also differs in fine details of setation, for example: the second antennary segment carries a short seta on the

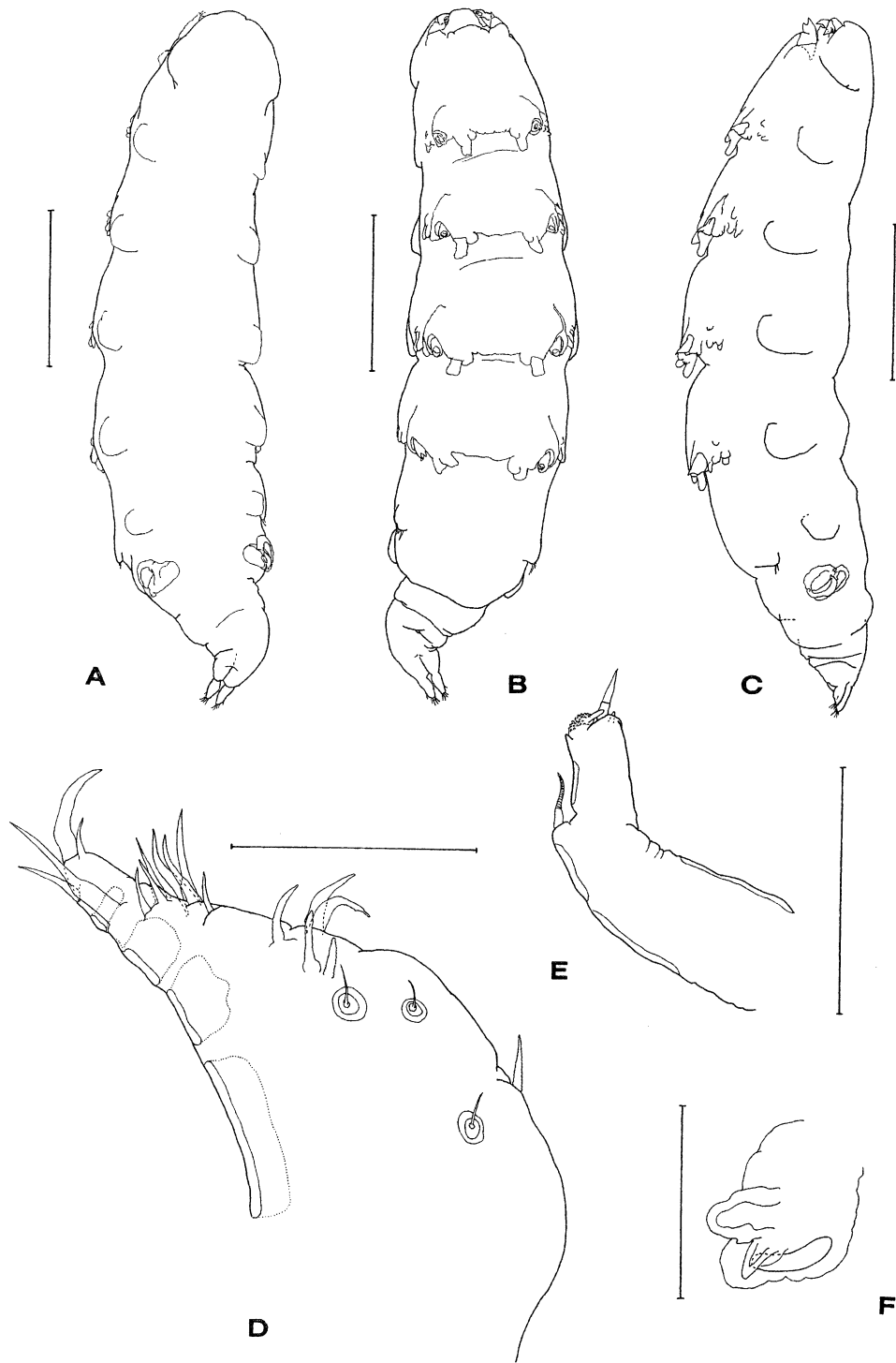


Figure 4. *Haplostomella distincta* Ooishi & Illg, 1977, adult female. (A) habitus, dorsal; (B) habitus, ventral; (C) habitus, lateral; (D) antennule; (E) antenna; (F) mandible. Scale-bars A–C, 500  $\mu\text{m}$ ; D–E 50  $\mu\text{m}$ ; F, 25  $\mu\text{m}$ .



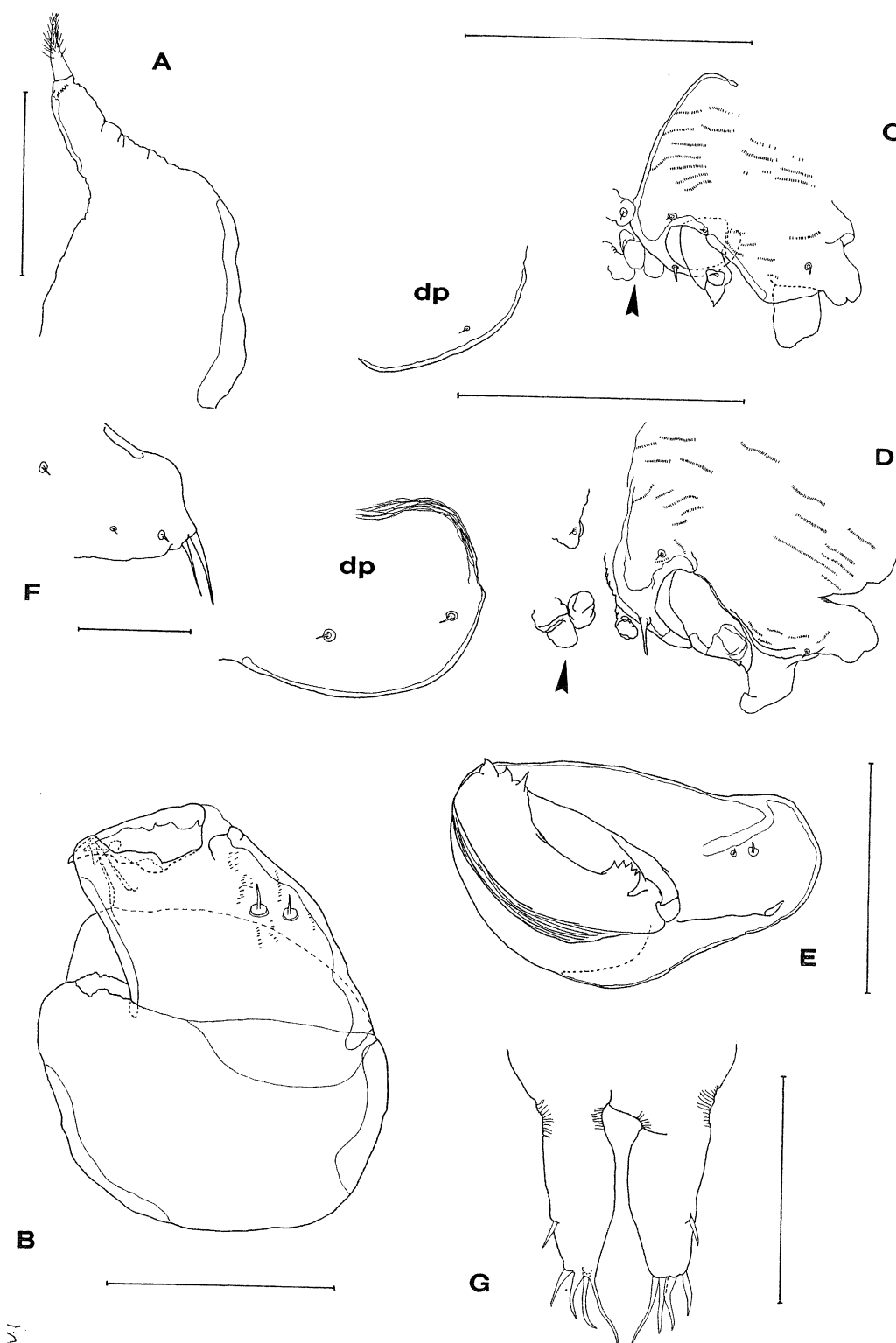


Figure 5. *Haplostomella distincta* Ooishi & Illg, 1977, adult female. (A) maxilla; (B) maxilliped; (C) leg 1, showing lateral protrusions near base of leg (arrowhead) and dorsolateral plates (dp); (D) leg 4, showing same; (E) operculum closing off oviduct aperture; (F) leg 5; G, caudal rami. Scale-bars A–B, 50  $\mu$ m; C–D, 200  $\mu$ m; E, G, 100  $\mu$ m; F, 50  $\mu$ m.

medial margin whereas in our material it is well developed, and the third segment in our material carries a hemispherical dentate process which was not mentioned by Ooishi & Illg (1977). The mandible of *H. distincta* was originally described as reduced with up to 1 curved stout spine, whereas our specimens have a bilobate vestige of the palp. The maxilla was described as having a rounded outer surface ornamented with short hair-like setules, but no hair-like setules were present in the new material. Finally, Ooishi & Illg (1977) described the swimming legs as having the small rounded protrusions medially near the base of each leg. Our material lacks any such protrusions.

All these differences can be interpreted as intraspecific, given the wide geographical separation and the different hosts. At this time, we do not regard them as sufficient justification for erecting a new species.

Genus *Haplostomides* Chatton & Harant, 1924  
*Haplostomides sanamyani* n. sp.

*Type material*: Holotype female and 14 paratype females deposited in the collections of the Zoological Institute of the Russian Academy of Sciences, St Petersburg, Russia, Registration Numbers 18024 (Holotype) and 18025–18039 (paratypes); 6 female paratypes deposited in collection of The Natural History Museum, London: Registration Numbers BMNH 2002.425–430.

*Type locality*: Bering Sea, near Bering Island – 55° 35' 4" N; 165° 09' 4" E. Depth 205 m.

*Host*: *Aplidium* sp.

*Site in host*: unknown.

*Etymology*: The new species is named for the collector Dr Karen Sanamyan in honour of his contributions to the study of tunicate biology.

*Description of female* (Figs 6–9)

Body (Fig. 6A–C) eruciform gradually widening towards posterior part of metasome, curved dorsally in lateral view. Mean body length 1.71 mm (ranging from 1.6 to 1.8 mm, based on 4 specimens) excluding caudal setae. Body divided into cephalosome, metasome and genitoabdomen. Intersegmental boundaries indistinct. Cephalosome relatively small, lacking defined dorsal cephalic shield. Rostrum (Fig. 7B) represented by anteriorly-directed sclerite ornamented with 1 mid-ventral and 2 dorsolateral rows of denticles; sensillae present on dorsal surface of rostrum and densely distributed over cephalosome

surface. Metasome (Fig. 6A–C) comprising 5 pedigerous somites: first to fourth each with pair of well-developed biramous legs, fifth bearing pair of dorsolateral lobes, representing fifth legs.

Genitoabdomen (Fig. 6A–C) rounded in dorsal view, bearing caudal rami on convex posterior surface. Genital somite bearing paired oviducal apertures dorsally and midventral copulatory pore; dorsal area between apertures heavily sclerotized (Fig. 9C): each oviducal aperture covered by cuticular fold ornamented with row of 7 denticles along medial margin and armed with 2 spines (1 stout and 1 slender). Anus opening posterodorsally.

Antennule (Fig. 6D) conical, laterally curved: segmentation indistinct, but incomplete sclerites along posterior margin indicating original segmentation: setation comprising total of 23 elements including well-developed setae, reduced lobe-like elements and setule-like elements: ventral surface ornamented with 4 sensillae.

Antenna (Fig. 7A) strongly developed, 3-segmented; first and second segments forming robust unarmed base, third segment with 3 strongly sclerotized spines arranged along medial margin and 1 terminal spine; elements increasing in size distally.

Mandible (Fig. 7C) consisting of small coxa bearing reduced gnathobase retaining sclerotized, blade-like serrations along medial margin, plus elongate, indistinctly 2-segmented palp armed with 3 distal elements: 1 large and 2 small.

Maxillule (Fig. 7D) bilobed: inner proximal lobe representing precoxal arthrite armed with 5 naked setae; distal lobe bearing 2 plumose seta laterally and 2 process-like elements distally; rounded inner margin ornamented with patch of spinules.

Maxilla (Fig. 7E) a conical lobe, tapering apically, with 1 stout apical seta, 1 slender medial seta and 1 short inner seta near stout seta on antero-lateral margin.

Maxilliped (Fig. 7F) reduced, tapering from broad base, consisting of 3 segments: second segment with 2 inner setae; terminal subchela apparently subdivided near distal bifurcation.

First to fourth pairs of legs (Fig. 8A–D) consisting of broad protopods, lacking distinct articulation with body but with thick transverse sclerotized band marking plane of coxa-basis joint; both exopod and endopod fused to basis, forming a bilobed structure. All endopods similar; each forming shallow conical lobe ornamented with 2 sensillae on anterior surface. All exopods similar in shape, longer and tapering to

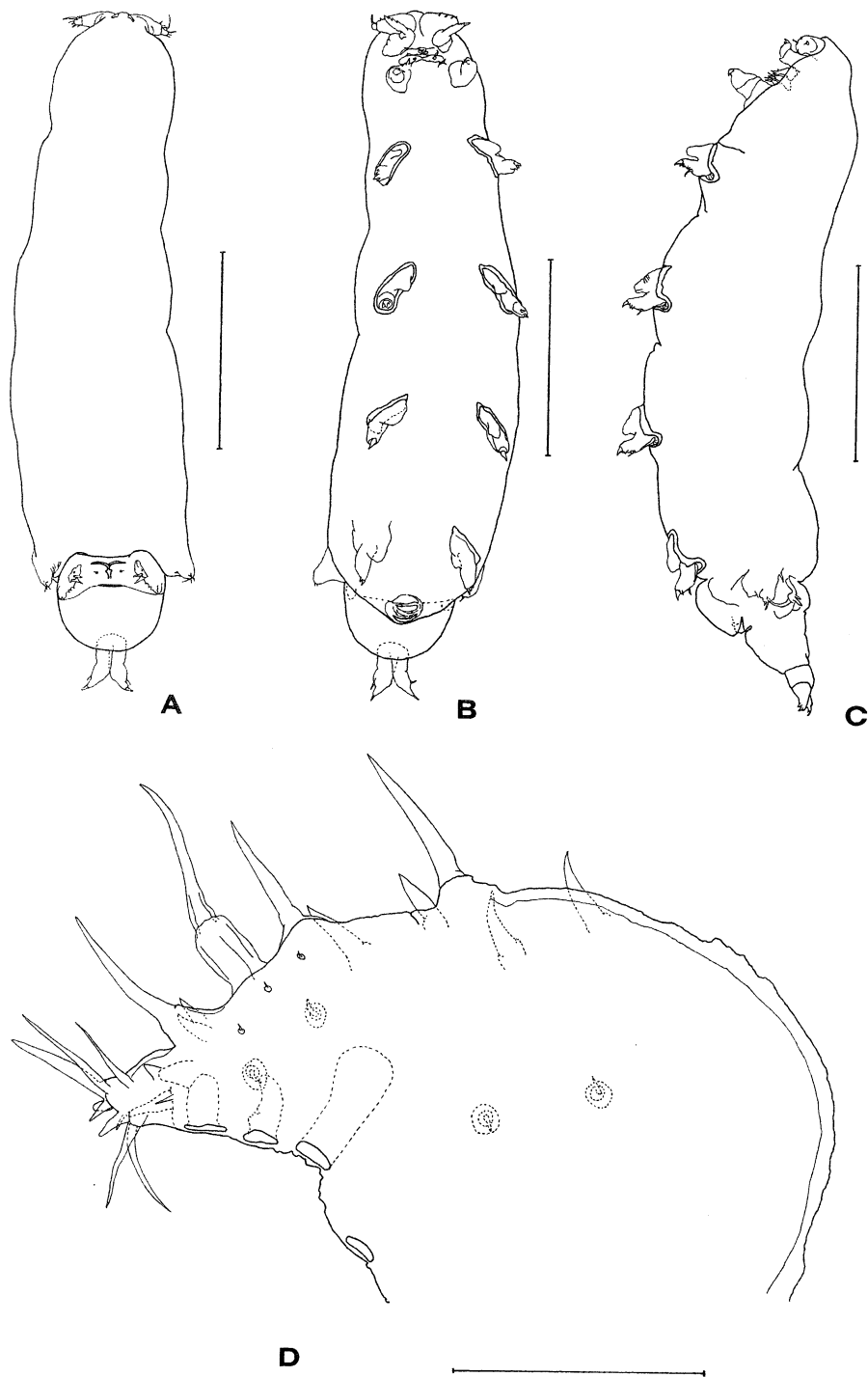


Figure 6. *Haplostomides sanamyani* n. sp., adult female. (A) habitus, dorsal; (B) habitus, ventral; (C) habitus, lateral; (D) antennule. Scale-bars A–C, 500  $\mu\text{m}$ ; D 50  $\mu\text{m}$ .

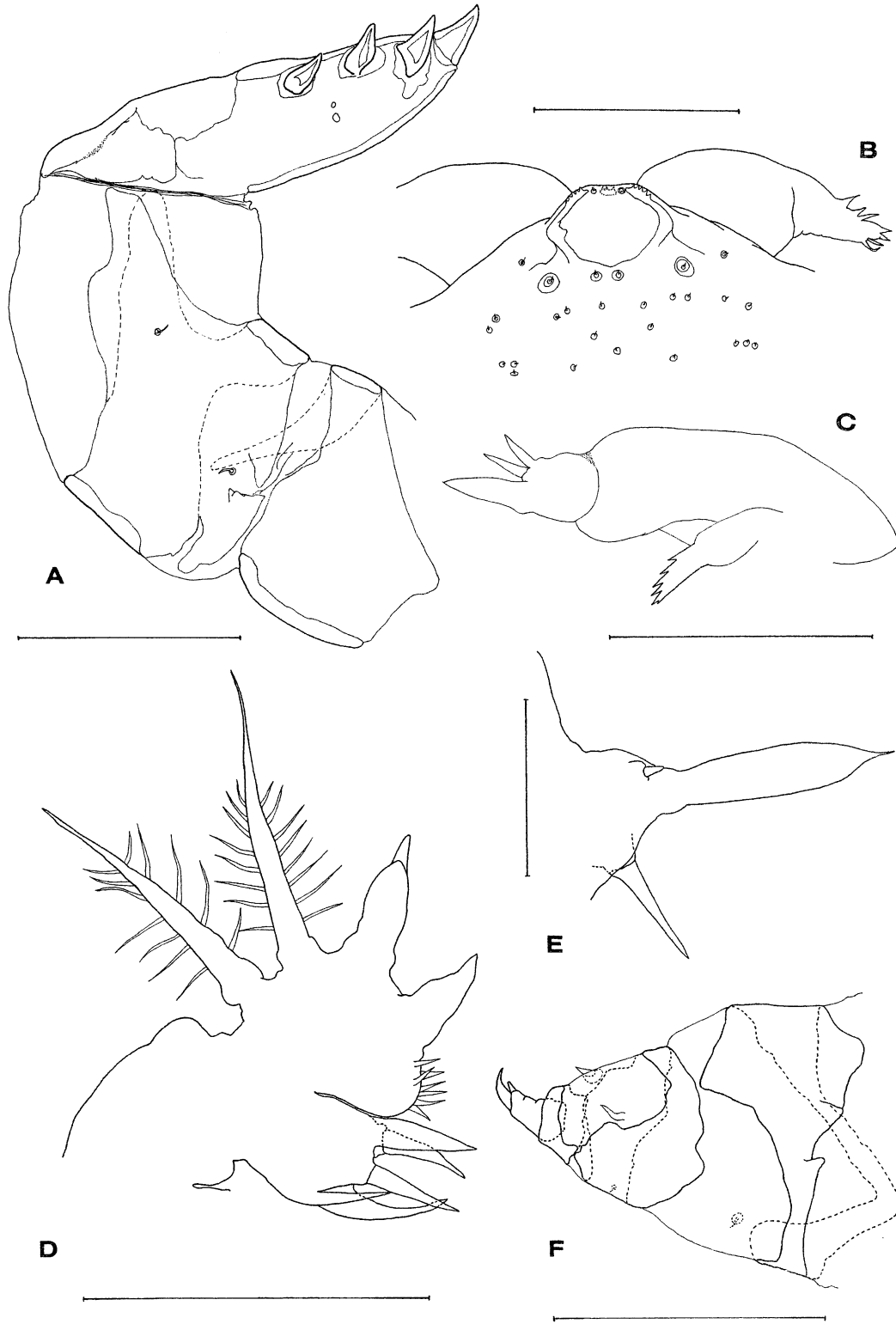


Figure 7. *Haplostomides sananyani* n. sp., adult female. (A) antenna; (B) frontal margin of head showing rostrum; (C) mandible; (D) maxillule; (E) maxilla; (F) maxilliped. Scale-bars A,C–D, 50  $\mu\text{m}$ ; B,F, 100  $\mu\text{m}$ ; E, 25  $\mu\text{m}$ .

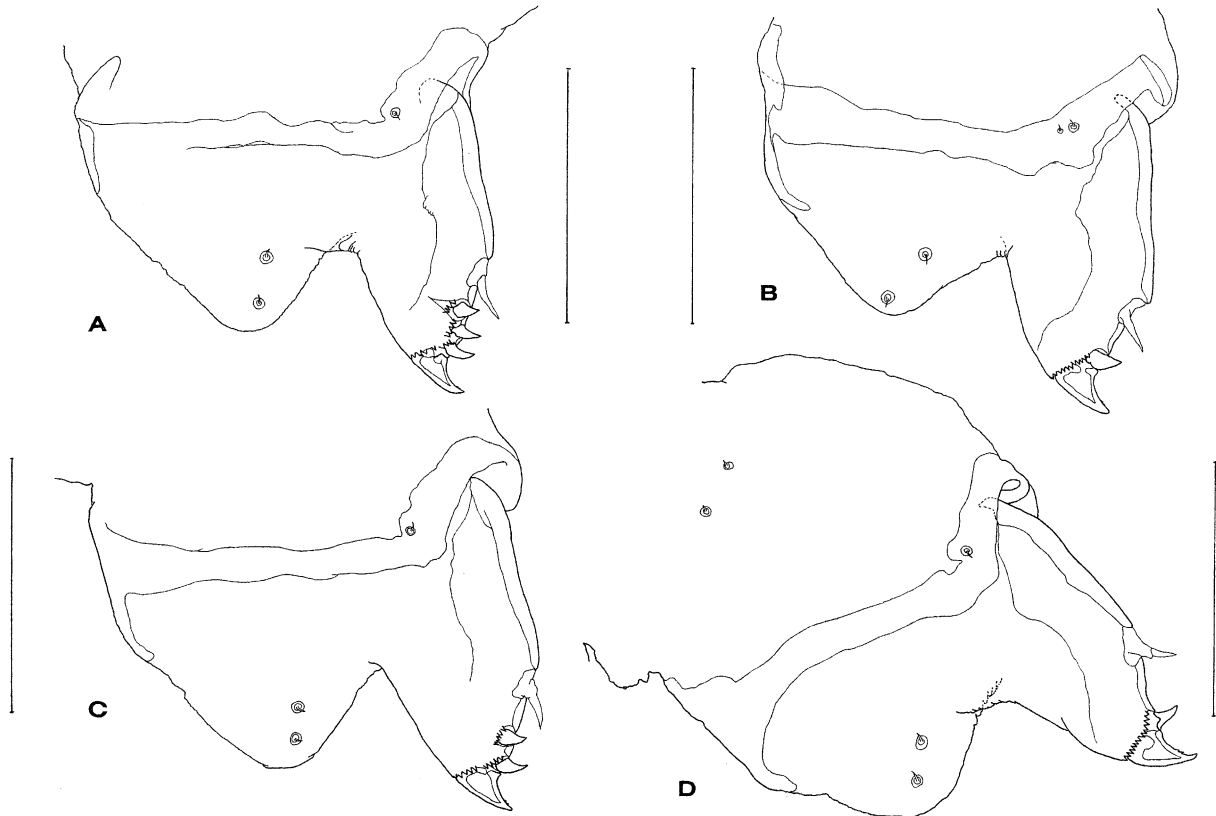


Figure 8. *Haplostomides sanamyani* n. sp., adult female. (A) leg 1; (B) leg 3; (C) leg 2; (D) leg 4. Scale-bars A–D, 100  $\mu$ m.

more acutely pointed tip than endopods. Legs differing in armature; leg 1 exopod with smooth proximal seta and 4 stout curved spines along outer margin; leg 2 with smooth proximal seta and 3 spines; exopods of legs 3 and 4 each with proximal seta and 2 spines: all spines subtended by spinule rows.

Leg 5 (Fig. 9A) represented by wrinkled lobe bearing 3 apical setae and isolated (outer basal) seta on somite near base of leg.

Caudal rami (Fig. 9B) small, tapering; each bearing 4 setae: 2 terminal, 1 subterminal and 1 lateral in distal third.

Male unknown.

#### Remarks

There are currently eight species in the genus *Haplostomides* (Ooishi, 1994, 2001, 2002). The new species differs from its congeners in details of the antennae, mandibles, maxillules and maxillae. The other limbs exhibit virtually no variation between congeners and have little taxonomic value at the species level. The new species most closely resembles *H. ama-*

*rouci*, as described by Blake (1929) and Dudley & Illg (1991), in both habitus and many anatomical details, but it differs in the form of the mandible and maxillule. The new species can be distinguished from its congeners using the following key to adult females which is adapted from the key in Ooishi (2001):

1. Distal segment of antenna with 2 spines .....2
  - Distal segment of antenna with 4 spines .....3
2. Mandible with 1 distal seta; maxillule with 4 setae; maxilla with 3 setae ..... *H. hibernicus*
  - Mandible with 3 distal setae; maxillule with 7 setae; maxilla with 2 setae ..... *H. hawaiiensis*
3. Mandible comprising distinct serrated gnathobase plus palp ..... *H. sanamyani* n. sp.
  - Mandible without serrated gnathobase, gnathobase typically absent or possibly represented by taper-

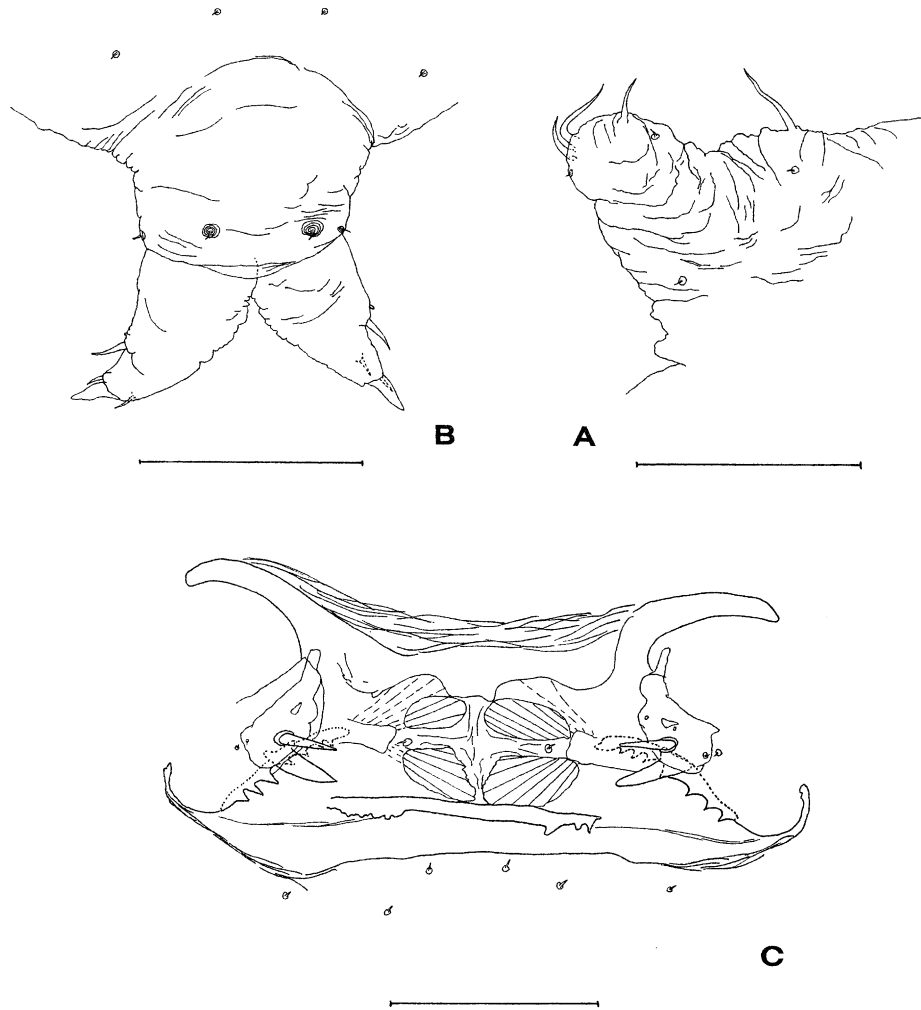


Figure 9. *Haplostomides sanamyani* n. sp., adult female. (A) leg 5; (B) caudal rami; (C) oviduct apertures and area of dorsal body surface between them. Scale-bars A–C, 100  $\mu$ m.

- |   |   |
|---|---|
| ing spinous process . . . . . 4   | Maxilla with 4 setae; basal part of indistinctly segmented mandibular palp armed with large seta . <i>H. luteolus</i> |
| 4. Maxilla with 2 setae . . . . . 5   |   |
| Maxilla with 3 or 4 setae . . . . . 6   |   |
| 5. Mandible with 2 distal setae . . . . . <i>H. brementi</i>  | 7. Basal part of mandibular palp simple, without spinous process . . . . . <i>H. otagoensis</i>                       |
| Mandible with 3 distal setae . . . . . <i>H. scotti</i>   | Basal part of mandibular palp with spinous process 8  |
| 6. Maxilla with 3 setae; basal part of indistinctly segmented mandibular palp unarmed, or forming broad spinous process . . . . . 7 | 8. Tip of mandibular palp with 2 setae; maxillule with 9 setae . . . . . <i>H. amarouci</i>                           |

Tip of mandibular palp with 3 setae; maxillule with 10 setae ..... *H. bellus*

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