



A revision of the family Archinotodelphyidae Lang, 1949 (Copepoda: Cyclopoida: Oithonida), with the recognition of 15 new species

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Abstract

The family Archinotodelphyidae Lang, 1949 is reviewed. Only the type genus, *Archinotodelphys* Lang, 1949, is accepted as valid and the genus *Pararchinotodelphys* Lang, 1949 is recognized as its junior subjective synonym. The two species formerly placed in the latter genus are transferred to the type genus as *Archinotodelphys gurneyi* (Illg, 1955) comb. nov. and *A. phallusiae* (Hansen, 1923) comb. nov. The species *A. polynesiensis* Monniot, 1986 was regarded as highly variable by Monniot (1986) but here we separate out his material from the host *Herdmania momus* (Savigny, 1816) which we recognise as a distinct species, *A. momus* sp. nov. Another 14 new species are described for the first time, from material collected at numerous localities across the global ocean. The new species are: *A. curtus* sp. nov. from *Styela* sp., *A. illgi* sp. nov. from an unknown host, *A. hexasetosus* sp. nov. from *Molgula platybranchia* Monniot C., 1970, *A. cinctus* sp. nov. from *Bathystyeloides enderbyanus* (Michaelsen, 1904), *A. antarcticus* sp. nov. from *Molgula pedunculata* (Herdman, 1881), *A. monnioti* sp. nov. from *Pareugyrioides galathea* Millar, 1959 (type host) and *P. digitus* Monniot C., 1997, *A. bimerus* sp. nov. from an unidentified species of the family Molgulidae, *A. longiseta* sp. nov. from *Styela sigma* Hartmeyer, 1912, *A. reductus* sp. nov. from *Pyura gangelion* (Savigny, 1816), *A. elegans* sp. nov. from *Polycarpa argentata* (Sluiter, 1898), *A. rostralis* sp. nov. from *Polycarpa nigricans* Heller, 1878, *A. longicaudatus* sp. nov. from *Microcosmus longicloa* Monniot C. & Monniot F., 1991, *A. nudus* sp. nov. from a *Polycarpa* sp., and *A. unisetosus* sp. nov. from an unidentified phlebobranch ascidian host. A key to species is provided.

Keywords: taxonomy, new species, ascidian hosts, *Archinotodelphys*, symbiotic copepods

Introduction

The cyclopoid copepod family Archinotodelphyidae was established by Lang (1949) to accommodate two new monotypic genera, *Archinotodelphys* Lang, 1949 and *Pararchinotodelphys* Lang, 1949, living in association with tunicate hosts. The former was based on material of a new species, collected from an Antarctic tunicate and described by Lang (1949), while the latter was based on the females already described by Hansen (1923) under the name *Cyclopina phallusiae* Hansen, 1923, which came from a tunicate collected off the Faeroe Islands in the North Atlantic. Illg (1955) described a second species of *Pararchinotodelphys*, also from the female only. Illg (1955) regarded this family as significant because, both morphologically and ecologically, he considered that it illustrated the transition from “casually occurring associates of ascidians to anatomically modified forms reflecting ecological dependence on these host organisms as providing either shelter or nutrition”. Lang (1949) inferred that archinotodelphyids represented a link between the free-living Cyclopinidae Sars, 1913 and the symbiotic Notodelphyidae Dana, 1853, and Illg (1955) discussed in considerable detail some of the character transformations involved in such a transition.

Since these two pioneering studies little has changed within the family except for the addition of two new species of *Archinotodelphys* and the discovery of the male (Monniot, 1968, 1986). In contrast, the systematic landscape around the family Archinotodelphyidae has changed considerably. Firstly, the traditional family Cyclopinidae has

undergone major change and it is now a cluster of nine families: Cyclopinidae *sensu stricto*, Cyclopettidae Martínez Arbizu, 2000, Giselinidae Martínez Arbizu, 2000, Hemicyclopinidae Martínez Arbizu, 2001, Psammocyclopinidae Martínez Arbizu, 2001, Pterinopsyllidae Sars, 1913, Schminkepinellidae Martínez Arbizu, 2006, Smirnovipinidae Khodami, McArthur, Blanco-Bercial, & Martínez Arbizu, 2017 and Cyclopicinidae Khodami, McArthur, Blanco-Bercial, & Martínez Arbizu, 2017 (Martínez Arbizu, 2000a, b, 2001a, b, 2006; Khodami *et al.*, 2017), distributed across three of the four suborders of Cyclopoida proposed by Khodami *et al.* (2019). Secondly, the Notodelphyidae has grown enormously to encompass a total of over 200 species, classified in 51 genera (Walter & Boxshall, 2019), almost all of which utilize tunicates as hosts. The evolutionary transformations within the Notodelphyidae are now beginning to be better understood as a result of increased awareness of the range of morphological diversity expressed in the family. Thirdly, the Mantridae, established by Leigh-Sharpe (1934), is now recognized as closely related to the Archinotodelphyidae (Boxshall & Halsey, 2004). Previously the phylogenetic affinities of this family were poorly understood: it was placed in the Poecilostomatoida by Bowman & Abele (1982) but Humes (1987) suggested that it was related to the Cyclopinidae and should be classified in the Cyclopoida. Huys (1990) confirmed this placement and transferred the genus *Nearchinotodelphys* Ummerkutty, 1961 to the Mantridae. The discovery of a third monotypic genus, *Chamicola* Ohtsuka, Boxshall & Torigoe, 2000, raised the number of mantrid genera to three (Ohtsuka *et al.*, 2000). All live as associates of bivalve molluscs. The relationship between the Mantridae and the Archinotodelphyidae is in need of testing because it is possible that the three monotypic genera currently placed in the Mantridae represent a single host-switching event resulting in the formation of a mollusc-associated clade nested within the Archinotodelphyidae.

The recent family-level phylogenetic analysis of the order Cyclopoida by Khodami *et al.* (2019) placed the Archinotodelphyidae and Notodelphyidae together in the new suborder Oithonida. The former family was represented in their molecular sequence based analysis by two unidentified species, while the latter family was represented by five known species belonging to four genera. These two families were recovered as sister taxa. The Mantridae was not represented in the Khodami *et al.* (2019) analysis but they also placed it in the suborder Oithonida.

Against this background, the discovery of 15 new species provides an opportunity to enhance our understanding of the diversity and systematics of the Archinotodelphyidae. The diagnosis of the family is amended below to take into account the range of character states revealed by the novel taxa. The new species, together with their hosts and known geographical distributions are summarized in Table 1.

Material and Methods

The copepod specimens examined in this study were collected by Claude and Françoise Monniot (Muséum national d'Histoire naturelle, Paris) during their decades of distinguished systematic research on ascidians. The ascidian hosts of these copepods were collected during research campaigns undertaken all over the world and were initially stored in seawater formalin. The copepods were extracted from their hosts and then stored in the MNHN collections and initially made available for study by Danielle Defaye (MNHN). All collected copepods were preserved in 70–80% ethanol. For microscopic observation, the copepods were immersed in lactic acid for at least 10 minutes and dissected. Dissected appendages were observed using the reverse slide method of Humes & Gooding (1964). Drawings were made with the aid of a microscope equipped with a drawing apparatus. In the armature formula, Roman numerals indicate spines and Arabic numerals represent setae. Lengths of copepod specimens and measurements of appendages are mostly based on a single dissected specimen of each species. Measurement of body length is from the frontal margin of the cephalosome to the rear margin of the caudal rami, excluding the caudal setae. Morphological terminology for the caudal setae follows Huys & Boxshall (1991). Type specimens have been deposited in the Muséum national d'Histoire naturelle, Paris.

Systematics

Subclass Copepoda Milne Edwards, 1830

Superorder Podoplea Giesbrecht, 1882

Order Cyclopoida Burmeister, 1835

Suborder Oithonida Khodami, Mercado-Salas, Tang & Martínez Arbizu, 2019

Family Archinotodelphyidae Lang, 1949

Diagnosis of family Archinotodelphyidae

Body cyclopiform in both sexes: prosome comprising cephalosome and 4 free pedigerous somites. Dorsal cephalosomic shield typically distinctly wider than first pedigerous somite; posterolateral corners of shield sometimes produced over tergite of first pedigerous somite. Urosome 5-segmented; with genital and first abdominal somites fused to form genital double-somite in female; plus 3 free abdominal somites. Genital apparatus variable in female: paired or single median copulatory pore located on ventral surface of double-somite; paired gonopores located dorsolaterally on double-somite. Urosome 6-segmented in male; comprising fifth pedigerous, genital and 4 abdominal somites: paired genital apertures located on ventral surface. Caudal rami typically slender, with 6 setae. Paired external egg sacs with multiseriate arrangement of eggs.

Rostrum well developed, anteriorly or postero-ventrally directed. Nauplius eye present. Female antennule 10- to 17-segmented; segmental homologies in 17-segmented antennule: I-II, III-V, VI-IX, X, XI, XII-XIV, XV-XVI, XVII, XVIII, XIX, XX, XXI, XXII, XXIII, XXIV, XXV, XXVI-XXVIII. Male antennule geniculate on both sides; ranging from 12-segmented with geniculation between segments 10 (XIX-XX) and 11 (XXI-XXIII) to 17-segmented with geniculation between segments 15 (XIX-XX) and 16 (XXI-XXIII).

Antenna biramous; with coxa and basis separate; coxal seta lacking; basis bearing inner seta plus 1 or 2 setae on outer margin representing exopod; endopod 3-segmented; segment 1 with 1 seta, segment 2 with 1 inner and 4 distal setae (or reduced), segment 3 with 1 claw and up to 6 setae. Mandible comprising coxa with well-developed gnathobase and biramous distal palp: palp consisting of basis armed with 1 inner seta, 2-segmented endopod and 4-segmented exopod; endopodal segments 1 and 2 with between 1 and 6, and up to 10 setae, respectively; exopodal segments typically armed with 1, 1, 1, and 1/2 setae. Maxillule biramous, comprising 3-segmented protopod bearing 1-segmented exopod and 1 or 2-segmented endopod; precoxa with arthrite bearing between 9 and 11 elements; coxa with endite bearing 1 seta and with 2 setae on outer surface of segment representing epipodite; basis with proximal and distal groups of 2 to 3 and 4 to 5 setae, representing endites: endopod typically 1-segmented and armed with up to 12 setae, rarely indistinctly 2-segmented (as in *A. bimerus* sp. nov.): exopod armed with 4 setae. Maxilla primitively 6-segmented with precoxa and coxa separate, or 5-segmented with precoxa and coxa fused to form syncoxa; setal groups of 4, 1, 2/3 and 3 setae representing precoxal and coxal endites; basis with claw plus 1 or 2 setae; free endopod 3-segmented; segments 1 to 3 armed with 2, 2, 4 elements, respectively, or with setation reduced. Maxilliped primitively 4-segmented; syncoxa armed with groups of 1, 3/5, and 2/5 setae representing endites; basis with 1 or 2 setae; endopod primitively 2-segmented with each segment bearing up to 4 setae; endopodal segments often fused to form compound segment carrying maximum of 7 setae.

Swimming legs 1 to 4 biramous with 3-segmented rami. Spine and seta formula typically as follows:

| | coxa | basis | exopod | endopod |
|-------|------|-------|-------------------|-----------------|
| leg 1 | 0-1 | 1-I | I-1; I-1; III,I,4 | 0-1; 0-1; 1,2,3 |
| leg 2 | 0-1 | 1-0 | I-1; I-1; III,I,5 | 0-1; 0-2; 1,2,3 |
| leg 3 | 0-1 | 1-0 | I-1; I-1; III,I,5 | 0-1; 0-2; 1,2,3 |
| leg 4 | 0-1 | 1-0 | I-1; I-1; II,I,5 | 0-1; 0-2; 1,2,2 |

Inner coxal seta present in legs 1 to 4, sometimes lost from legs 3 and 4. Outer spine on second exopodal segment lost in legs 2 to 4 in *Archinotodelphys nudus* sp. nov.

Female fifth leg comprising 1-segmented protopod with outer basal seta, and 1-segmented exopod bearing 4 or 6 setal elements. Male fifth leg typically as in female; rarely sexually dimorphic, with 6 setal elements on exopodal segment in male but only 4 in female (as in *A. antarcticus* sp. nov.). Leg 6 represented by 1 to 3 setae on genital operculum of female; by 3 setae in male.

TABLE 1. Species of *Archinotodelphys*, with hosts and known distributions.

| Species | Host species | Host family | Distribution | Depth | Source |
|---|---|-------------|--|-------------|-----------------------|
| <i>A. typicus</i> Lang, 1949 | <i>Pyura georgiana</i> Michaelsen, 1898 | Pyuridae | Subantarctic, off South Georgia | 75 m | Lang, 1949 |
| <i>A. gurneyi</i> (Illg, 1955) comb. nov. | <i>Molgula pulchra</i> Michaelsen, 1900 | Molgulidae | Subantarctic, off South Georgia | 68-80 m | Lang, 1949 |
| <i>A. phallusiae</i> (Hansen, 1923) comb. nov. | <i>Styela canopus</i> (Savigny, 1816) as <i>S. partita</i> (Stimpson, 1852) | Styelidae | Atlantic coast of USA (Martha's Vineyard) | 245 m | Illg, 1955 |
| <i>A. profundus</i> Monniot, 1968 | <i>Ascidia obliqua</i> Alder, 1863 (as <i>Phallusia obliqua</i>) | Asciidiidae | North Atlantic, off Faeroe Islands | 800 m | Hansen, 1923 |
| <i>A. polynesiensis</i> Monniot, 1986 | <i>Cnemidocarpa digonata</i> Monniot, C. & Monniot, F., 1968 | Styelidae | North Atlantic (38°46'N, 70°06'W) | 2886 m | Monniot, 1968 |
| | <i>Ascidia areolata</i> Sluiter, 1890 | Asciidiidae | Pacific Ocean, off Tikehau (Tuamotu) in French Polynesia | unknown | Monniot, 1986 |
| | <i>Corella</i> sp. | Corellidae | Pacific Ocean, off Tikehau and Moorea in French Polynesia | unknown | Monniot, 1986 |
| | <i>Ascidia</i> sp. | Asciidiidae | Pacific Ocean, off Tikehau, Moorea & Tahiti in French Polynesia | unknown | Monniot, 1986 |
| | <i>Molguloides vitrea</i> (Sluiter, 1904) | Molgulidae | French Polynesia North Pacific, in the Philippines | unknown | Huys & Boxshall, 1991 |
| <i>A. momus</i> sp. nov. | <i>Herdmania momus</i> (Savigny, 1816) (as <i>Pyura momus</i>) | Pyuridae | Pacific Ocean, off Tikehau and Moorea in French Polynesia | unknown | Monniot, 1986 |
| <i>A. curtus</i> sp. nov. | <i>Styela</i> sp. | Styelidae | Indian Ocean | unknown | Present account |
| <i>A. illgi</i> sp. nov. | unknown | | Unknown | unknown | Present account |
| <i>A. hexasetosus</i> sp. nov. | <i>Molgula playbranchia</i> Monniot C., 1970 | Molgulidae | Atlantic, Banc Seine (33°48.5'N, 14°22.6'W) | 250-256 m | Present account |
| <i>A. cinctus</i> sp. nov. | <i>Bathystyloides enderbyanus</i> (Michaelsen, 1904) | Styelidae | Tropical Atlantic, Cape Verde basin, (18°30'0"N, 21°1'0.012"W) | 3120 m | Present account |
| <i>A. antarcticus</i> sp. nov. | <i>Molgula pedunculata</i> (Herdman, 1881) | Molgulidae | Subantarctic, off South Georgia, (59°27'S, 27°02'W) | 86-101 m | Present account |
| | <i>Molgula hodgsoni</i> Herdman, 1910 | Molgulidae | Subantarctic, off South Georgia (53°43.1'S-36°49.3'W) | 188-192 m | Present account |
| | <i>Molgula euplicata</i> Herdman, 1923 | Molgulidae | Weddell Sea (71°06.2'S, 12°33.5'W) | 499-515 m | Present account |
| | <i>Molgula hodgsoni</i> Herdman, 1910 | Molgulidae | Subantarctic (66°32'S, 140°03'E) | 176-288 m | Present account |
| <i>A. monnioti</i> sp. nov. | <i>Pareugyrioides galathea</i> (Millar, 1959) | Molgulidae | SW Heard I., Kerguelen Plateau (55°50'S, 69°36'E) | 4200-4225 m | Present account |
| | <i>Pareugyrioides digitus</i> Monniot C., 1997 | Molgulidae | N Atlantic, Cape Verde basin off Mauritania (18°24.5'N, 21°09.8'W) | 3086 m | Present account |
| <i>A. bimerus</i> sp. nov. | Unidentified species | Molgulidae | North Atlantic, America Basin (39°37'N, 66°45'W) | 3806 m | Present account |
| <i>A. longiseta</i> sp. nov. | <i>Styela sigma</i> Hartmeyer, 1912 | Styelidae | French Guiana (07°10'N, 52°59'W) | 397-399 m | Present account |
| <i>A. reductus</i> sp. nov. | <i>Pyura gangelion</i> (Savigny, 1816) | Pyuridae | Kai Islands, Indonesia (5°40'S, 132°51'E) | 288 m | Present account |
| <i>A. elegans</i> sp. nov. | <i>Polycarpa argentata</i> (Sluiter, 1890) | Styelidae | Ngeteklou Island, Koror, Palau Islands (07°19.47'N, 134°29.42'E) | 10 m | Present account |
| <i>A. rostralis</i> sp. nov. | <i>Polycarpa nigricans</i> Heller, 1878 | Styelidae | Thio, New Caledonia | 18 m | Present account |
| <i>A. longicaudatus</i> sp. nov. | <i>Microcosmus longicla</i> Monniot, C. & Monniot, F., 1991 | Pyuridae | N. Lubang, The Philippines (13°59'N, 120°18'E) | 183-190 m | Present account |
| <i>A. nudus</i> sp. nov. | <i>Polycarpa</i> sp. | Styelidae | Manado, Sulawesi, Indonesia | unknown | Present account |
| <i>A. unisetosus</i> sp. nov. | Unidentified species | Styelidae | North Atlantic (42°59.7'N, 14°05.4'W) | 5260 m | Present account |

Type-genus: *Archinotodelphys* Lang, 1949.

Remarks. Currently five species of archinotodelphyids placed in two genera are recognized as valid (Boxshall & Halsey, 2004), but here we provide descriptions of 14 new species. We also recognize *Archinotodelphys polyne-siensis* Monniot, 1986 as a species complex (as discussed below). The availability of a much wider range of taxa within the family revealed numerous apparent series of changes in setal patterns (see Table 2). For example, the first endopodal segment of the mandible carries 6 setae in five species, 5 in one species, 4 in 13 species and 1 seta in a single species. Similarly, the number of setae on the endopod of the maxillule varies from 12 in two species, 11 in two species, 10 in seven species, 9 in one species, 8 in seven species and 5 in a single species. [The possession of 12 setae in *Pararchinotodelphys phallusiae* (Hansen, 1923) and in *A. polyne-siensis* is in need of confirmation.] The key diagnostic character that Lang (1949) used to distinguish between his two genera was the number of segments on the endopod of the maxilliped: *Archinotodelphys* has a 2-segmented endopod whereas in *Pararchinotodelphys* it is unsegmented. Twelve of the species documented in this paper have a 2-segmented endopod, while the other eight lack any articulation separating proximal and distal endopodal segments. There is considerable variation in the setation of various limbs but most of these character transformations are gradual and we detect no major dichotomy that is common to these different transformation series or that is congruent with the change in segmentation of the endopod of the maxilliped.

The other diagnostic character used by Lang (1949) to support the recognition of *Pararchinotodelphys* as a new genus was “abdomen in female four-segmented”. Hansen’s figure of female *P. phallusiae* (Hansen, 1923: pl. I, Fig. 1a) clearly shows the urosome as comprising a short fifth pedigerous somite, a large genital double-somite and three free abdominal somites. Lang (1949) presumably included the genital double-somite in his count of “abdominal segments”. Lang’s figure (Lang, 1949: Fig. 13) of *Archinotodelphys typicus* Lang, 1949 was labelled “Abdomen” but the relative lengths of the five somites (i.e. the first somite is the shortest and is likely to be the fifth pedigerous somite, the second is the longest and likely to be the genital double-somite, and the remaining three somites are free abdominal somites) suggest that this illustration depicts the entire urosome. On this basis we believe that Lang was mistaken in his interpretation. Indeed, Huys & Boxshall (1991) examined material of *A. typicus* obtained from, and identified by, Claude Monniot and figured a genital double-somite in this species (Huys & Boxshall, 1991: Fig. 2.8.31D-F). It appears that the female urosome is 5-segmented in all archinotodelphyids.

We found no evidence to support the maintenance of *Pararchinotodelphys* as a valid genus distinct from *Archinotodelphys*: recognizing two genera leaves one paraphyletic. We currently recognize only a single genus within this family, the type genus *Archinotodelphys*. As a consequence of treating *Pararchinotodelphys* as a junior subjective synonym of *Archinotodelphys*, two new combinations are created, *A. phallusiae* (Hansen, 1923) **comb. nov.** and *A. gurneyi* (Illg, 1955) **comb. nov.**

The descriptions of some of the existing nominal species appear to contain inaccuracies: for example, the presence of only 1 outer seta representing the exopod of the antenna in *A. gurneyi* **comb. nov.** and *A. phallusiae* **comb. nov.**, rather than 2 as present in all other species suggests that the second (often very small) seta has been overlooked or broken off during dissection in these species. Similarly, the setation of the second endopodal segment of the antenna is given as 2 + 0 and 2 + 1 in these two species, respectively, and we consider it probable that some setae have been missed. Doubtful setal counts such as these have been avoided in our comparisons and in the key to species provided here. Monniot’s (1968) description of the maxilliped of *A. profundus* as 6-segmented is based on misinterpretation of transverse folds associated with the margins of the endites on the syncoxa, as segmental articulations.

Existing species

Archinotodelphys typicus Lang, 1949

The type species was described by Lang (1949) based on 5 females (3 ovigerous) taken from the branchial cavity of *Pyura georgiana* Michaelsen, 1898 collected at a depth of 250 m off South Georgia in the subantarctic plus 2 non-ovigerous females from the same host collected at a nearby station at a depth of 75 m off South Georgia. Four further females were examined by Huys & Boxshall (1991). These specimens were taken from *Molgula pulchra*

TABLE 2. Morphological comparisons between *Archinotodelphys* species. [?] = missing data, or data in need of confirmation: Abbreviations: BL = body length, C Rami = caudal rami, A1 = antennule, A2 = antenna, Mnd = mandible, Mx1 = maxillule, Mx2 = maxilla, Mxp = maxilliped, P5 = leg 5, L/W = length to width ratio, segs = number of segments, exp = exopod, enp = endopod, set = number of setae]

| Species | BL (mm) | C Rami | | ♀ A1 | | A2 | | Mnd | | Mx1 | | Mx2 | | Mxp | | P5 | | exp L/W |
|---|------------|--------|-----|------|---------|-----|-------|-----|------|-------|-----|----------|-----|-------|-----|-----|-----|------------|
| | | L/W | set | segs | exp | exp | enp | enp | enp | enp | enp | enp | enp | enp | enp | enp | enp | |
| <i>A. typicus</i> | 2.5 | 4.5:1 | 17 | 2 | 3+0? | 5 | 4-9 | 7? | 8 | 1-3? | 2 | 7-1-3-3 | 4 | 1.5:1 | | | | |
| <i>A. gurneyi</i> comb. nov. | 1.66 | 5:1 | 16 | 1? | 2?+0? | 5 | 4-10 | 6 | 10 | 1-1-4 | 2 | 5-1-3-2 | 4 | 3:1 | | | | |
| <i>A. phallusia</i> comb. nov. | 2.2 | 4:1 | 17 | 1? | 2?+1 | 5 | 4-10 | 7 | 12? | ? | 1 | 6-2-6 | 4 | 2:1 | | | | |
| <i>A. profundus</i> | 1.0 | 5:1 | 10 | 1? | 3+1 | 5 | 4-8 | 5 | 8 | 2-2-3 | 2 | 6-2-3-3 | 4 | 1.5:1 | | | | |
| <i>A. polynesensis</i> | 1.7 | 2.5:1 | 17 | 2 | 4+1 | 5 | 6-10* | 8 | 12** | 2-1-4 | 2 | 6-2-3-4 | 6 | 2:1 | | | | |
| <i>A. momus</i> sp. nov. | ? | 3:1 | 17 | 2 | 4+1 | 5 | 5-9 | 8 | 11 | 1-1-4 | 1 | 6-2-7 | 6 | 2.4:1 | | | | |
| <i>A. curtus</i> sp. nov. | 1.52 | 2.3:1 | 17 | 1+s | 3+1 | 5 | 6-10 | 7 | 11 | 2-2-3 | 2 | 6-2-4-3 | 4 | 2.3:1 | | | | |
| <i>A. illigi</i> sp. nov. | 1.42 | 4.0:1 | 17 | 1+s | 4+1 | 5 | 6-10 | 7 | 10 | 2-2-4 | 2 | 6-2-3-3 | 4 | 2.1:1 | | | | |
| <i>A. hexasetosus</i> sp. nov. | 1.34 | 3.3:1 | 17 | 2 | 3+1 | 5 | 6-9 | 8 | 10 | 2-6 | 2 | 5-2-3-4 | 6 | 3.8:1 | | | | |
| <i>A. cinctus</i> sp. nov. | 1.62 | 4.8:1 | 17 | 1+s | 4+1 | 5 | 5-10 | 7 | 5-4 | 2-2-4 | 2 | 6-2-3-3 | 4 | 1.9:1 | | | | |
| <i>A. antarcticus</i> sp. nov. | 3.32 | 5.8:1 | 17 | 2 | 3+1 | 5 | 4-10 | 8 | 6-4 | 1-5 | 2 | 10-1-3-3 | 4 | 2.0:1 | | | | |
| <i>A. monniti</i> sp. nov. | 2.10 | 4.0:1 | 17 | 2 | 3+1 | 5 | 4-10 | 7 | 6-4 | 2-1-4 | 2 | 9-1-3-3 | 4 | 2.8:1 | | | | |
| <i>A. bimerus</i> sp. nov. | 0.88 ♂ | 6.0:1 | ? | 1+s | 3+1 | 5 | 4-9 | 5 | 4-4 | 2-2-3 | 2 | 6-2-3-3 | 4 | 1.1:1 | | | | |
| <i>A. longiseta</i> sp. nov. | 1.39 | 6.2:1 | 16 | 2 | 4+1 | 5 | 4-10 | 6 | 10 | 1-1-4 | 2 | 4-1-3-2 | 4 | 2.5:1 | | | | |
| <i>A. reductus</i> sp. nov. | 1.59 | 6.3:1 | 17 | 1+s | 4+0 | 5 | 4-10 | 6 | 6-4 | 1-1-3 | 1 | 5-1-6 | 4 | 1.7:1 | | | | |
| <i>A. elegans</i> sp. nov. | 1.82 | 3.6:1 | 15 | 1+s | 4+0 | 4 | 4-9 | 6 | 8 | 1-1-4 | 1 | 5-1-4 | 4 | 1.3:1 | | | | |
| <i>A. rostralis</i> sp. nov. | 2.47 | 5.4:1 | 15 | 1+s | 4+0 | 4 | 4-9 | 4 | 8 | 1-1-4 | 1 | 5-1-4 | 4 | 1.7:1 | | | | |
| <i>A. longicaudatus</i> sp. nov. | 1.98 | 9.4:1 | 14 | 1+s | 4+1 (s) | 4 | 4-9 | 4 | 8 | 1-2-3 | 1 | 5-1-4 | 4 | 2.0:1 | | | | |
| <i>A. nudus</i> sp. nov. | 0.66 | 1:1 | 15 | 2 | 3+0 | 4 | 4-9 | 5 | 8 | 1-1-4 | 1 | 4-1-3 | 4 | 1.9:1 | | | | |
| <i>A. unisetosus</i> sp. nov. | 0.82 | 2.6:1 | 12 | 2 | 3+1 | 4 | 1-7 | 6 | 5 | 1-2-3 | 1 | 4-1-3 | 4 | 1.9:1 | | | | |

*Monniot (1986) figured 6-9, but also mentioned 7-10 in the text

** Monniot (1986) figured 12 setae on the endopod but this requires confirmation as this exceeds the number previously reported for the order Cyclopoida.

Michaelsen, 1900 and were collected and identified by Claude Monniot at a station off South Georgia at a depth of 68 to 80 m. The available data on body and limb segmentation and on limb setation of this species comes from Lang (1949) with the exception of the antenna, maxilliped, and female genital double-somite, all of which were figured by Huys & Boxshall (1991).

***Archinotodelphys gurneyi* (Illg, 1955) comb. nov.**

Synonym: *Pararchinotodelphys gurneyi* Illg, 1955

Illg (1955) described this species based on 4 adult females extracted from the branchial cavity of *Styela canopus* (Savigny, 1816) (as *S. partita* (Stimpson, 1852)) collected off the Atlantic coast of America at Martha's Vineyard in 1881, at a depth of 134 fathoms (= 245 m).

***Archinotodelphys phallusiae* (Hansen, 1923) comb. nov.**

Synonyms: *Cyclopina Phallusiae* Hansen, 1923

Pararchinotodelphys phallusiae (Hansen, 1923)

According to Hansen (1923), this species was collected in the North Atlantic from the Faeroe Islands and from a second locality to the southwest of these islands. It was based on two females, both of which were found in specimens of *Ascidia obliqua* Alder, 1863 (as *Phallusia obliqua*). The depth of the offshore locality was 800 m.

***Archinotodelphys profundus* Monniot, 1968**

Monniot (1986) found one male and one female of *A. profundus* in *Cnemidocarpa digonas* Monniot, C. & Monniot, F., 1968 collected at a depth of 2886 m in the North Atlantic (at 38°46'N, 70°06'W). The morphological data on this species came primarily from Monniot's (1968) description. However, the holotype and allotype were re-examined by Huys & Boxshall (1991) who figured the antennules of both sexes in detail.

***Archinotodelphys polynesiensis* Monniot, 1986**

Monniot (1986) noted variation in setal counts on several limbs within the material he used to describe *A. polynesiensis*. He interpreted this as intraspecific variation related to the utilization of different hosts; indeed, this variation was highlighted as a central theme of his paper. However, in the light of the much greater species level diversity available for this study and in the awareness of the relatively low variability in setal counts exhibited by copepods in general, we consider that *A. polynesiensis* is an unresolved complex of species. The holotype female of *A. polynesiensis* came from *Ascidia archaia* Sluiter, 1890, the type host, collected off Tikehau (Tuamotou) in French Polynesia. However Monniot (1986) also mentions additional material from *Herdmania momus* (Savigny, 1816) (as *Pyura momus*), as well as from *Corella* sp. collected at Moorea and Tikehau, and from *Ascidia* sp. collected at Tahiti, Moorea and Tikehau. Monniot documented substantial variation in many of the cephalosomic limbs in the material from these other hosts. In particular, he noted "enormous differences" in many appendages of the female from *Herdmania momus*, so he figured this female specimen separately. In the light of the new taxa studied here, we consider that there is now sufficient evidence to treat the copepod from *H. momus* as a distinct species, *Archinotodelphys momus* sp. nov., which is diagnosed below. Huys & Boxshall (1991) examined one female of *A. polynesiensis* collected by Claude Monniot from a specimen of *Molguloides vitrea* (Sluiter, 1904) taken in The Philippines. They figured the mandible, maxillule, maxilla, maxilliped, fifth legs and genital double-somite of this specimen. There are significant differences between this specimen and the holotype female from *Ascidia archaia* but until new material becomes available there isn't sufficient evidence to support the recognition of further separate species from this *A. polynesiensis* complex.

New Species

Archinotodelphys momus sp. nov.

Synonym: *Archinotodelphys polynesiensis* Monniot, 1986 (partim)

Differential diagnosis. Characters as for *A. polynesiensis* except as follows: antenna with same setation but segments shorter and broader than in *A. polynesiensis*. Mandibular palp with 8 setae on second endopodal segment (cf. 9 setae in *A. polynesiensis*). Endopod of maxillule with 11 setae (cf. 12 setae in *A. polynesiensis*, according to Monniot (1986)). Setation of free endopodal segments of maxilla 1, 1, 4 (cf. 2, 1, 4 in *A. polynesiensis*). Maxilliped with endopodal segments fused and bearing total of 7 setae (cf. segments 1 and 2 separate and bearing total of 6 setae in *A. polynesiensis*). Leg 4 with inner coxal seta (cf. absent in *A. polynesiensis*). Leg 5 with 6 setae on exopodal segment.

Remarks. There are additional small scale differences, for example, in the relative lengths of the 6 setae carried on the free exopodal segment of leg 5, and in the caudal setae. The fusion of the endopodal segments of the maxilliped and the differences in setation highlighted by Monniot (1986) and listed above, provide sufficient evidence to justify the establishment of the new species based on material from *Herdmania momus*, the type host. The holotype is the female specimen collected from *H. momus* described and figured by Monniot (1986).

Archinotodelphys curtus sp. nov.

(Figs. 1, 2)

Type material. Holotype ♀ (MNHN-IU-2014-21192; dissected and mounted on a slide).

Type host. *Styela* sp.

Type locality. Indian Ocean, Safari II cruise of R.V. *Marion Dufresne* (MD28), Stn data unknown; 24 July – 24 August 1981.

Etymology. The name *curtus* refers to the relatively short caudal rami of this species.

Female. Body cycloform (Fig. 1A) dorsoventrally flattened; 1.52 mm total length; prosome length 836 µm, greatest width 636 µm. Cephalosome 436 µm long; first pedigerous somite 564 µm wide, distinctly narrower than cephalosome. Urosome (Fig. 1B) 5-segmented; fifth pedigerous somite 203 µm wide. Genital double-somite 227×189 µm, 1.2 times as long as wide, narrowing slightly posteriorly; paired genital apertures located near anterior third. Three free abdominal somites 85×133, 61×127, and 88×121 µm, respectively. Caudal rami widely separated at base, divergent; each ramus about 2.3 times longer than wide (115×50 µm), armed with 6 naked setae; outer lateral seta located at about 45% of ramus length (Fig. 1C).

Rostrum (Fig. 1D) 122×96 µm, tapering to bluntly pointed tip. Antennule 453 µm long and 17-segmented; armature formula 3, 6, 8, 2, 2, 6, 4+aesthetasc, 2, 2, 2, 2, 2+aesthetasc, 0, 1, 2, 2+aesthetasc, and 7+aesthetasc; seventh segment with incomplete suture line on one side; all setae thin and naked. Antenna (Fig. 1F) with short, unarmed coxa: basis with pinnate inner seta, and 2 unequal (1 larger plumose and 1 small naked) outer setae representing exopod: endopod 3-segmented; first segment with 1 small seta on middle of inner margin; second segment with 4 setae (3 at inner distal corner and 1 on inner margin); third segment 47×27 µm, as long as second, armed with 1 slender curved claw and 6 naked setae distally.

Labrum not observed (destroyed during dissection). Mandible (Fig. 1G) with 8 spiniform teeth (including smaller second distal most one), 2 proximal setae, and row of fine spinules on medial margin of gnathobase; basis with 1 plumose seta on medial margin; exopod 4-segmented with 5 setae (1, 1, 1, and 2 on first to fourth segments respectively), 2 terminal setae plumose; endopod with 6 and 10 naked setae on first and second segments, respectively. Maxillule (Fig. 1H) with 11 setae on arthrite, 1 seta on coxal endite, and 2 setae on epipodite; basis with 1 spine and 6 setae on inner margin; endopod unsegmented with 11 setae, outer distalmost seta plumose, other 10 naked; exopod with 4 large, plumose setae. Maxilla (Fig. 2A) consisting of precoxa, coxa, basis, and 3-segmented endopod: complete suture line separating precoxa and coxa; precoxa with 4 (1 of them small) and 1 setae on proximal and distal endites, respectively; coxa with 3 setae each on proximal and distal endites; basis with 2 setae and 1 strong claw bearing fine spinules along proximal margin; endopod short, 3-segmented and armed with 2, 2, and 3

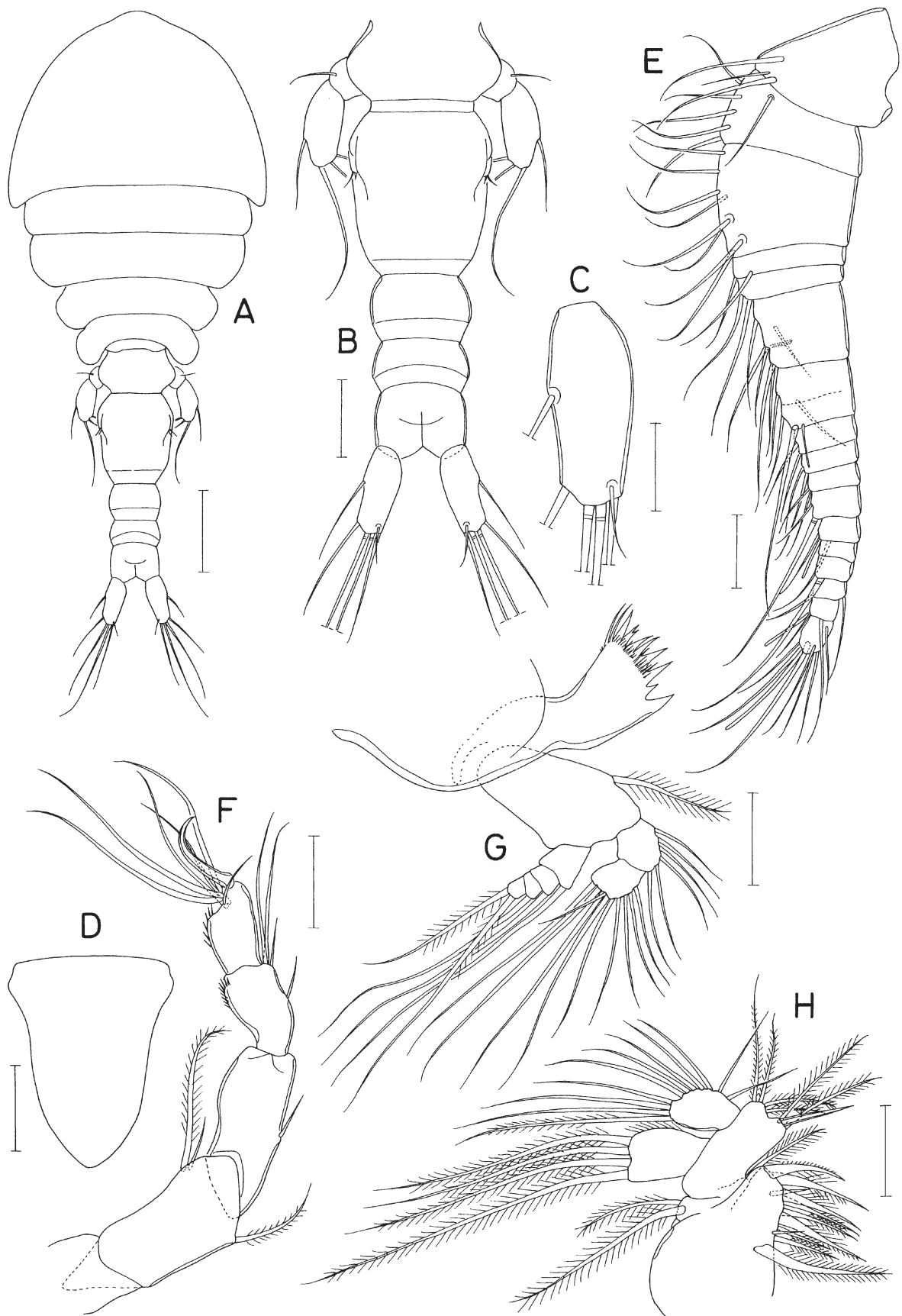


FIG. 1. *Archinotodelphys curtus* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, mandible; H, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–H, 0.05 mm.

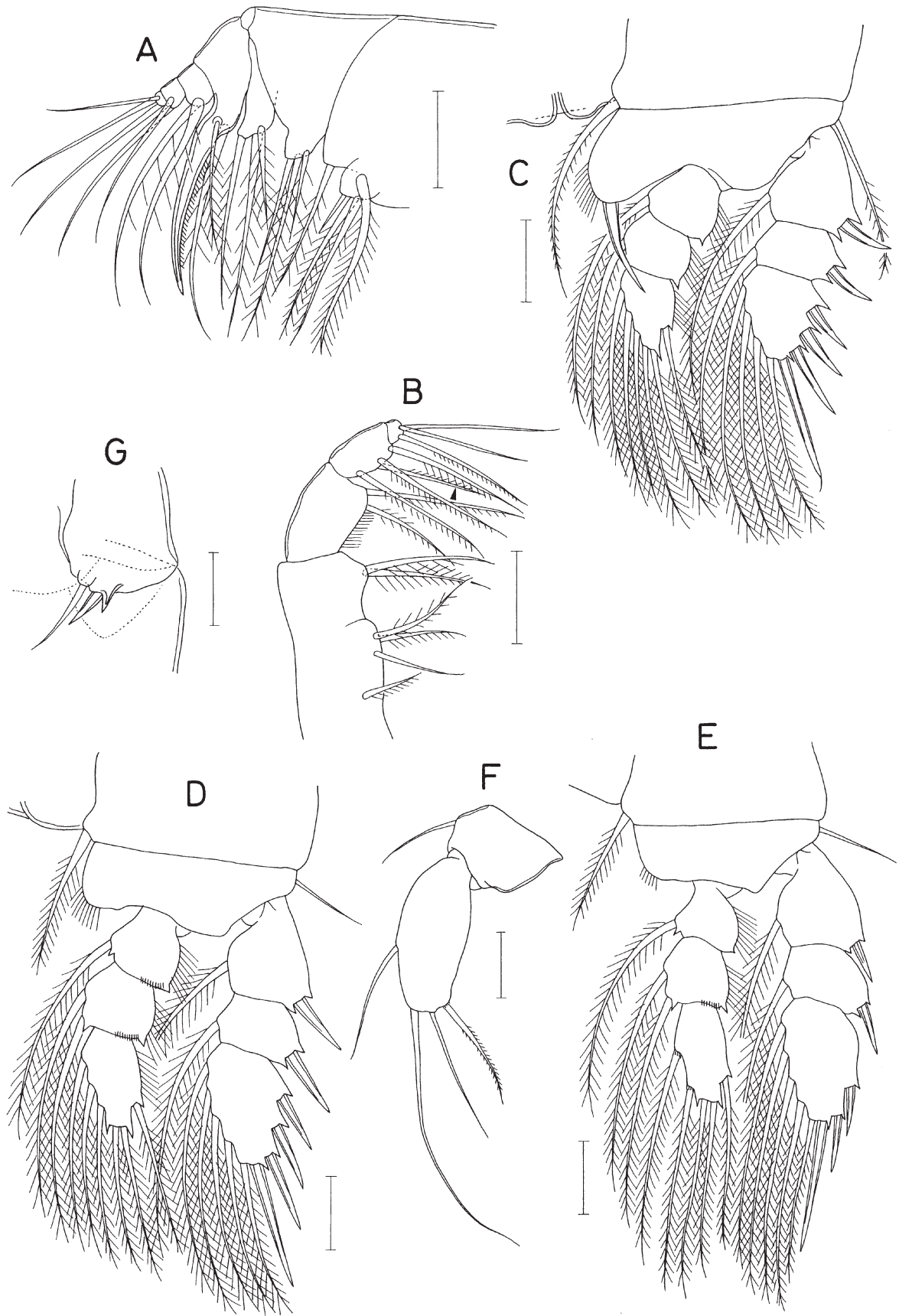


FIG. 2. *Archinotodelphys curtus* sp. nov. holotype female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, leg 6, dorsolateral. Scale bars: A–F, 0.05 mm; G, 0.02 mm.

setae on first to third segments, respectively. Maxilliped (Fig. 2B) 4-segmented, syncoxa with 6 setae (4 proximal and 2 distal), basis with 2, and 2-segmented endopod with 4, and 3 setae respectively; second seta (indicated by arrowhead in Fig. 2B) missing on one member of limb pair.

Legs 1–4 with 3-segmented rami; outer margins of exopods smooth (Fig. 2C–E). Leg 1 basis with inner distal spine 59 μm long, naked and slightly curved. Leg 3 same as leg 2 (Fig. 2D) in structure. Armature formula of legs 1–4 as in family diagnosis.

Leg 5 (Fig. 2F) consisting of protopodal and exopodal segments; protopodal segment wider than long and distinctly articulated from somite, with 1 seta on outer margin; exopodal segment about 2.3 times as long as wide (124 \times 55 μm), with 4 setae (1 lateral and 3 distal); outer distal seta much longer than other 3; inner distal seta weakly plumose. Leg 6 (Fig. 2G) represented by 1 seta, 1 spine and 1 spiniform process located in genital aperture.

Male. Unknown.

Remarks. This new species is similar to typical *A. polynesiensis* and *A. momus* **sp. nov.** in having 6 setae on the first endopodal segment of the mandible and 11 setae on the endopod of the maxillule, but it differs in having 7 setae on the basis of the maxillule (cf. 8 in *A. polynesiensis*) and only 4 setae on the exopod of leg 5 (cf. 6 in *A. polynesiensis* and *A. momus* **sp. nov.**). These differences are sufficient to justify the establishment of a new species. A unique feature of the new species is the presence of 4 setae on the proximal segment of a 2-segmented endopod on the maxilliped. However, this fourth seta was present on one member of the limb pair only; it was absent on the other. In all other species, including the new species described here, a maximum of 3 setae is present on this segment.

Archinotodelphys illgi **sp. nov.**

(Figs. 3, 4)

Type material. Holotype ♀ (MNHN-IU-2014-21193; dissected and mounted on a slide).

Type host. unknown

Type locality. unknown

Etymology. The species is named in honour of Paul L. Illg, who contributed much to our understanding of associated copepods in general and the Archinotodelphyidae in particular.

Female. Body (Fig. 3A) dorsoventrally flattened; body length 1.43 mm, prosome length 836 μm ; cephalosome 412 \times 570 μm . First pedigerous somite 133 \times 418 μm , distinctly narrower than second. Urosome (Fig. 3B) 5-segmented; fifth pedigerous somite 185 μm wide. Genital double-somite 167 \times 170 μm , gradually narrowing posteriorly; paired genital apertures located dorsolaterally at about 37% of length along double-somite. Three free abdominal somites 64 \times 130, 51 \times 127, and 87 \times 124 μm , respectively. Anal somite (Fig. 3C) ornamented on ventral surface with 2 transverse rows of fine spinules proximally plus row of fine spinules along posterior margin near origin of caudal rami. Caudal ramus (Fig. 3C) about 4 times longer than wide (158 \times 40 μm), armed with 6 naked setae; outer lateral seta located at 43% of length of caudal ramus.

Rostrum (Fig. 3D) longer than wide with rounded apex. Antennule (Fig. 3E) 472 μm long and 17-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 2, 2, 2, 2, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; all setae thin and naked. Antenna (Fig. 3F) with short, unarmed coxa: basis with inner distal seta and 2 outer setae (1 large plumose and 1 small naked) representing exopod: endopod 3-segmented with 1 seta on inner margin of first segment, 5 setae (4 at inner distal corner and 1 on inner margin) on second segment, and 1 small curved claw plus 6 setae on third.

Labrum (Fig. 3G) narrowing distally, with large mid-posterior lobe; ornamented with long setules on posterolateral corners and along free margin of mid-posterior lobe. Mandible (Fig. 3H) with 2 setae and 8 teeth on gnathobase; proximal, second and third teeth tipped with spinules; basis with 1 seta on inner margin; exopod 4-segmented with setal formula 1, 1, 1, and 2 plumose setae; endopod 2-segmented, bearing 6 and 10 setae on first and second segments, respectively. Paragnath (Fig. 3I) lobate, ornamented with setules on inner surface. Maxillule (Fig. 4A) with 11 setae on arthrite (1 on ventral surface), 1 seta on coxal endite, 2 setae on epipodite, 7 setae (one spiniform) on medial margin of basis, 4 setae on exopod and 10 setae on endopod. Maxilla (Fig. 4B) with distinct suture line between precoxa and coxa; precoxa with 3 setae plus spiniform process on proximal endite and 1 seta on distal endite; coxa with 3 setae each on proximal and distal endites; basis with claw ornamented with spinules along proximal margin and bearing 2 setae; endopod short and 3-segmented, armed with 2, 2, and 4 setae on first to third segments,

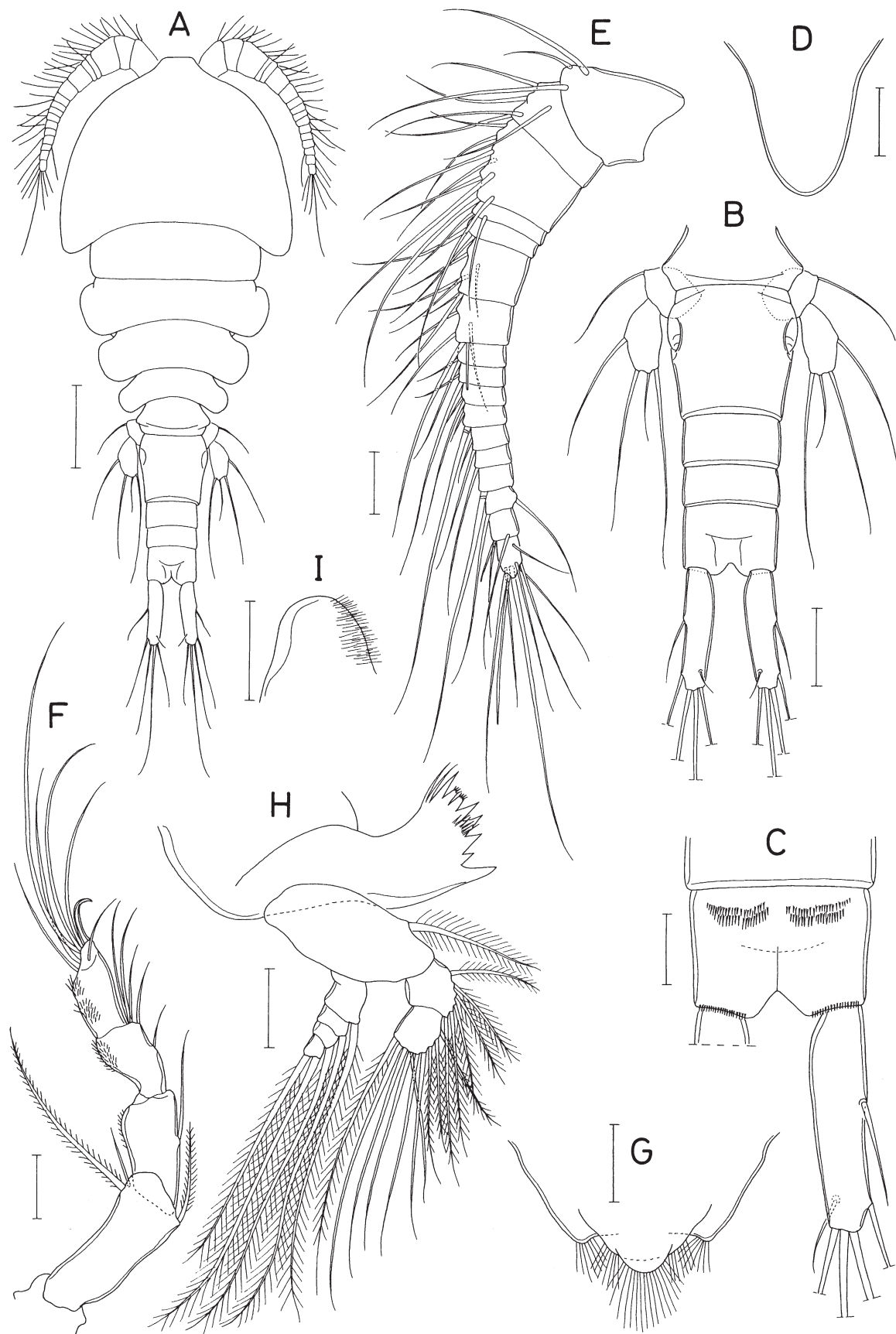


FIG. 3. *Archinotodelphys illgi* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal, C, anal somite and left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath. Scale bars: A, 0.2 mm; B, 0.1 mm; C–I, 0.05 mm.

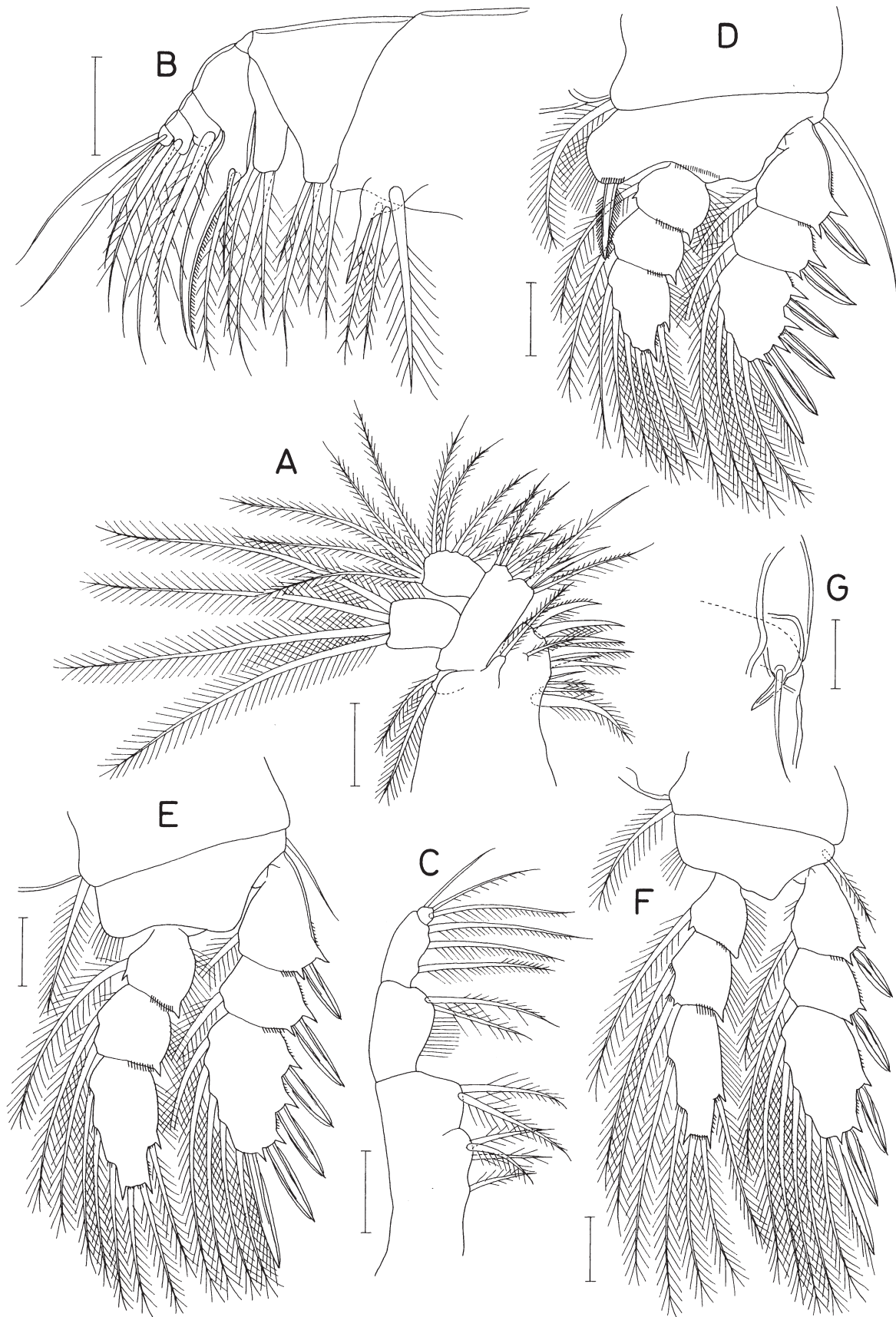


FIG. 4. *Archinotodelphys illgi* sp. nov. holotype female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, right genital aperture, dorsal. Scale bars: A–F, 0.05 mm; G, 0.02 mm.

respectively. Maxilliped (Fig. 4C) 4-segmented, fourth segment small: setal armature comprising 6, 2, 3, and 3 setae on first to fourth segments.

Legs 1–4 with 3-segmented rami: armature formula as in preceding species. Outer seta of basis naked in legs 1–3 but plumose in leg 4 (Figs. 4D–F). Inner distal spine on basis of leg 1 extending to distal margin of second endopodal segment, 54 μm long, and spinulose on both margins.

Leg 5 (Fig. 3B) 2-segmented: protopodal segment distinctly articulated from somite, 62 \times 78 μm , bearing outer naked seta; exopodal segment 2.07 times longer than wide (93 \times 45 μm), armed with 4 thin naked setae, mid-terminal seta smallest; medial seta largest at 255 μm , extending to posterior margin of anal somite. Leg 6 (Fig. 4G) represented by 1 naked seta and 1 spine located in genital aperture.

Male. Unknown.

Remarks. This new species can readily be distinguished from *A. polynesiensis* and *A. momus* **sp. nov.** by the presence of only 4 setae on the exopodal segment of leg 5. Both of these other species carry 6 setae on the exopodal segment of leg 5. The existing species *A. typicus*, *A. gurneyi*, *A. phallusiae*, and *A. profundus* all share the possession of 4 setae on the free exopodal segment of leg 5, but all of them carry only 4 setae on the first endopodal segment of the mandible. The new species, *A. illgi* **sp. nov.**, and *A. curtus* **sp. nov.** both have 6 setae on this segment. In *A. illgi* **sp. nov.** the endopod of the maxilla is armed with a total of 8 setae (arranged 2, 2, and 4 on the first to third segments, respectively). No other existing species has 8 setae on the endopod of the maxilla: in *A. polynesiensis* it has 7 setae (arranged 2, 1, and 4), and *A. profundus* also has 7 setae (arranged 2, 2 and 3). *Archinotodelphys curtus* **sp. nov.** also has 7 setae arranged 2, 2 and 3, but the second endopodal segment of its antenna is armed with 5 setae (4 distal plus 1 medial) in *A. illgi* **sp. nov.** whereas in *A. curtus* **sp. nov.** this segment carries only 4 setae (3 distal and 1 medial). These differences serve to justify the establishment of *A. illgi* as a new species.

Archinotodelphys hexasetosus **sp. nov.**

(Figs. 5, 6)

Type material. Holotype ♀ (MNHN-IU-2014-21194; dissected and mounted on a slide).

Type host. *Molgula platybranchia* Monniot C., 1970 (MNHN-IT-2008-5713 = MNHN S3/MOL.A/290).

Type locality. Banc Seine, N.E. Atlantic Seamount I cruise, Stn DE80 (33°48.5'N, 14°22.6'W), depth 250–256 m; coll. P. Bouchet; 10 October 1987.

Etymology. The name of the species refers to the presence of 6 setae on both the first endopodal segment of the mandible and the exopodal segment of leg 5.

Female. Body (Fig. 5A) rather slender, 1.34 mm long; prosome 659 μm long and gradually narrowing posteriorly; cephalosome 350 \times 490 μm , with characteristic acutely-produced posterolateral corners on dorsal cephalosomal shield. Urosome (Fig. 5B) 5-segmented: fifth pedigerous somite 168 μm wide. Genital double-somite 200 \times 173 μm , gradually narrowing posteriorly and bearing paired genital apertures dorsolaterally at about 32% of double-somite length. Three free abdominal somites 94 \times 121, 79 \times 115, and 82 \times 116 μm , respectively. Caudal rami widely separated from each other, directed posteriorly; each ramus (Fig. 5C) about 3.3 times as long as wide (136 \times 41 μm): armed with 6 setae; outer lateral seta naked and located about at middle of ramus; other 5 setae plumose.

Rostrum (Fig. 5D) slightly longer than wide, 98 \times 89 μm , tapering towards blunt apex. Antennule (Fig. 5E) 462 μm long and 17-segmented; first segment with 3 setae; setation of other segments uncertain (due to loss of setae during capture and subsequent handling). Antenna (Fig. 5F) with short coxa; basis with 2 plumose setae at outer distal corner, representing exopod; but inner distal seta absent; first to third endopodal segments with 1, 4 (3 distal and 1 at mid-length), and claw plus 6 setae, respectively; third segment about 2.6 times longer than wide (61 \times 23 μm); terminal curved claw small, about half length of segment.

Labrum (Fig. 5G) as figured. Mandible (Fig. 5H) with 8 teeth (3 spinule-like) plus 2 slender setae on coxal gnathobase; basis with subdistal seta on medial margin; exopod 4-segmented with 5 setae (setal formula 1, 1, 1, 2); endopod with 6 naked setae on first segment and 9 setae on second. Paragnath (Fig. 5I) ornamented with 2 denticles apically and setules on medial surface. Maxillule (Fig. 5J) with 10 setae on precoxal arthrite, 1 seta on coxal endite, 2 equal setae on coxal epipodite, 8 setae (3 proximal and 5 distal) on medial margin of basis, 4 distal setae on exopod and 10 setae on endopod. Maxilla (Fig. 6A) 5-segmented with distinct suture between precoxa and coxa; precoxa with 1 spine and 3 setae on proximal endite and 1 seta on distal endite; coxa with 3 setae each on proximal and distal

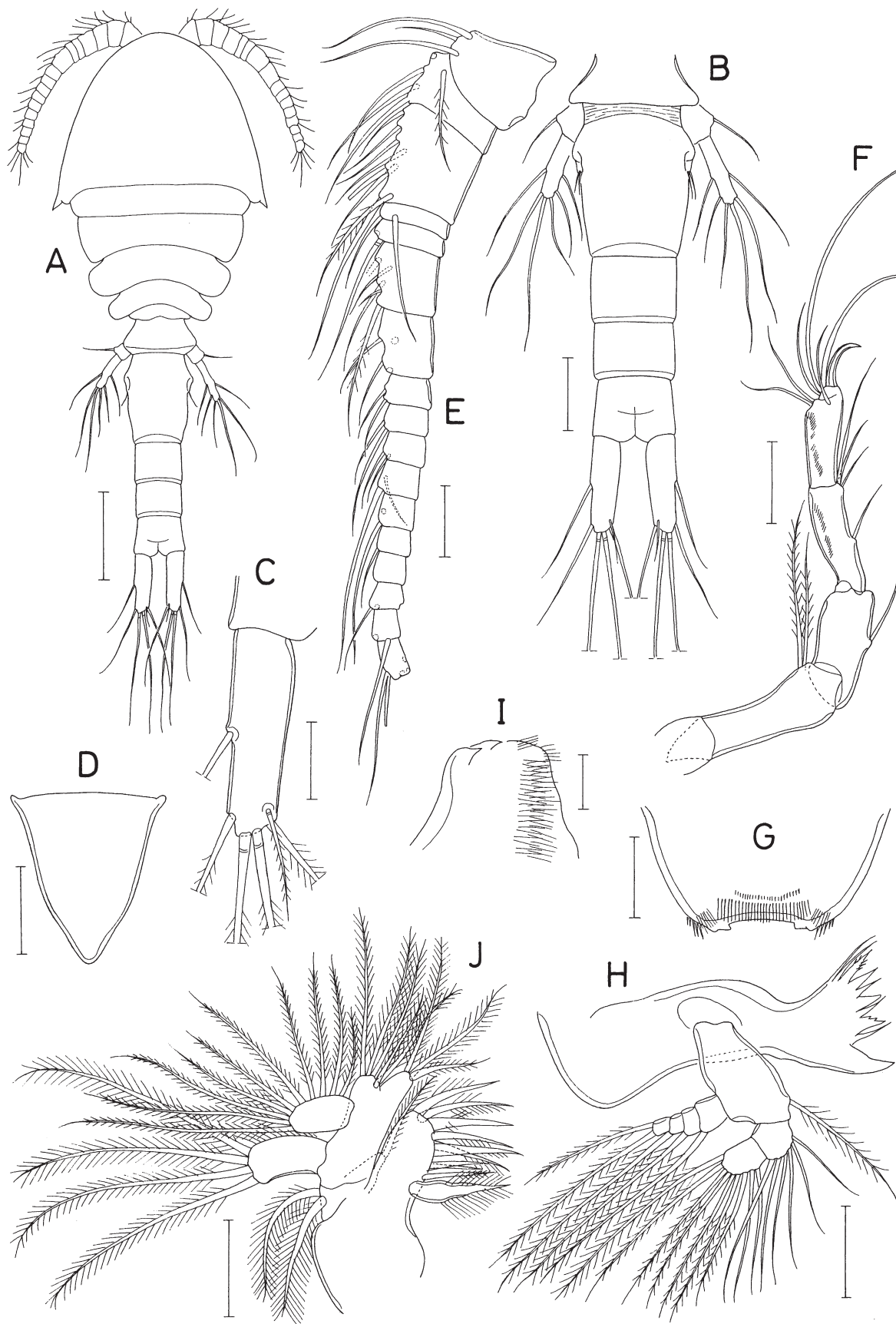


FIG. 5. *Archinotodelphys hexasetosus* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–H, J, 0.05 mm; I, 0.02 mm.

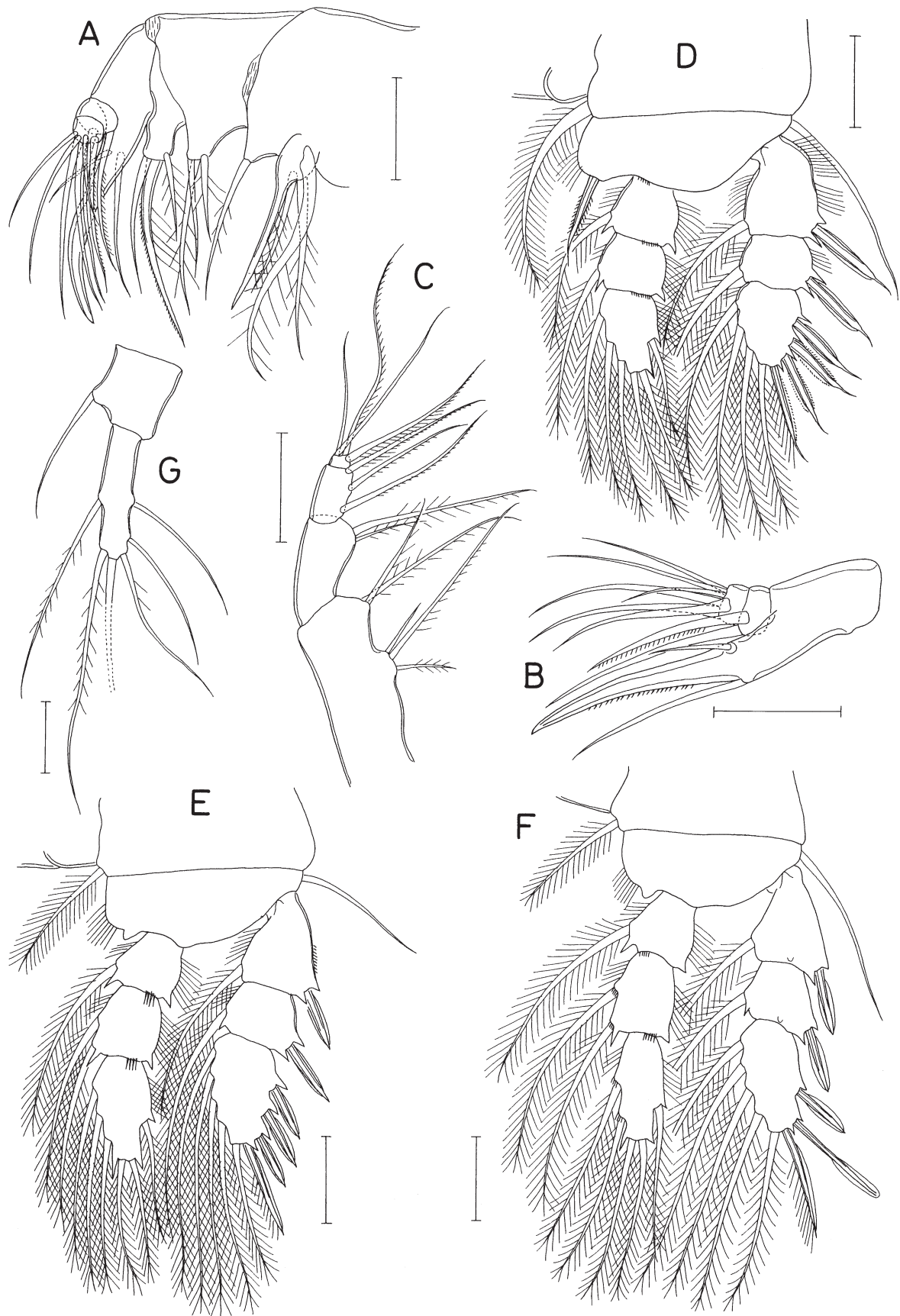


FIG. 6. *Archinotodelphys hexasetosus* sp. nov. holotype female. A, maxilla; B, basis and endopod of maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: 0.05 mm.

endites, middle seta on distal endite spiniform, ornamented with fine spinules along distal margin and scattered setules along proximal margin: basis with large claw plus 2 setae (Fig. 6B): endopod 2-segmented, armed with 2 setae on first segment and 6 setae on second. Maxilliped (Fig. 6C) 4-segmented with 5, 2, 3, and 4 setae respectively on first to fourth segments.

Legs 1–4 with 3-segmented rami: armature formula as in preceding species. Outer seta on basis of legs naked and relatively large (Fig. 6D–F). Spines on exopod of leg 1 each with flagellate tip. Distal spine on outer margin of third exopodal segment of leg 4 much longer than proximal.

Leg 5 (Fig. 6G) well-demarcated from somite; protopodal segment $53 \times 52 \mu\text{m}$ and armed with 1 seta on outer margin; exopodal segment about 3.8 times longer than wide ($92 \times 25 \mu\text{m}$) and bearing 6 setae (1 outer, 3 distal, and 2 inner). Leg 6 represented by 1 seta and 1 spine in genital aperture.

Male. Unknown.

Remarks. The possession of 6 setae on the free exopodal segment of leg 5 is shared only with *A. polynesiensis* and the newly established *A. momus* **sp. nov.**; the females of all other species including all the new species described below possess only 4 setae on this segment. The elongation of the exopodal segment of leg 5 in *A. hexasetosus* **sp. nov.** is also remarkable: in all other species this segment has a L:W ratio in the range of 1.1:1 to 3.0:1 whereas in the new species the segment is 3.8 times longer than wide. The new species possesses an inner coxal seta on leg 4, as in *A. momus* **sp. nov.** whereas *A. polynesiensis* lacks this seta (Monniot, 1986).

The first endopodal segment of the mandible has 6 setae, as in typical *A. polynesiensis*, *A. curtus* **sp. nov.**, *A. illgi* **sp. nov.** and *A. momus* **sp. nov.** However, the first three of these species each has 10 setae on the second endopodal segment and *A. momus* **sp. nov.** has only 8 setae: in contrast, the new species has 9 setae. *Archinotodelphys hexasetosus* **sp. nov.** has a 2-segmented endopod on the maxilla and these segments carry 2 and 6 setae, respectively, from which we infer that the distal segment is a compound segment derived from fusion of the second and third segments expressed in other species. The maxillary endopod is 3-segmented in all other species except for *A. antarcticus* **sp. nov.** described below, which has a setation pattern of 1, 5. [There is some uncertainty concerning the maxilla of *A. typicus* which Lang (1949) shows as 2-segmented and bearing only 4 elements: but it is probable that setal elements are missing.] Finally, the setal formula 5, 2, 3, and 4 of the 4-segmented maxilliped is unique within the genus: all other species which retain separate first and second endopodal segments on the maxilliped carry a maximum of 3 setae on the second endopodal segment. These differences provide sufficient evidence to support the establishment of a new species to accommodate this material.

Archinotodelphys cinctus **sp. nov.**

(Figs. 7, 8)

Type material. Holotype ♀ (MNHN-IU-2014-21195; dissected and mounted on a slide).

Type host. *Bathystyeloides enderbyanus* (Michaelsen, 1904) (MNHN-IT-2008-1441 = MNHN S1/BAT.B/36).

Type locality. Atlantique Tropical Campagne EUMELI 2 cruise, RV *Atalante*, Cape Verde basin, Stn CHP 07 ($18^{\circ}30'0''\text{N}$, $21^{\circ}1'0.012''\text{W}$), depth 3120 m, IFREMER coll., 10 February 1991.

Etymology. The name of the species refers to the presence of 5 setae on the first endopodal segment of the mandible.

Female. Body (Fig. 7A) length 1.62 mm; prosome 879 μm long; cephalosome $436 \times 600 \mu\text{m}$, dorsal cephalosomic shield with posteriorly extended posterolateral corners and distinctly broader than free pedigerous somites. Urosome (Fig. 7B) 5-segmented: fifth pedigerous somite 218 μm wide. Genital double somite $222 \times 189 \mu\text{m}$, gradually narrowing posteriorly; bearing paired genital apertures dorsolaterally at 38% of double-somite length. Three free abdominal somites 91×127 , 76×124 , and $109 \times 127 \mu\text{m}$, respectively; anal somite ornamented with minute spinules along posteroventral border near base of caudal rami (Fig. 7C). Caudal ramus (Fig. 7C) about 4.8 times longer than wide ($203 \times 42 \mu\text{m}$) and armed with 6 setae; lateral seta located about at mid-length of ramus.

Rostrum (Fig. 7D) about $127 \times 117 \mu\text{m}$, tapering to pointed apex. Antennule (Fig. 7E) 450 μm long and 17-segmented; third segment with trace of subdivision; setation not observed due to loss of setae. Antenna (Fig. 7F) with inner seta on basis, plus 2 exopodal setae (1 small and setule-like); first endopodal segment with 1 seta on inner margin; second with 5 setae (4 at inner distal corner and 1 on inner margin); third $73 \times 23 \mu\text{m}$, longer than second, and armed with slender curved claw plus 6 setae.

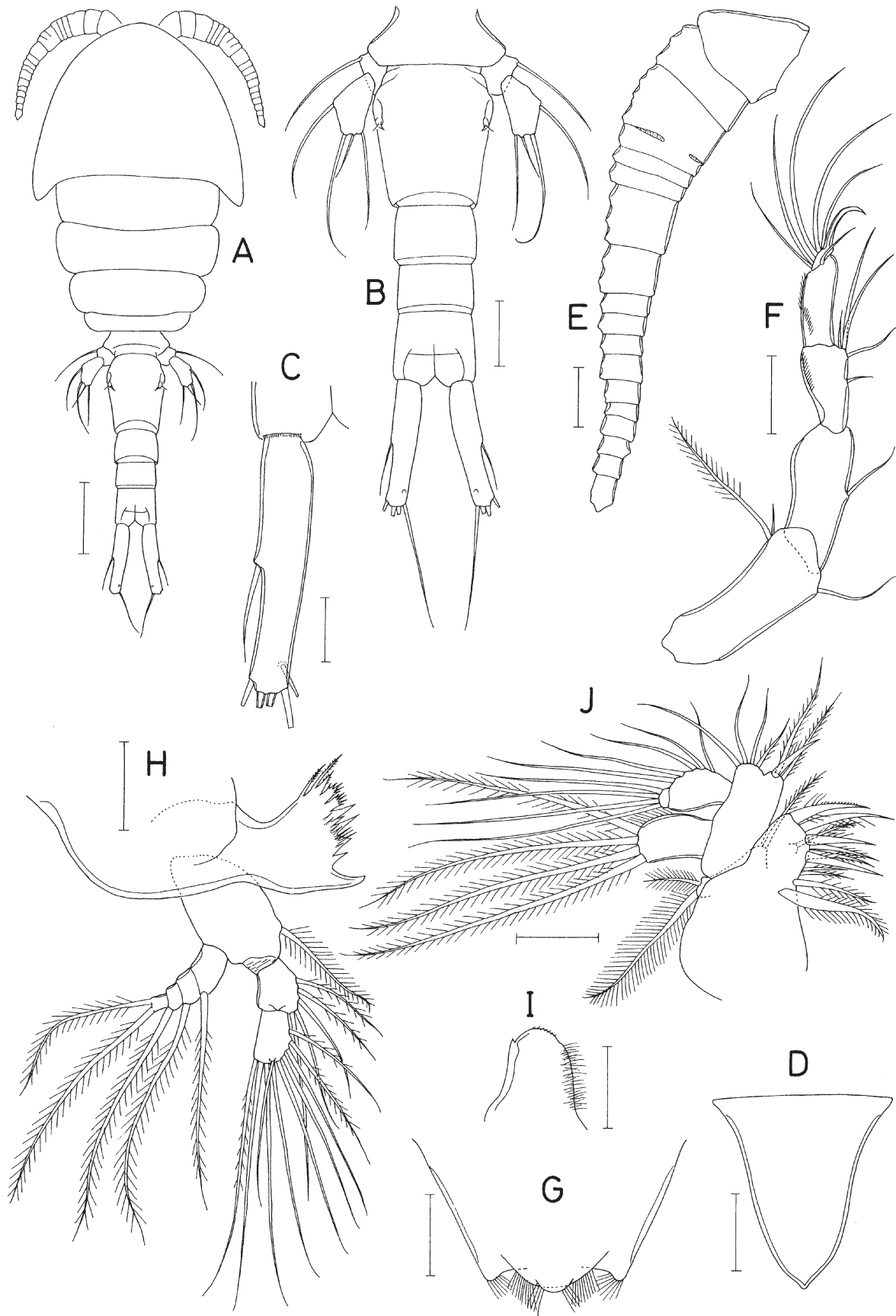


FIG. 7. *Archinotodelphys cinctus* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule segmentation pattern; F, antenna; G, labrum; H, mandible; I, paragnath; J, maxillule. Scale bars: A, 0.2 mm; B, 0.1 mm; C–I, 0.05 mm.

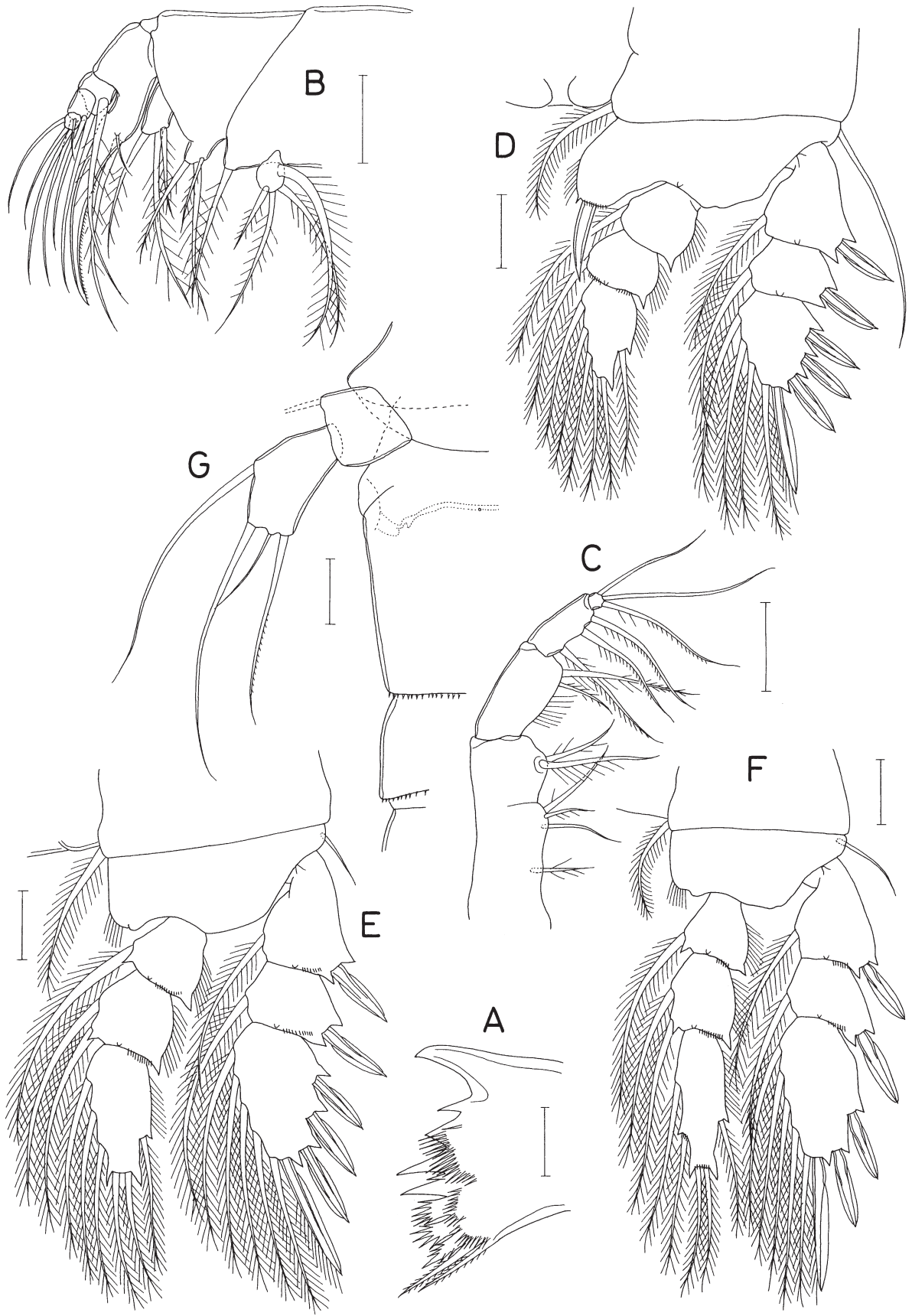


FIG. 8. *Archinotodelphys cinctus* sp. nov. holotype female. A, biting edge of coxal gnathobase of mandible; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, 0.02 mm; B–G, 0.05 mm.

Labrum (Fig. 7G) tapering posteriorly with broad posteromedian lobe; posterolateral corners and posteromedian lobe setulose. Mandible (Fig. 7H) with 8 teeth, 2 setae, and rows of spinules on coxal gnathobase (Fig. 8A), three proximal teeth spinulose; basis with 1 seta on medial margin: exopod 4-segmented, armed with 1, 1, 1, and 2 setae; endopod with 5 setae on first segment and 10 setae on second. Paragnath (Fig. 7I) ornamented with 1 small denticle at outer distal region, minute spinules apically, and setules on inner surface. Maxillule (Fig. 7J) with 11 setae (including 1 on ventral surface) on precoxal arthrite, 1 seta on coxal endite, 2 unequal setae on coxal epipodite, 1 spine and 6 setae on medial margin of basis, 4 setae on exopod and 9 setae on 2-segmented endopod (5 and 4 on first and second segments, respectively); all setae on endopod and 3 distal setae on basis naked. Maxilla (Fig. 8B) 6-segmented with suture line between precoxa and coxa; precoxa with 4 and 1 setae on proximal and distal endites, respectively; 3 setae present on each of proximal and distal coxal endites; basis bearing large claw ornamented with fine spinules along concave margin and bearing 2 unequal setae; endopod 3-segmented, with 2, 2, and 4 setae on first to third segments. Maxilliped (Fig. 8C) 4-segmented with setal formula 6, 2, 3, and 3; first segment partly subdivided by fold into proximal and distal parts bearing 4 and 2 setae, respectively.

Legs 1–4 with 3-segmented rami; armature formula as in family diagnosis. Outer basal seta of leg 1 large but outer basal seta on legs 2 to 4, small, all outer setae on basis naked (Fig. 8D–F). Inner distal spine on basis of leg 1 55 µm long and with smooth margins.

Leg 5 (Fig. 8G) 2-segmented; protopodal segment wider than long and clearly articulated from somite; exopodal segment about 1.9 times as long as wide (100×53 µm), outer margin convex, but inner margin straight; armed with 4 setae 205, 202, 69, and 149 µm in length from outermost to inner. Leg 6 represented by 1 spine and 1 seta in genital aperture.

Remarks. *Archinotodelphys cinctus* **sp. nov.** is similar to *A. illgi* **sp. nov.** in having 5 setae (4 + 1) on the second endopodal segment of the antenna and 2, 2, and 4 setae respectively on the first to third endopodal segments of the maxilla. The body form, the shape of the genital double-somite, and the segmentation and setation of the maxilliped are also similar in these two species. However, they can readily be distinguished by the presence of 5 setae on the first endopodal segment of the mandible in *A. cinctus* **sp. nov.** The possession of 5 setae is unique in the genus; most other species have 4 or 6 setae (see Table 2), with only a single new species, *A. nudus* **sp. nov.**, bearing just a single seta. A total of 9 setae is carried on the endopod of the maxillule of *A. cinctus* **sp. nov.** compared to 10 in *A. gurneyi*, *A. momus* **sp. nov.**, *A. hexasetosus* **sp. nov.** and *A. illgi* **sp. nov.**, and 11 in *A. curtus* **sp. nov.** and *A. polynesiensis*. These differences justify the establishment of a new species to accommodate the material from *Bathystyeloides enderbyanus*.

Archinotodelphys antarcticus **sp. nov.**

(Figs. 9–11)

Type Material. Holotype ♀ (MNHN-IU-2014-21196) and 4 paratype ♀♀ (MNHN-IU-2014-21197). 1 dissected paratype ♀ in the collection of IHK.

Type host. *Molgula pedunculata* (Herdman, 1881) (MNHN-IT-2008-5650 = MNHN S3/MOL.A/35).

Type locality. South Georgia, cruise of SOSC *Islas Orcadas*, Stn 131 (59°27'S, 27°02'W), depth 86–101 m, trawl, 27 February 1976.

Etymology. The new name refers to the type locality of this species, the Antarctic.

Additional non-type material. 1 ♀ (intact) (MNHN-IU-2018-1923) in *Molgula hodgsoni* Herdman, 1910 (MNHN-IT-2008-5550 = MNHN S3/MOL.A/152), South Georgia, Cruise 575 of SOSC *Islas Orcadas*, Stn 26 (53°43.1'S–36°49.3'W), depth 188–192 m, 17 May 1975. 1 ♀ (dissected) (MNHN-IU-2009-5726) in *M. hodgsoni* (MNHN-IT-2018-16 = MNHN S3/MOL.A/381), Antarctic, Terre Adelie, CEAMARC cruise, R.V. *Aurora Australis*, Stn 26AEV436 (66°32'S, 140°03'E), depth 176–288 m, IPEV-AAD-MNHN coll., 13 January 2008.

1 ♀ 1 ♂ (both dissected) in *Molgula euplicata* Herdman, 1923 (MNHN-IT-2008-5499 = MNHN S3/MOL.A/286), Weddell Sea, EPOS 3 cruise, RV *Polarstern*, Stn GSN 14 (71°06.2'S, 12°33.5'W), depth 499–515 m, 19 February 1989.

Female. Body (Fig. 9A) narrow, large, 3.32 mm long; prosome 1.74 mm long; cephalosome 969 µm long, with angular posterolateral corners on dorsal cephalosomic shield; first pedigerous somite 704 µm wide, distinctly narrower than cephalosome and second pedigerous somite. Urosome (Fig. 9B) 5-segmented: fifth pedigerous so

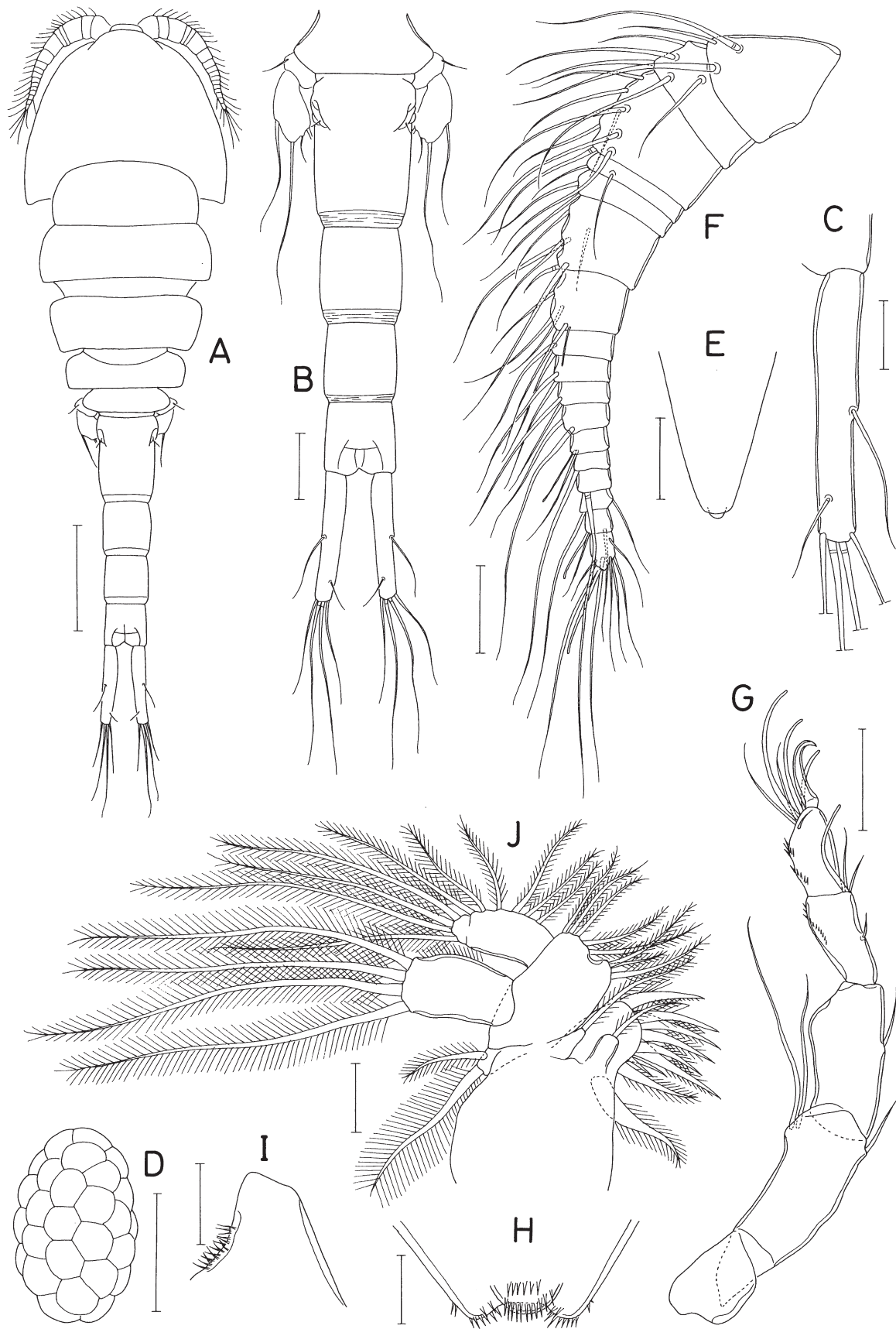


FIG. 9. *Archinotodelphys antarcticus* sp. nov. paratype female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, dorsal; D, egg sac; E, rostrum; F, antennule; G, antenna; H, labrum; I, paragnath; J, maxillule. Scale bars: A, D, 0.5 mm; B, 0.2 mm; C, E, F, 0.1 mm; G, H, 0.05 mm.

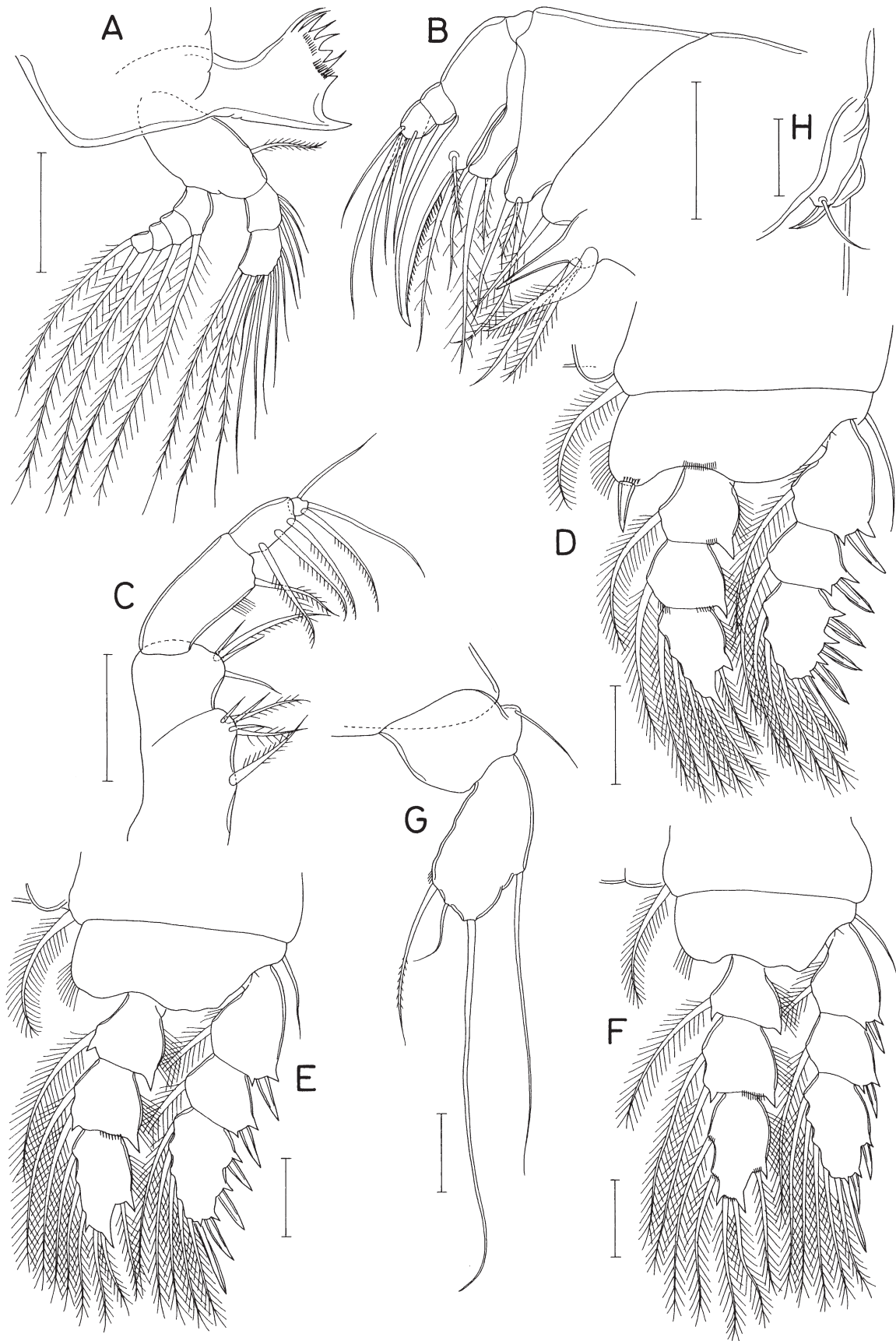


FIG. 10. *Archinotodelphys antarcticus* sp. nov. paratype female. A, mandible; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5; H, genital aperture on right side, dorsal. Scale bars: A–G, 0.1 mm; H, 0.05 mm.

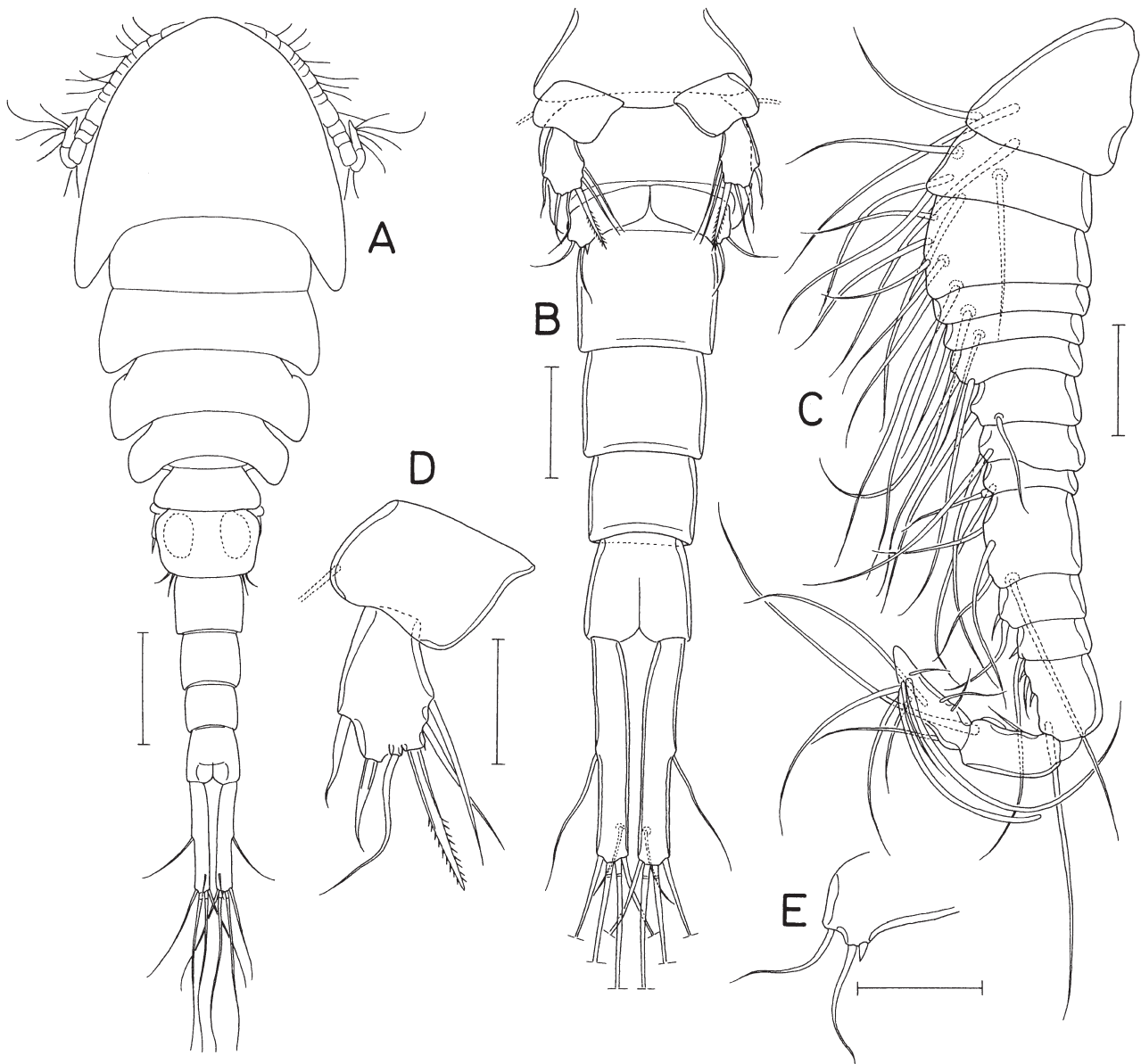


FIG. 11. *Archinotodelphys antarcticus* sp. nov. male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, leg 5; E, leg 6. Scale bars: A, 0.2 mm; B, 0.1 mm; C–E, 0.05 mm.

mite 436 μm wide, with tapering lateral margins. Genital double-somite 473 \times 327 μm , with nearly parallel lateral margins; bearing paired genital apertures dorsolaterally at anterior third. Three free abdominal somites 297 \times 255, 242 \times 224, and 212 \times 218 μm , respectively. Caudal ramus (Fig. 9C), about 5.9 times longer than wide (400 \times 68 μm), armed with 6 naked setae; outer lateral seta located at mid-length of ramus. Egg sac (Fig. 9D) oval, 836 \times 518 μm ; each egg about 170 μm in diameter.

Rostrum (Fig. 9E) longer than wide, evenly tapering with small lobe at blunt tip. Antennule (Fig. 9F) 723 μm long, gradually narrowing distally, 17-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 2, 2, 2, 2, 1+aesthetasc, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; all setae thin and naked; aesthetascs thin and short. Antenna (Fig. 9G) with short, unarmed coxa; basis with inner seta and 2 outer exopodal setae; first endopodal segment with 1 seta on inner margin; second with 4 setae, 3 at inner distal corner (1 with blunt tip) and 1 in middle of inner margin; third segment with 1 curved claw plus 6 setae, 3 of which bluntly tipped; setae on endopod remarkably short.

Labrum (Fig. 9H) strongly tapering, with spinulose posteromedian lobe and posterolateral corners. Mandible (Fig. 10A) with 2 setae and 7 teeth on coxal gnathobase; basis with 1 seta on medial margin; exopod 4-segmented with 1, 1, 1, and 2 setae; 2-segmented endopod with 4 setae on first segment and 10 setae on second. Paragnath (Fig.

9I) forming tapering lobe, obliquely truncate distally, ornamented with setules on medial surface. Maxillule (Fig. 9J) with 11 setae on precoxal arthrite (1 located at tip of digitiform lobe on ventral surface), 1 seta on coxal endite, 2 unequal setae on coxal epipodite, 8 setae on medial margin of basis, 4 setae distally on exopod; endopod incompletely 2-segmented with 6 setae on first segment and 4 setae on second. Maxilla (Fig. 10B) 5-segmented; suture line between precoxa and coxa distinct; precoxa with 1 spiniform process and 3 setae on proximal endite, and 1 seta on distal endite; coxa with 3 setae each on proximal and distal endites; basis with large claw bearing spinules along concave margin and 2 unequal setae; endopod 2-segmented, with 1 and 5 setae respectively on first and second segments. Maxilliped 4-segmented (Fig. 10C); incomplete transverse fold partially subdividing proximal segment; proximal segment with 1, 5, and 4 setae; basis with 1 seta; armature formula of endopod 3 and 3.

Legs 1–4 biramous with 3-segmented rami (Fig. 10D–F) and with same armature formula as preceding species. Inner distal spine on basis of leg 1 stout, 52 μm long, not extending beyond distal margin of first endopodal segment.

Leg 5 (Fig. 10G) 2-segmented; protopodal segment clearly articulated with somite, wider than long, with 1 seta on outer margin; exopodal segment nearly rhomboidal, about 2.0 times longer than wide (218 \times 112 μm), armed with 4 slender setae of very unequal lengths; longest apical seta 545 μm , extending to posterior margin of first free abdominal somite. Leg 6 (Fig. 10H) represented by 1 spine and 1 seta in genital aperture.

Male. Body (Fig. 11A) much smaller than female, 1.59 mm long. Cephalosome with extended posterolateral corners bearing blunt tip. Urosome (Fig. 11B) 6-segmented; fifth pedigerous 195 μm wide; genital somite 123 \times 193 μm , slightly narrowing distally; four free abdominal somites 104 \times 127, 95 \times 111, 75 \times 98, and 90 \times 97 μm , respectively. Caudal ramus about 6.8 times as long as wide (204 \times 30 μm).

Rostrum as in female. Antennule (Fig. 11C) 15-segmented, with geniculation between antepenultimate and penultimate segments; terminal segment attenuated; armature formula 3, 5, 6, 2, 2, 2, 2, 2, 4, 2, 2, 4, 2, and 10+aes-thetasc. Antenna, labrum, mandible, paragnath, maxillule, maxilla, maxilliped, and legs 1–4 as in female.

Leg 5 (Fig. 11D) exopodal segment 1.5 times longer than wide (60 \times 39 μm), armed with 1 spine (inner distal element, 60 μm long) and 5 setae. Leg 6 (Fig. 11E) represented by 2 naked setae and 1 spinule on genital operculum.

Remarks. Only two species of *Archinotodelphys* are known to possess a 2-segmented endopod on the maxilla, *A. hexasetosus* **sp. nov.** and *A. antarcticus* **sp. nov.** In all other species the endopod is 3-segmented. The setation of the endopod varies: in *A. hexasetosus* **sp. nov.** the setation formula is 2, 6, whereas in *A. antarcticus* **sp. nov.** it is 1, 5. The total number of setae (6) is the same as reported here for several new species described below, but the setal formula for the 3-segmented endopod in these cases is either 1, 1, 4 (*A. gurneyi* **comb. nov.** plus four of the new species) or 1, 2, 3 (two species). The total number of setae on the 4-segmented maxilliped is 17 (10, 1, 3, and 3 per segment) which is the highest total for any species in the genus. The highest total setation recorded for any other species is 16, found in *A. monnioti* **sp. nov.** (see Table 2).

Archinotodelphys monnioti **sp. nov.**

(Figs. 12–14)

Type Material. Holotype ♀ (MNHN-IU-2014-21198; intact), 2 paratypes (1 ♀, MNHN-IU-2014-21199, and 1 ♂, MNHN-IU-2014-21200; both dissected)

Type host. *Pareugyrioides galatheae* (Millar, 1959) (MNHN-IT-2008-6004 = MNHN S3/PAR.A/11).

Type locality. SW Heard I., Kerguelen Plateau, MD03/ICTHYO cruise, RV *Marion Dufresne*, Stn 12-36-CP08 (55°50'S, 69°36'E), depth 4200–4225 m, 11 April 1974.

Additional material. 1 ♀ (dissected) in *Pareugyrioides digitus* Monniot C., 1997, (MNHN-IT-2008-6002 = MNHN S3/PAR.A/3), Cape Verde basin, Mauritanie Eumeli 2 cruise, RV *Atalante*, Stn CP01 (18°24.5'N, 21°09.8'W), depth 3086 m, IFREMER coll., 24 January 1991.

Etymology. The new species is named in honour of Claude Monniot, in recognition of his contribution to knowledge of copepods living in association with tunicates.

Female. Body (Fig. 12A) relatively large, 2.46 mm long; prosome 1.40 mm long; all prosomites with rounded posterolateral corners; cephalosome 618 \times 887 μm ; first pedigerous somite narrower than dorsal cephalosomic shield and second pedigerous somite. Urosome 5-segmented: fifth pedigerous somite 287 μm wide. Genital double-somite 298 \times 225 μm ; bearing paired genital apertures dorsolaterally at about 41% of double-somite length. Three free

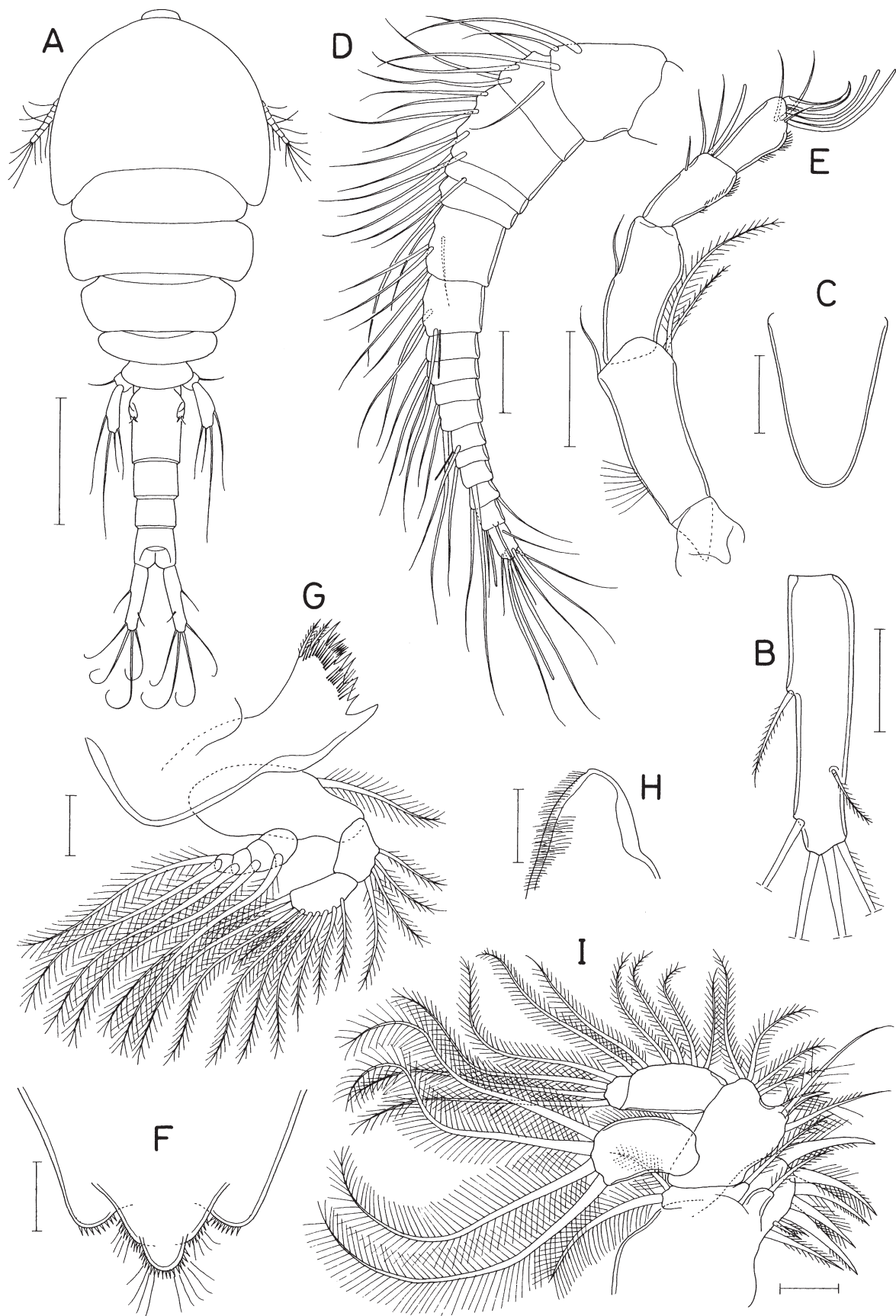


FIG. 12. *Archinotodelphys monnioti* sp. nov. paratype female. A, habitus, dorsal; B, left caudal ramus, dorsal; C, rostrum; D, antennule; E, antenna; F, labrum; G, mandible; H, paragnath; I, maxillule. Scale bars: A, 0.5 mm; B–E, 0.1 mm; F–I, 0.05 mm.

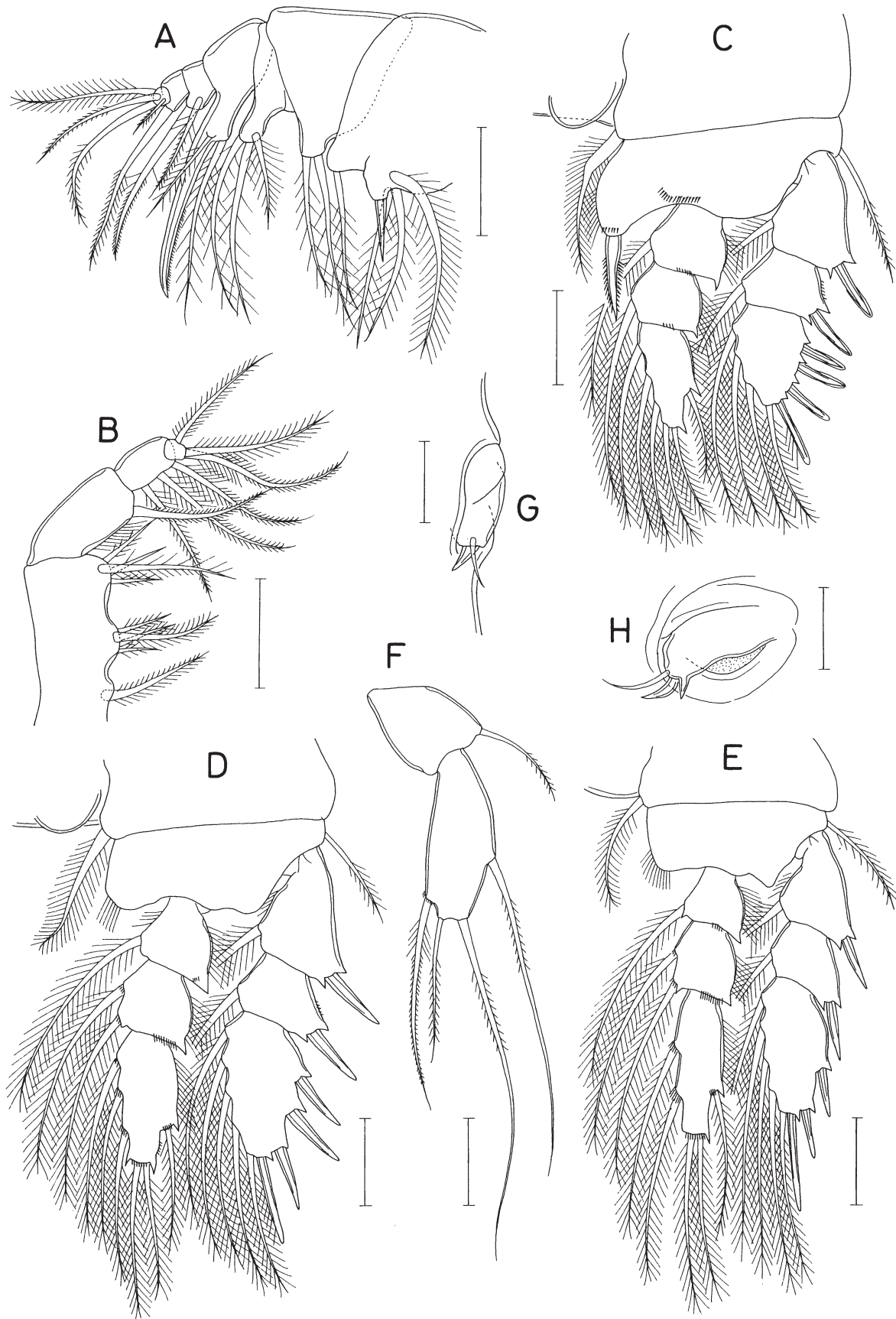


FIG. 13. *Archinotodelphys monnioti* **sp. nov.** paratype female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, right genital aperture, dorsal; H, right genital aperture, lateral. Scale bars: A–F, 0.1 mm; G, H, 0.05 mm.

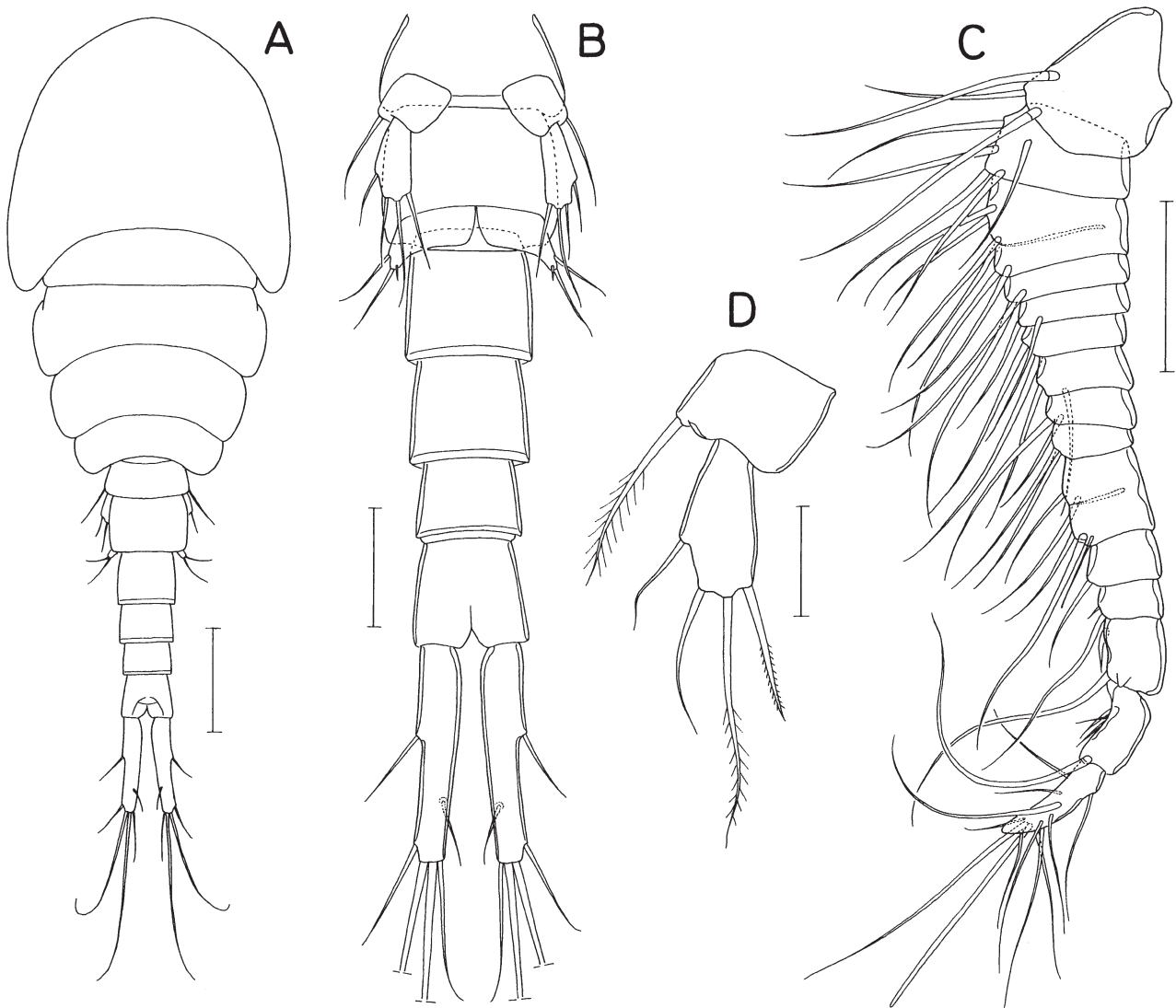


FIG. 14. *Archinotodelphys monnioti* sp. nov. male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, leg 5. Scale bars: A, 0.2 mm; B, C, 0.1 mm; D, 0.05 mm.

abdominal somites 145×181 , 116×167 , and 145×167 μm , respectively. Caudal ramus (Fig. 12B) about 4.1 times longer than wide (275×67 μm); armed with 6 setae; lateral seta located about at 42% of ramus length; outer distal and 2 mid-terminal setae (setae III–V) naked; 2 mid-terminal setae without annulation at base; other 3 setae weakly pinnate; dorsal seta (seta VII) located at 70% of ramus length.

Rostrum (Fig. 12C) narrow, 229×156 μm , with rounded apex. Antennule (Fig. 12D) 17-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 1+aesthetasc, 1, 1, 2, 2+aesthetasc, and 7+aesthetasc; aesthetascs small, setiform; all setae naked. Antenna (Fig. 12E) with short unarmed coxa; basis with inner distal seta plus 2 exopodal setae, and ornamented with several setules on inner margin; endopodal segments 118, 80, 76 μm long, respectively; armed with 1, 4, and 6 plus claw; terminal claw curved and slender; 1 seta on second segment and 3 setae on third with rounded tips.

Labrum (Fig. 12F) with large posteromedian lobe ornamented with spinules and setules along free margins; posterolateral corners also with spinules. Mandible (Fig. 12G) with complex cutting edge of coxal gnathobase bearing 7 teeth, 2 setae and many spinules; basis with 1 seta on inner margin; exopod distinctly 4-segmented with 5 setae (1, 1, 1, and 2 on first to fourth segments); endopod 2-segmented with 4 setae on first segment and 10 setae on second. Paragnath (Fig. 12H) forming tapering lobe ornamented with setules on medial surface. Maxillule (Fig. 12I) with 10 setae on precoxal arthrite, 1 of which located on ventral papilla; coxal endite and epipodite with 1 and 2 setae, respectively; basis with 1 spine and 6 setae on medial margin; exopod with 4 setae; endopod 2-segmented with

6 setae on first and 4 setae on second segment. Maxilla (Fig. 13A) 6-segmented; precoxa and coxa clearly defined; precoxa with 3 setae and 1 small spine on proximal endite and 1 seta on distal endite; coxa with 2 setae on proximal endite and 3 setae on distal endite; basis with 1 claw and 2 setae; endopod 3-segmented, third segment small; armed with 2, 1, and 4 setae on first to third segments. Maxilliped (Fig. 13B) 4-segmented with 9, 1, 3, and 3 setae on first to fourth segments; setae on first segment grouped as 1, 4, and 4 from proximal to distal.

Legs 1–4 with 3-segmented rami (Fig. 13C–E) and same armature formula as preceding species. All setae on legs pinnate. Inner distal spine on basis of leg 1 spinulose.

Leg 5 (Fig. 13F) consisting of protopodal segment with outer seta and exopodal segment about 2.4 times longer than wide (189×80 µm), armed with 4 setae; setal lengths 375, 410, 161, and 250 µm, from outer to innermost. Leg 6 (Fig. 13G, H) consisting of 1 seta, 1 spine and 1 spiniform process on genital operculum.

Male. Body (Fig. 14A) length 1.53 mm; prosome length 855 µm; cephalosome 406×545 µm. Urosome (Fig. 14B) 6-segmented; fifth pedigerous somite 159 µm wide; genital somite sub-square, 125×150 µm; 4 free abdominal somites 106×112, 91×102, 68×91, and 91×95 µm, respectively. Caudal ramus about 5 times longer than wide (184×36 µm); all 6 caudal setae naked.

Rostrum as in female. Antennule (Fig. 14C) 15-segmented and geniculate between thirteenth and fourteenth segments; armature formula 3, 5, 6, 2, 2, 2, 2, 2, 2, 4+aesthetasc, 1, 2, 2, 4, and 11+aesthetasc; third and tenth segments each with rudiment of articulation in mid segment. Antenna, labrum, mandible, paragnath, maxillule, maxilla, maxilliped, and legs 1–4 as in female.

Leg 5 (Fig. 14D) protopodal segment wider than long; exopodal segment about 2.1 times longer than wide (74×36 µm), armed with 4 setae; lengths of setae 48, 71, 117, and 93 µm, from outermost to inner; inner seta stiff. Leg 6 represented by 2 pinnate and 1 small, spiniform setae on genital operculum.

Remarks. The new species possesses a 4-segmented maxilliped armed with a total of 16 setae. This is a unique character state, distinguishing *A. monnioti* **sp. nov.** from *A. antarcticus* **sp. nov.** (with 17 setae) and *A. curtus* **sp. nov.** (with 14 or 15 setae), and *A. illgi* **sp. nov.**, *A. hexasetosus* **sp. nov.**, *A. cincutus* **sp. nov.**, and *A. bimerus* **sp. nov.** (with 14 setae). The setal formula of the 3-segmented endopod of the maxilla (2, 1, 4) is shared only with *A. momus* **sp. nov.** but this species has 6 setae on the exopodal segment of leg 5 rather than 4 setae as in *A. monnioti* **sp. nov.**

The new species occurs on two different host species, both belonging to the same genus *Pareugyrioides* Hartmeyer, 1914.

Archinotodelphys bimerus **sp. nov.**

(Figs. 15, 16)

Type material. Holotype (♂; MNHN-IU-2014-21201). Dissected paratype (♂) in the collection of IHK.

Type host. unidentified species of family Molgulidae.

Type locality. North Atlantic, America Basin, R.V. *Atlantis II* Cruise 24, Stn 126 (39°37'N, 66°45'W), depth 3806 m, 24 August 1966.

Etymology. The name of the new species refers to the 2-segmented state of the maxillary endopod.

Male. Body (Fig. 15A) slender; length 876 µm; prosome 447 µm long; cephalosome 212×248 µm, dorsal cephalosomic shield with posteriorly extended posterolateral corners. Urosome 6-segmented: fifth pedigerous somite 47×87 µm; genital somite sub-square, 75×90 µm; 4 abdominal somites 47×56, 32×48, 32×46, and 48×46 µm, respectively; anal somite ornamented with spinules along posteroventral margin, rather deep postero-median incision, and nipple-shaped process at both sides of incision (indicated by arrowhead in Fig. 15C). Caudal ramus (Fig. 15C) about 6.0 times longer than wide (99×16 µm), ornamented with spinules along posteroventral margin and armed with 6 setae; outer lateral seta pinnate and located at midlength of ramus; other 5 setae naked.

Rostrum (Fig. 15D) tapering, 73×47 µm. Antennule (Fig. 15E) 278 µm long and 16-segmented, with geniculation between segments 14 and 15; terminal segment pointed at tip; armature formula 3, 5, 4, 2, 2, 2, 2, 2, 2, 4+aesthetasc, 2, 2, 4, 4+aesthetasc, and 9+aesthetasc; all setae naked; aesthetascs small, setiform. Antenna (Fig. 15F) with short unarmed coxa; basis with 1 inner seta plus 2 exopodal setae (1 minute); endopod 3-segmented with armature formula 1, 4, and 6 plus claw; terminal segment about 3 times longer than wide; curved terminal claw slender; outer margin of endopodal segments ornamented with spinules; distal seta on second segment with blunt tip.

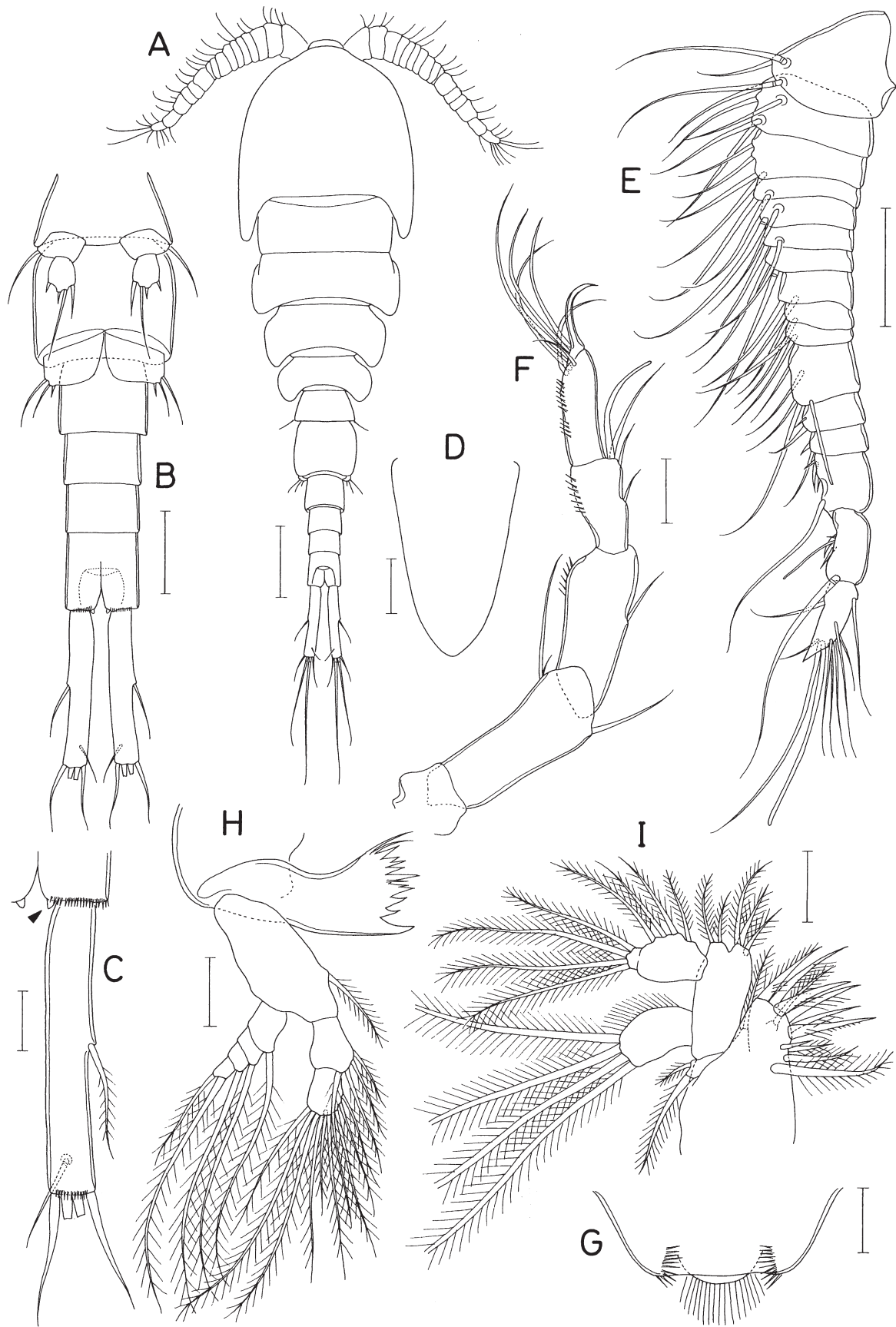


FIG. 15. *Archinotodelphys bimerus* sp. nov. paratype male. A, habitus, dorsal; B, urosome, ventral; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.1 mm; B, E, 0.05 mm; C, D, F–I, 0.02 mm.

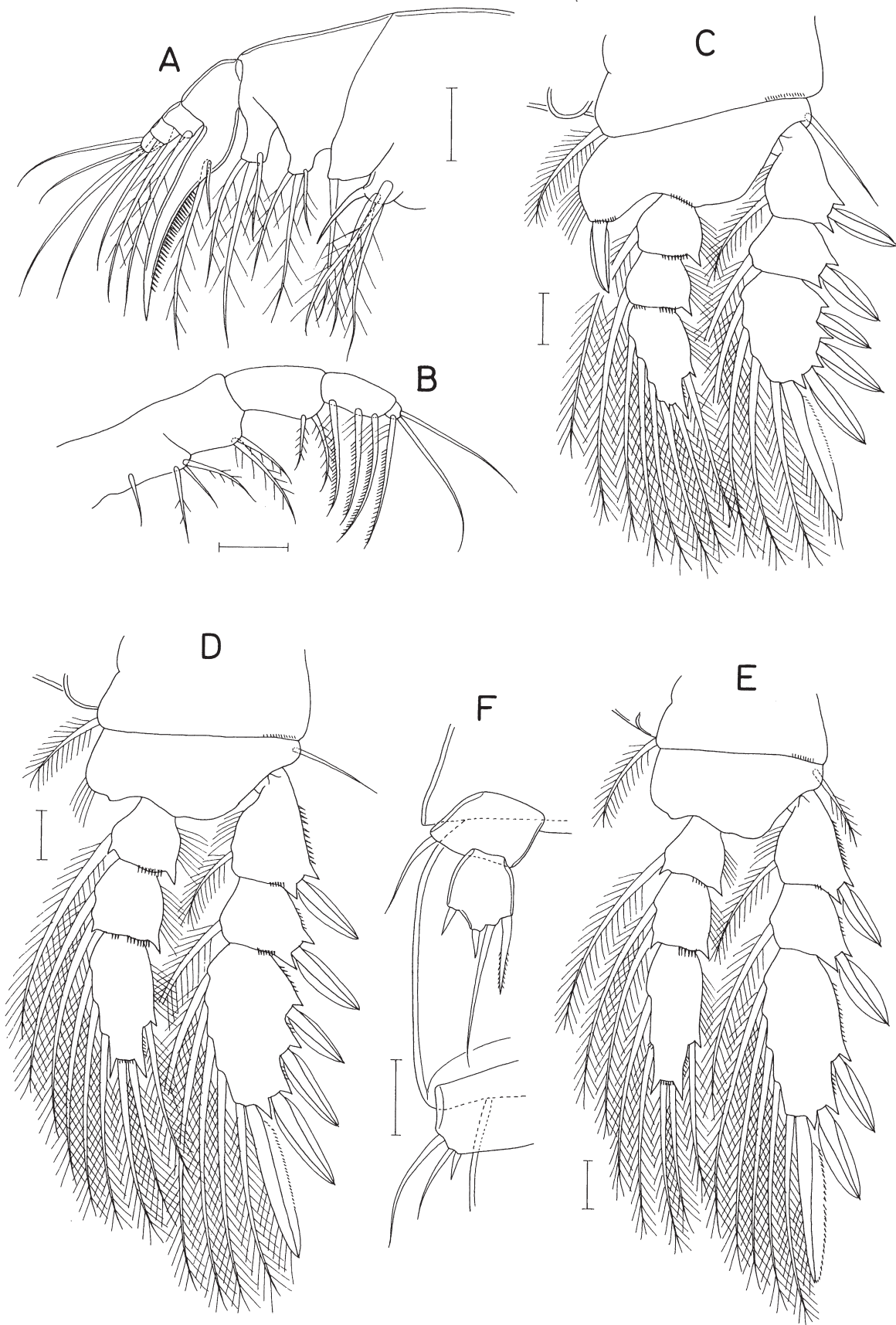


FIG. 16. *Archinotodelphys bimerus* sp. nov. paratype male. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, right legs 5 and 6, ventral. Scale bars: 0.02 mm.

Labrum (Fig. 15G) with semicircular posteromedian lobe ornamented with long setules and row of spinules on both sides posteriorly. Mandible (Fig. 15H) with about 9 acute teeth of irregular sizes and 2 setae on cutting edge of coxal gnathobase; basis with 1 seta on medial margin; exopod 4-segmented, with 1, 1, 1, and 2 setae on first to fourth segments, respectively, distalmost seta small, less than half length of other 4 setae; endopod 2-segmented with 4 setae on first segment and 9 setae on second. Maxillule (Fig. 15I) with 11 setae on precoxal arthrite; coxa with 1 seta on endite and 2 setae on epipodite; basis with 5 setae on medial margin (grouped 3 and 2); exopod with 4 large setae distally; endopod incompletely 2-segmented with 4 setae (only 3 setae on other member of leg pair) on first segment and 4 setae on second. Maxilla (Fig. 16A) 6-segmented with suture line between precoxa and coxa; precoxa with 3 setae plus 1 spine on proximal endite and 1 seta on distal endite; coxa with 3 setae each on proximal and distal endites; basis with strong claw ornamented with spinules along concave margin, plus 2 setae; endopod 3-segmented, with 2, 2, and 3 setae respectively on first to third segments; setae on second and third segments naked. Maxilliped (Fig. 16B) 4-segmented with 6, 2, 3, and 3 setae on first to fourth segments; terminal segment small; setae on first segment (syncoxa) grouped as 1, 3, and 2.

Legs 1–4 with 3-segmented rami; with same armature formula as preceding species. Inner distal spine on basis of leg 1 and outer setae on exopod of legs 1–4 with membranous fringe bilaterally (Fig. 16C–E).

Leg 5 (Fig. 16F) protopodal segment wider than long, with 1 naked seta; exopodal segment about 1.1 times longer than wide ($20 \times 18 \mu\text{m}$), with 4 setae; 2 outer distal setae short, spiniform. Leg 6 (Fig. 16F) represented by 2 setae and 1 small, spiniform seta on genital operculum.

Female. Unknown.

Remarks. This new species is established from the male only, but given that archinotodelphyid species typically show sexual dimorphism only in the urosome, the antennule, and legs 5 and 6, it is still possible to make sufficient comparisons. The new species, *A. bimerus* sp. nov., has an incompletely 2-segmented endopod on the maxillule and each segment is armed with 4 setae. This is a unique character state within the family. The presence of 2, 2, and 3 setae on the first to third endopodal segments of the maxilla is shared only by two species, *A. profundus* and *A. curtus* sp. nov. The new species also shares the presence of 5 setae on the basis of the maxillule with *A. profundus*, but not with *A. curtus* sp. nov., which carries 7 setal elements on the basis. The new species can be distinguished from *A. profundus* by the presence of only 9 setae on the distal segment of the mandibular endopod, compared to 8 in *A. profundus*. In addition, the endopod of the maxillule of *A. profundus* is unsegmented whereas it is incompletely 2-segmented in *A. bimerus* sp. nov. These differences serve to distinguish *A. bimerus* sp. nov. from its congeners.

Archinotodelphys longiseta sp. nov.

(Figs. 17, 18)

Type material. Holotype (♀, MNHN-IU-2015-12, dissected and mounted on a slide).

Type host. *Styela sigma* Hartmeyer, 1912 (MNHN-IT-2018-13 = MNHN S1/STY/322).

Type locality. French Guiana, GUYANE 2014 cruise, N/O *Hermano Gines*, Stn CP4368 (07°10'N, 52°59'W), depth 397–399 m, MNHN-Convention APA-973-1 coll., 01 August 2014.

Etymology. The name of the new species, *longiseta*, refers to the extremely long seta on the apex of the fifth leg which extends beyond the articulation between first and second free abdominal somites.

Female. Body (Fig. 17A) 1.39 mm long. Prosome 727 μm long, cephalosome greatest width 485 μm , wider than pedigerous somites. Urosome (Fig. 17B) 5-segmented. fifth pedigerous somite 170 μm wide. Genital double-somite $182 \times 136 \mu\text{m}$, about 1.3 times longer than wide, gradually narrowing posteriorly; bearing paired genital apertures at 37% of double-somite length. Three free abdominal somites 80×98 , 75×93 , and $91 \times 86 \mu\text{m}$, respectively. Caudal ramus (Fig. 17C) $185 \times 30 \mu\text{m}$, about 6.2 times longer than wide; armed with 6 naked setae, outer lateral seta located about at 37% of ramus length.

Rostrum (Fig. 17D) $128 \times 73 \mu\text{m}$, elongate, articulated from cephalosome. Antennule (Fig. 17E) 330 μm long and 16-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 1+aesthetasc, 1, 2, 2+aesthetasc, and 7+aesthetasc; all setae thin and naked. Antenna (Fig. 17F) with short, unarmed coxa; basis with 2 outer setae distally (1 long and 1 short), representing exopod, both setae naked; endopod 3-segmented; first segment with 1 small seta on middle of inner margin and ornamented with several spinules on subdistal outer margin; second segment with 5 setae (4 distal and 1 subdistal) on inner margin, one of 4 distal setae blunt tipped; third segment $32 \times 19 \mu\text{m}$, 2/3 as long as second segment, armed with 1 slender claw and 6 naked setae distally, 3 of distal setae bluntly tipped.

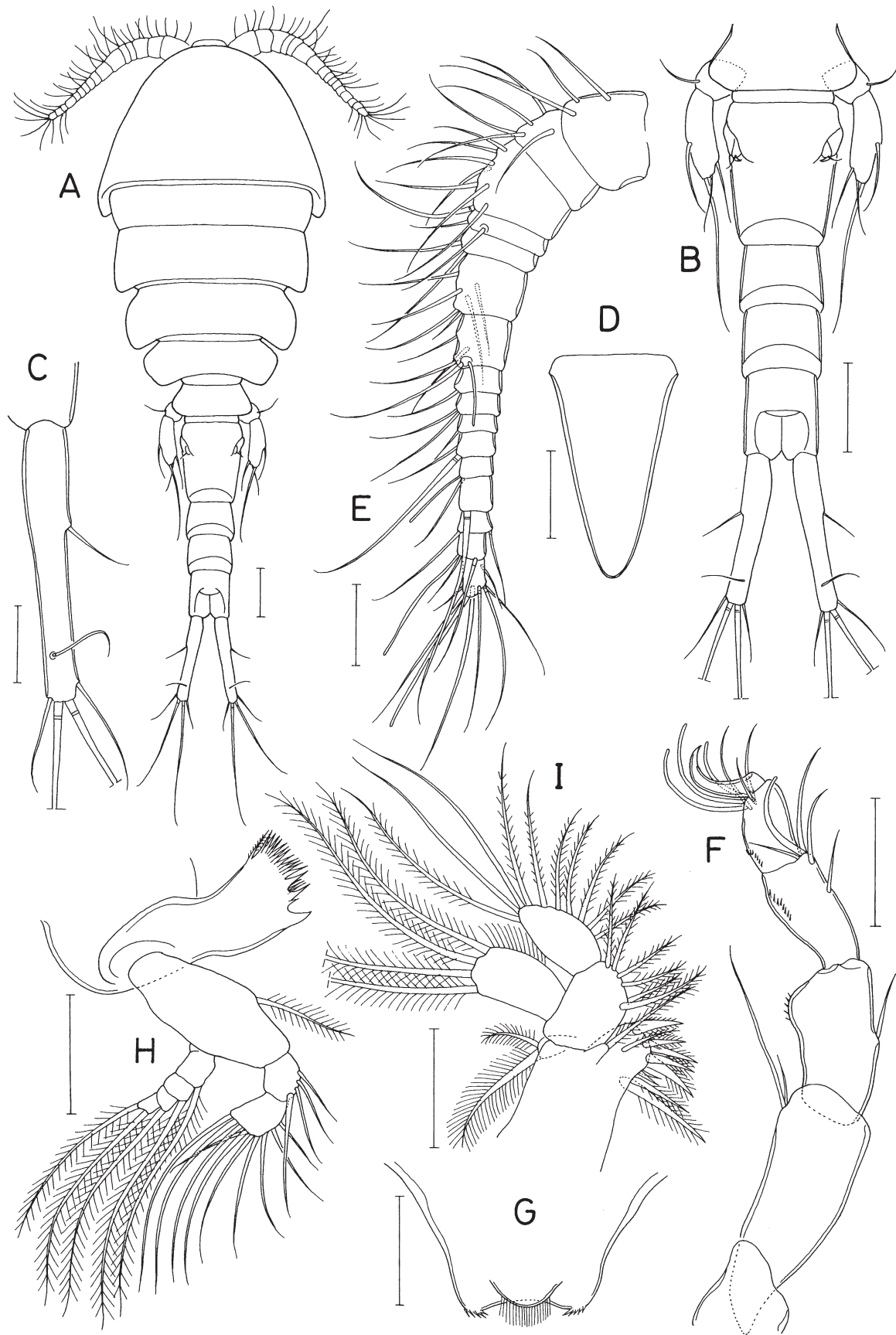


FIG. 17. *Archinotodelphys longiseta* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, B, 0.1 mm; C–I, 0.05 mm.

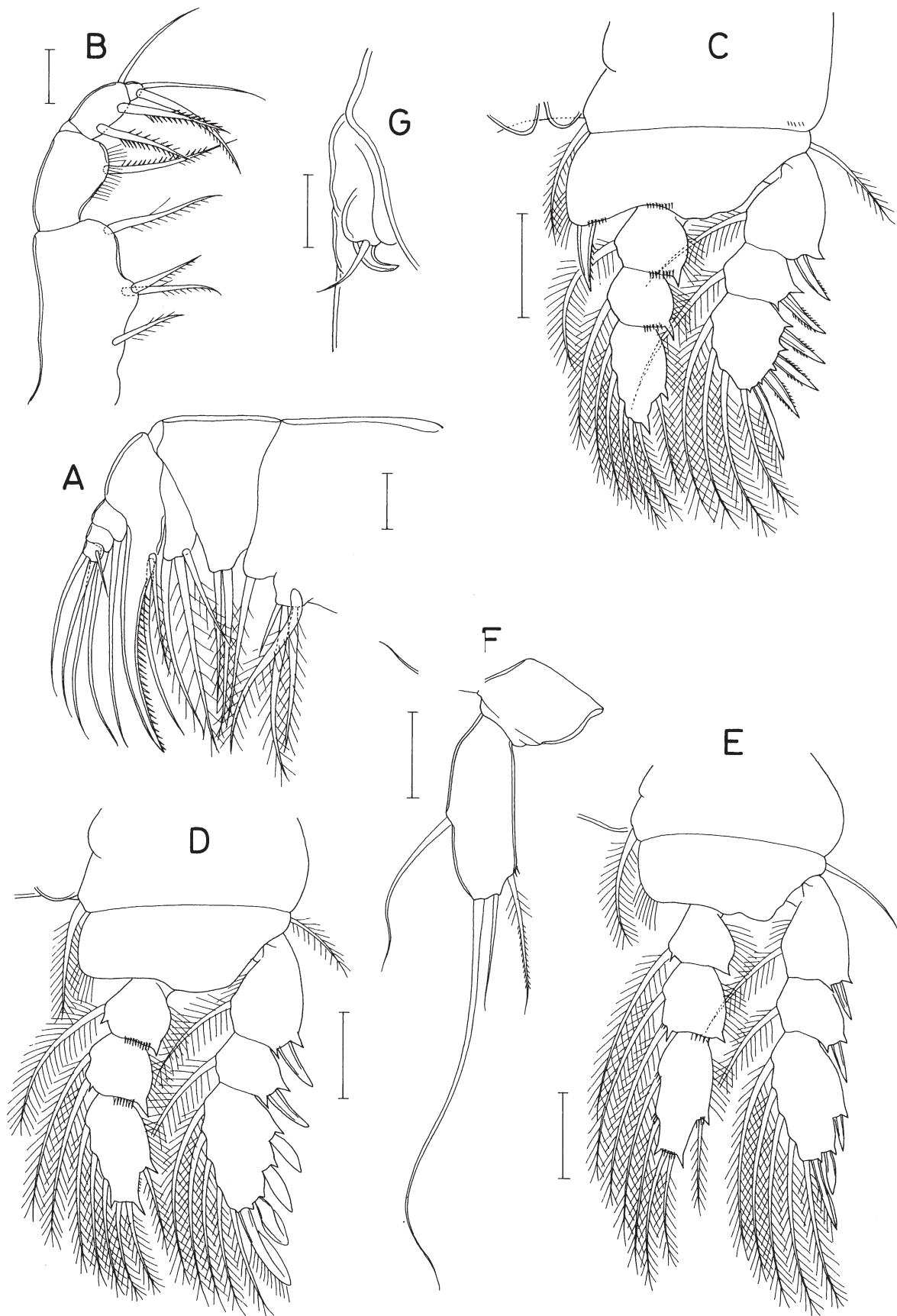


FIG. 18. *Archinotodelphys longiseta* **sp. nov.** holotype female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, left genital aperture, dorsal. Scale bars: A, B, G, 0.02 mm; C–F, 0.05 mm.

Labrum (Fig. 17G) with setulose posteromedian lobe and 5 or 6 denticles each posterolateral corner. Mandible (Fig. 17H) with 1 major tooth and pectinate medial margin of coxal gnathobase; basis with 1 plumose seta on medial margin; exopod 4-segmented with 5 setae (1, 1, 1, and 2); endopod with 4 and 10 naked setae on first and second segments, respectively. Maxillule (Fig. 17I) with 10 setae on arthrite (one on anterior surface), 1 seta on coxal endite, and 2 setae on epipodite; basis with 6 setae on inner margin; endopod unsegmented with 10 setae (2 distal setae naked); exopod with 4 large setae. Maxilla (Fig. 18A) consisting of precoxa, coxa, basis, and 3-segmented endopod; precoxa with 4 (including small one) and 1 setae on proximal and distal endites, respectively; coxa with 2 and 3 setae on proximal and distal endites, respectively; basis with 2 setae and 1 strong claw ornamented with fine spinules along concave margin; endopod short, 3-segmented, armed with 1, 1, and 4 setae. Maxilliped (Fig. 18B) 4-segmented with 4 (1, 2, and 1), 1, 3, and 2 setae respectively on first to fourth segments; 1 of 3 setae on third segment characteristically located at outer distal corner.

Legs 1–4 with 3-segmented rami; armature formula of legs 1–4 as in family diagnosis. Outer margins of exopods smooth (Fig. 18C–E). Leg 1 with inner distal spine on basis 33 μm long. Outer spines on third exopodal segment of legs 2 and 3 broad, leaf-like.

Leg 5 (Fig. 18F) consisting of protopodal and exopodal segments; protopodal segment wider than long and distinctly articulated from somite, with 1 seta on outer margin; exopod $102 \times 41 \mu\text{m}$, about 2.5 times longer than wide and armed with 4 setae (1 outer lateral and 3 distal); lengths of exopodal setae 102, 230, 68, and 81 μm from outer to inner, respectively: innermost seta pinnate proximally and spinulose distally, all other setae naked. Leg 6 (Fig. 18G) in dorsal view represented by 1 naked seta and 1 claw-like spine on genital operculum.

Male. Unknown.

Remarks. The new species carries an armature of 1, 1, 4 setae on the 3-segmented maxillary endopod, a formula shared with *A. gurneyi*, and three species described below (*A. elegans* sp. nov., *A. rostralis* sp. nov. and *A. nudus* sp. nov.) (see Table 2). It differs from all of these species in having a setal formula of 4, 1, 3, 2 on the 4-segmented maxilliped. The first three species all have 5 setae on the first segment (syncoxa) whereas the new species has only 4 as in *A. nudus* sp. nov., but the maxilliped in the latter species is only 3-segmented. One of 3 setae on the third maxilliped segment is located at the outer distal angle of the segment. No other *Archinotodelphys* species has a seta in such a position. These characteristics are sufficient to justify the establishment of a new species.

Archinotodelphys reductus sp. nov.

(Figs. 19–21)

Type material. Holotype (♀, MNHN-IU-2014-21202; dissected and mounted on a slide).

Type host. *Pyura gangelion* (Savigny, 1816) (MNHN-IT-2008-7540, =MNHN S2/PUY/143).

Type locality. Kai Islands, Indonesia, KARUBAR cruise, N/O *Baruna Jaya I*, Stn DW31 (05°40'S, 132°51'E), depth 288 m, Bouchet, Kastoro & Métivier coll., 26 October 1991

Etymology. The name of the new species refers to the extremely reduced setation of the endopod of the maxilla.

Female. Body (Fig. 19A) slender; length 1.59 mm; prosome 788 μm long; greatest width across cephalosome 426 μm . First pedigerous somite not narrow, wider than second somite. Urosome (Fig. 19B) 5-segmented; fifth pedigerous somite 178 μm wide; pseudo-somite present between fifth pedigerous and genital double-somites. Genital double-somite $203 \times 151 \mu\text{m}$; paired genital apertures located dorsolaterally in anterior quarter of somite. Three free abdominal somites 126×111 , 116×97 , and $102 \times 89 \mu\text{m}$, respectively. Caudal ramus about 6.3 times longer than wide ($194 \times 31 \mu\text{m}$) and armed with 6 setae; outer lateral seta located at about 40% of ramus length; 2 mid-terminal and dorsal setae naked, other 3 setae pinnate.

Rostrum (Fig. 19C) longer than wide ($79 \times 56 \mu\text{m}$), tapering towards rounded apex. Antennule (Fig. 19D) 290 μm long and 17-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 1+aesthetasc, 0, 1, 2, 2+aesthetasc, and 7+aesthetasc; 2 setae on first segment pinnate, other setae naked; aesthetascs thin, setiform. Antenna (Fig. 19E) with short, unarmed coxa: basis with minute seta at inner distal corner, plus 1 large and 1 tiny exopodal setae at outer distal corner, and ornamented with row of several spinules in middle of inner margin: endopod 3-segmented; first segment with 1 seta on inner margin and expanded, spinulose outer margin; second segment with 4 setae distally (1 bluntly tipped) and row of fine spinules on outer margin; third segment about 1.6 times longer than wide; armed with 6 setae (3 bluntly tipped) plus slender curved claw, and ornamented with spinules on outer margin.

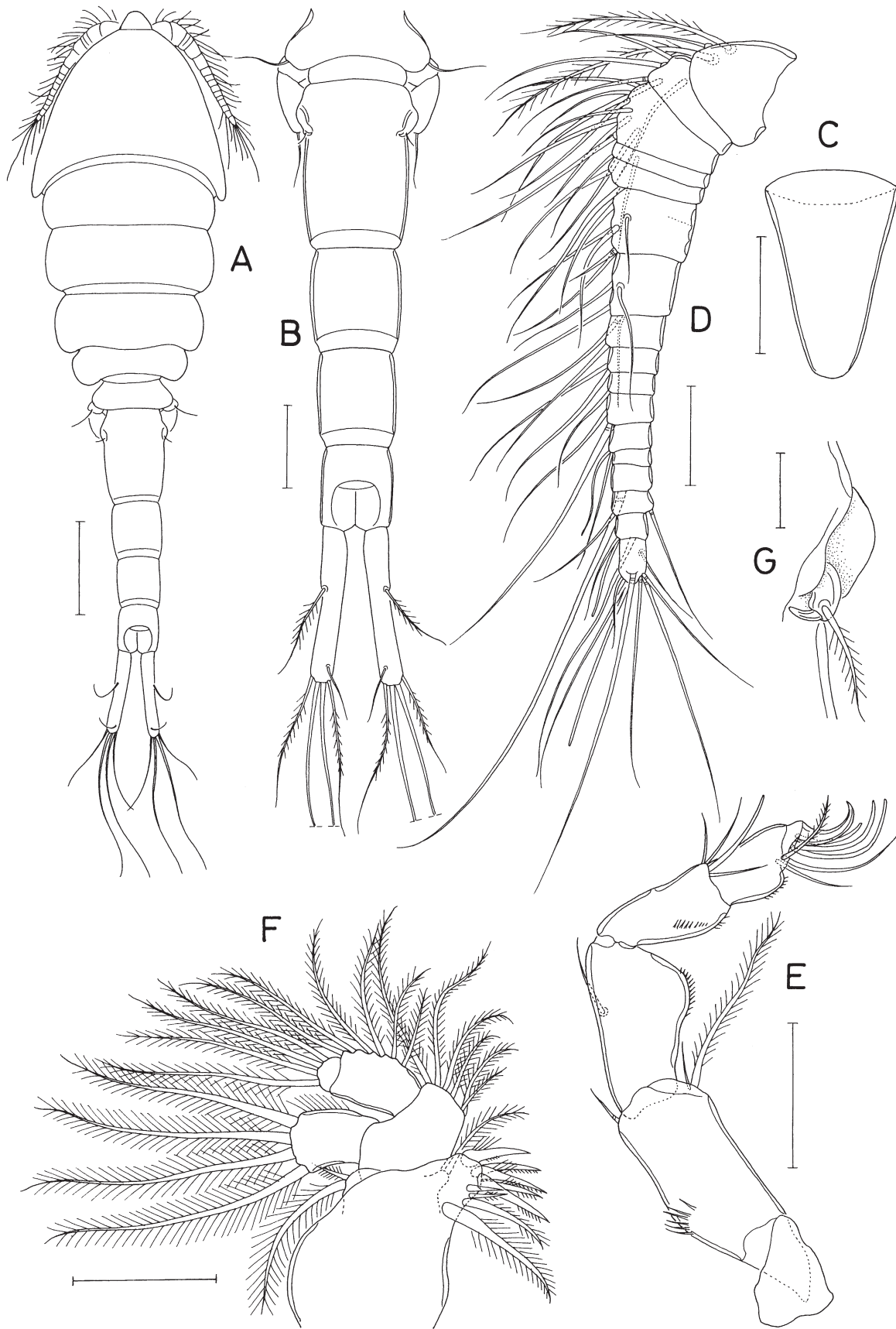


FIG. 19. *Archinotodelphys reductus* **sp. nov.** holotype female. A, habitus, dorsal; B, urosome, dorsal; C, rostrum; D, antennule; E, antenna; F, maxillule; G, right genital aperture, dorsal. Scale bars: A, 0.2 mm; B, 0.1 mm; C–F, 0.05 mm; G, 0.02 mm,

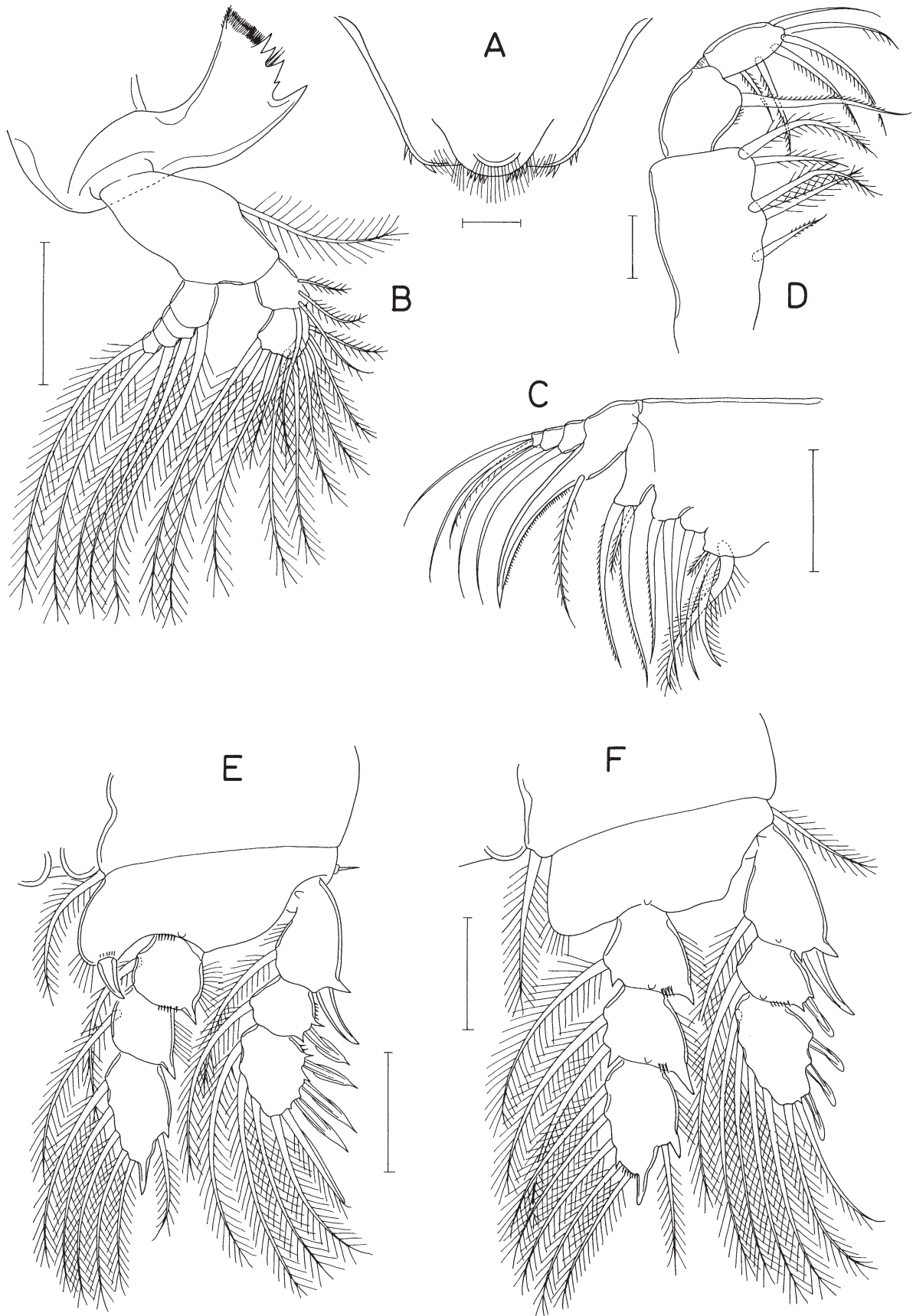


FIG. 20. *Archinotodelphys reductus* **sp. nov.** holotype female. A, labrum; B, mandible; C, maxilla; D, maxilliped; E, leg 1; F, leg 2. Scale bars: A, D, 0.02 mm; B, C, E, F, 0.05 mm.

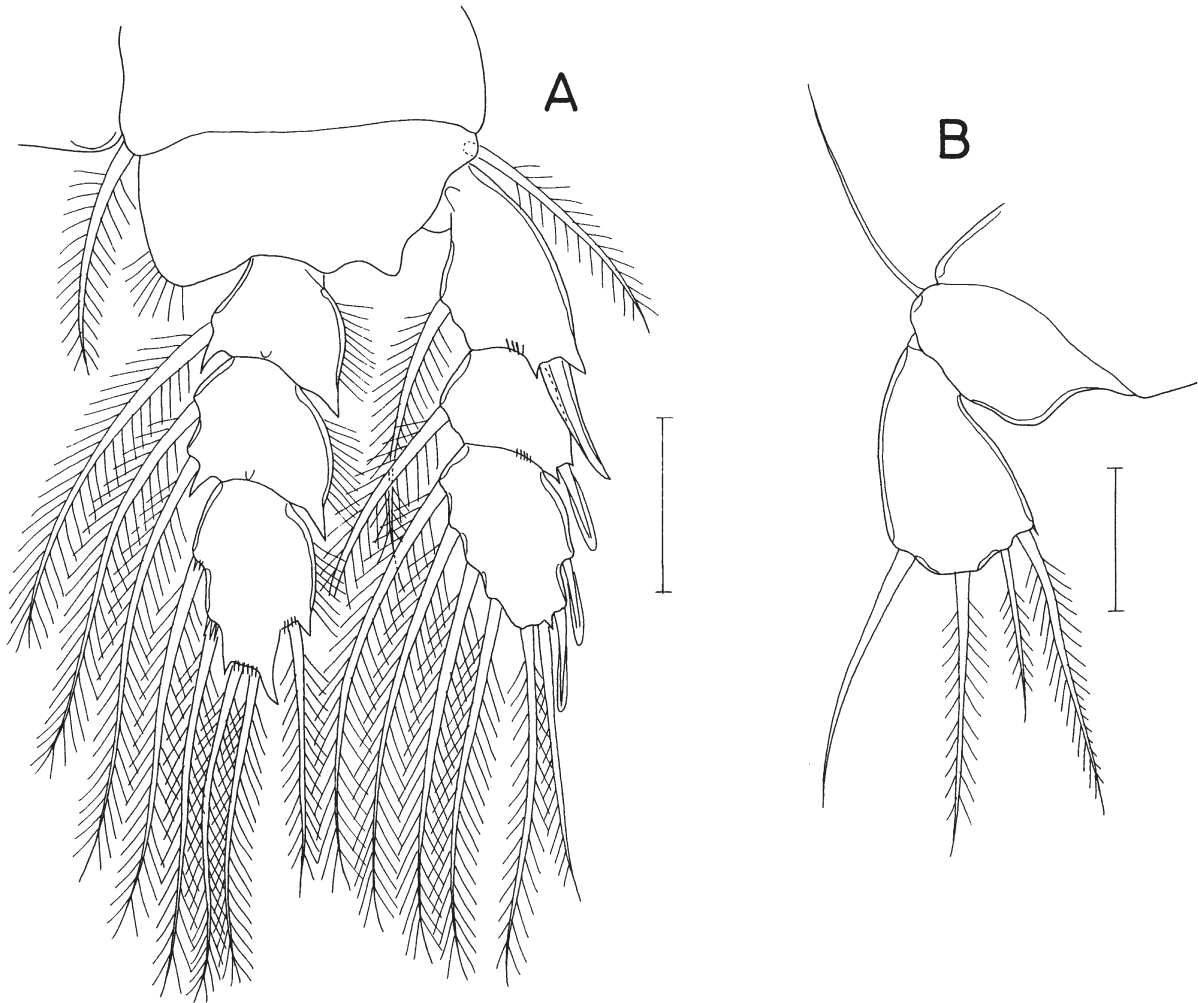


FIG. 21. *Archinotodelphys reductus* sp. nov. holotype female. A, leg 4; B, leg 5. Scale bars: 0.05 mm.

Labrum (Fig. 20A) with semicircular posteromedian lobe; ornamented with spinules and setules along posterior margin. Mandible (Fig. 20B): medial margin of coxal gnathobase with 4 teeth, 1 seta, and pectinate region, 2 needle-like spinules between second and third teeth, and 1 subsidiary tooth between distal 2 teeth: basis with 1 seta on medial margin: exopod 4-segmented with 1, 1, 1, and 2 setae, all setae equal in length: endopod with 4 and 10 setae on first and second segments, respectively. Maxillule (Fig. 19F) with 9 setae on precoxal arthrite; coxal endite with 1 seta; coxal epipodite with 2 unequal setae; basis with 6 setae on medial margin; exopod with 4 setae; endopod 2-segmented, with 6 and 4 setae on first and second segments. Maxilla (Fig. 20C) 5-segmented; syncoxa with 4 (including 1 small), 1, 2, and 3 setae representing first to fourth endites; basis with 1 seta and 1 strong claw bearing fine spinules along concave margin; endopod 3-segmented with 1, 1, and 3 setae on first to third segments. Maxilliped (Fig. 20D) 3-segmented with 5, 1, and 6 setae on first to third segments; 5 setae on first segment grouped as 1, 2, and 2 from proximal to distal.

Legs 1–4 biramous with 3-segmented rami. Leg 1 (Fig. 20E) with small outer seta on basis; inner distal spine on basis stout, about half as long as first endopodal segment; outer spine on first exopodal segment of legs 1–4 distinctly larger than spines on other exopodal segments. Distal process on third endopodal segment of legs 1–4 well-developed, spiniform (Figs. 20E, F, 21A). Armature formula for legs as for generic diagnosis but with inner and distal margins of third endopodal segment of legs 1–3 indistinctly delimited:

| | Coxa | Basis | Exopod | Endopod |
|-------------|------|-------|---------------------|-------------------|
| Leg 1: | 0-1 | 1-I | I-1; I-1; III, I, 4 | 0-1; 0-1; 1, 5 |
| Legs 2 & 3: | 0-1 | 1-0 | I-1; I-1; III, 1, 5 | 0-1; 0-2; 1, 5 |
| Leg 4: | 0-1 | 1-0 | I-1; I-1; II, 1, 5 | 0-1; 0-2; 1, 2, 2 |

Leg 5 (Fig. 21B) protopodal segment clearly defined from somite, with 1 naked outer seta; exopodal segment, 1.6 times longer than wide (81×50 µm), broadening distally and armed with setae around distal margin, outermost seta naked, other 3 setae pinnate. Leg 6 (Fig. 19G) represented by 1 seta and 1 spine on genital operculum.

Male. Unknown.

Remarks. The distinguishing feature of this species is the reduction in the setation of the endopod of the maxilla: it has an armature formula of 1, 1, and 3 on the first to third segments. This is the most extreme reduction found in any described species, including the additional new species described below. All other species possess a total of between 6 and 8 setae on the maxillary endopod compared to the 5 setae retained in *A. reductus* **sp. nov.** (see Table 2). The armature formula of the 3-segmented maxilliped is also unique: the first to third segments carry 5, 1, and 6 setae, respectively. The third exopodal segment of legs 2 and 3 carries 3 spines and 6 setae, and in leg 4 it carries 2 spines and 6 setae. In each of these legs the terminal spine is setiform, but its derivation from the terminal spine is indicated by the plumose ornamentation along the inner margin only.

Archinotodelphys elegans **sp. nov.**

(Figs. 22, 23)

Type material. Holotype (intact ♀, MNHN-IU-2014-21203) 1 paratype (intact ♀, MNHN-IU-2014-21204), 1 dissected ♀ paratype in the collection of IHK.

Type host. *Polycarpa argentata* (Sluiter, 1890) (MNHN-IT-2008-6326 = MNHN S1 POL.B 360).

Type locality. Ngeteklou Island, Koror, Palau Islands (07°19.47'N, 134°29.42'E), depth 10 m, OCDN 3413-T, 01, CRRFcoll., November 1995.

Etymology. The name of the new species, *elegans*, refers to the very slender form of the body.

Female. Body (Fig. 22A, B) slender, 1.82 mm long; prosome 910 µm long, with sub-parallel lateral margins; greatest width 467 µm across cephalosome. Urosome 5-segmented; fifth pedigerous somite 245 µm wide; genital double-somite 267×176 µm; bearing paired genital apertures dorsally at anterior third of double-somite (Fig. 22C). Three free abdominal somites 170×158, 136×133, and 143×127 µm, respectively. Caudal ramus (Fig. 22D) about 3.6 times as long as wide (155×43 µm); armed with 6 naked setae, outer lateral seta located at about 40% of ramus length; dorsal seta (seta VII) located at 74% of ramus length; lengths of mid-terminal setae 352 (inner) and 284 (outer) µm.

Rostrum (Fig. 22E) elongate (130×55 µm), tapering weakly towards blunt tip. Antennule (Fig. 22F) 310 µm long and 15-segmented; armature 3, 5, 7, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; seventh segment subdivided on ventral surface; one seta on first segment pinnate, other setae naked. Antenna (Fig. 22G) with unarmed coxa; basis with 1 large and 1 tiny exopodal setae at outer distal corner, lacking seta at inner distal corner; endopod 3-segmented with armature formula 1, 4, and 6 plus claw; third endopodal segment (32×27 µm), shorter than second; 1 seta on second segment and 3 on third bluntly tipped.

Labrum (Fig. 22H) with rounded, projecting posterolateral corners ornamented with spinules and setules; posteromedian lobe smooth, not projecting beyond posterior margin of labrum. Mandible (Fig. 22I) with 4 teeth and 1 seta on coxal gnathobase; basis with 1 seta on medial margin; exopod 4-segmented, with 1 seta on each segment (4 setae in total); endopod with 4 and 9 setae on first and second segments, respectively. Paragnath (Fig. 22J) ornamented with 2 teeth apically and setules on medial surface. Maxillule (Fig. 23A) with 9 setae on precoxal arthrite, 1 seta on coxal endite and 2 unequal setae on coxal epipodite; basis with 6 setae on medial margin; exopod with 4 setae; endopod unsegmented and bearing 8 setae (4 medial and 4 distal). Maxilla (Fig. 23B) 5-segmented; syncoxa with 4 (including 1 small), 1, 2, and 3 (including 1 small) setae on first to fourth endites, respectively; basis with 1 seta and strong claw bearing spinules along concave margin; endopod 3-segmented with 1, 1, and 4 setae; setae on first and second segments and 1 seta on terminal segment elongate. Maxilliped (Fig. 23C) 3-segmented with 5, 1, and 4 setae on first to third segments, respectively; 5 setae on first segment grouped as 1, 2, and 2, from proximal to distal.

Legs 1–4 biramous with 3-segmented rami; armature formula for legs 1–4 as in previous species. Outer seta on basis of legs 1–4 naked. Inner distal spine on basis of leg 1 (Fig. 23D) stout, shorter than first endopodal segment. Terminal process on third endopodal segment of legs 1–4 produced and sharply pointed (Fig. 23D–F). Terminal spine on third exopodal segment of legs 2–4 setiform.

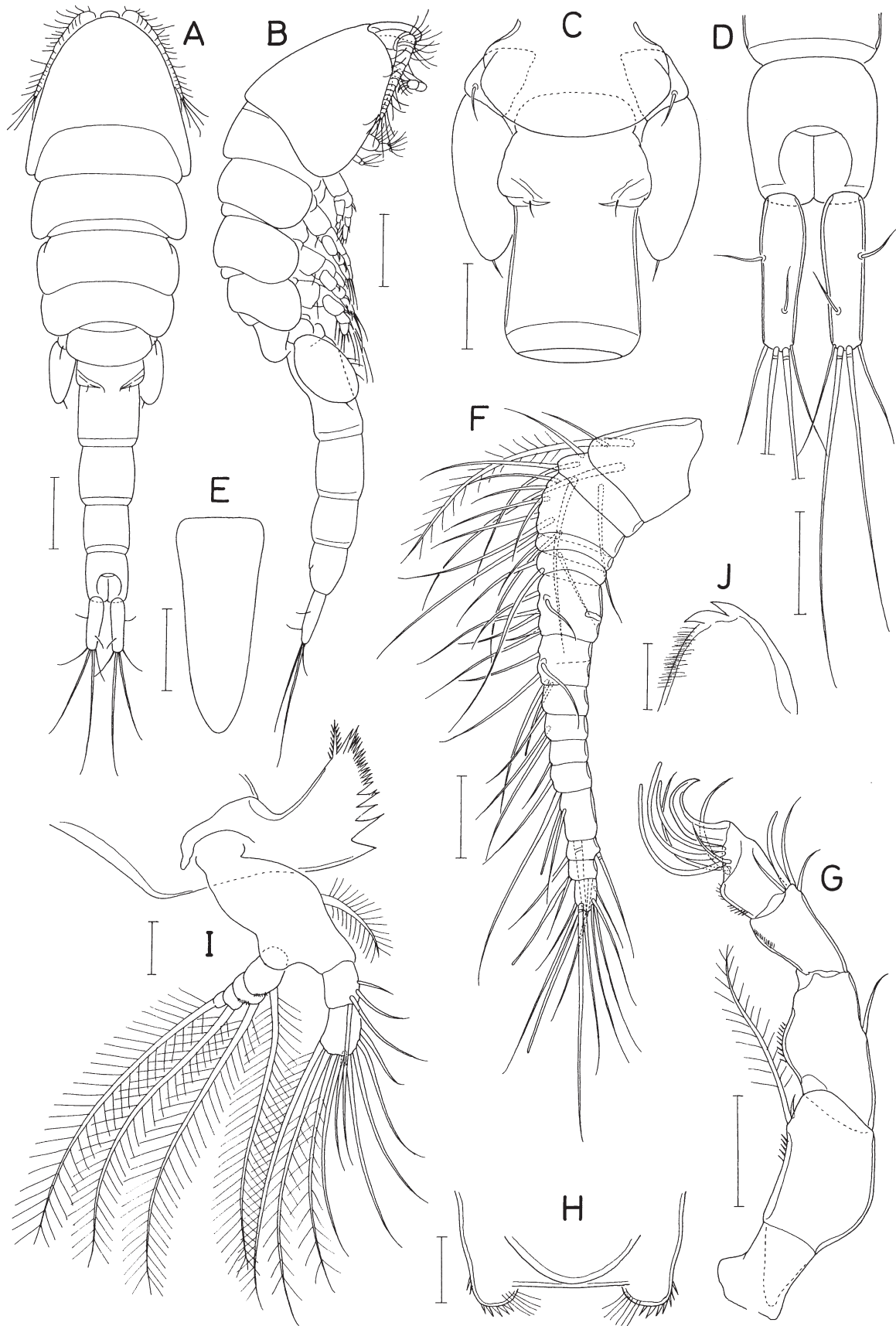


FIG. 22. *Archinotodelphys elegans* sp. nov. paratype female. A, habitus, dorsal; B, habitus, lateral view from right side; C, first two urosomites, dorsal; D, anal somite and caudal rami, dorsal; E, rostrum; F, antennule; G, antenna; H, labrum; I, mandible; J, paragnath. Scale bars: A, B, 0.2 mm; C, D, 0.1 mm; E–G, 0.05 mm; H–J, 0.02 mm.

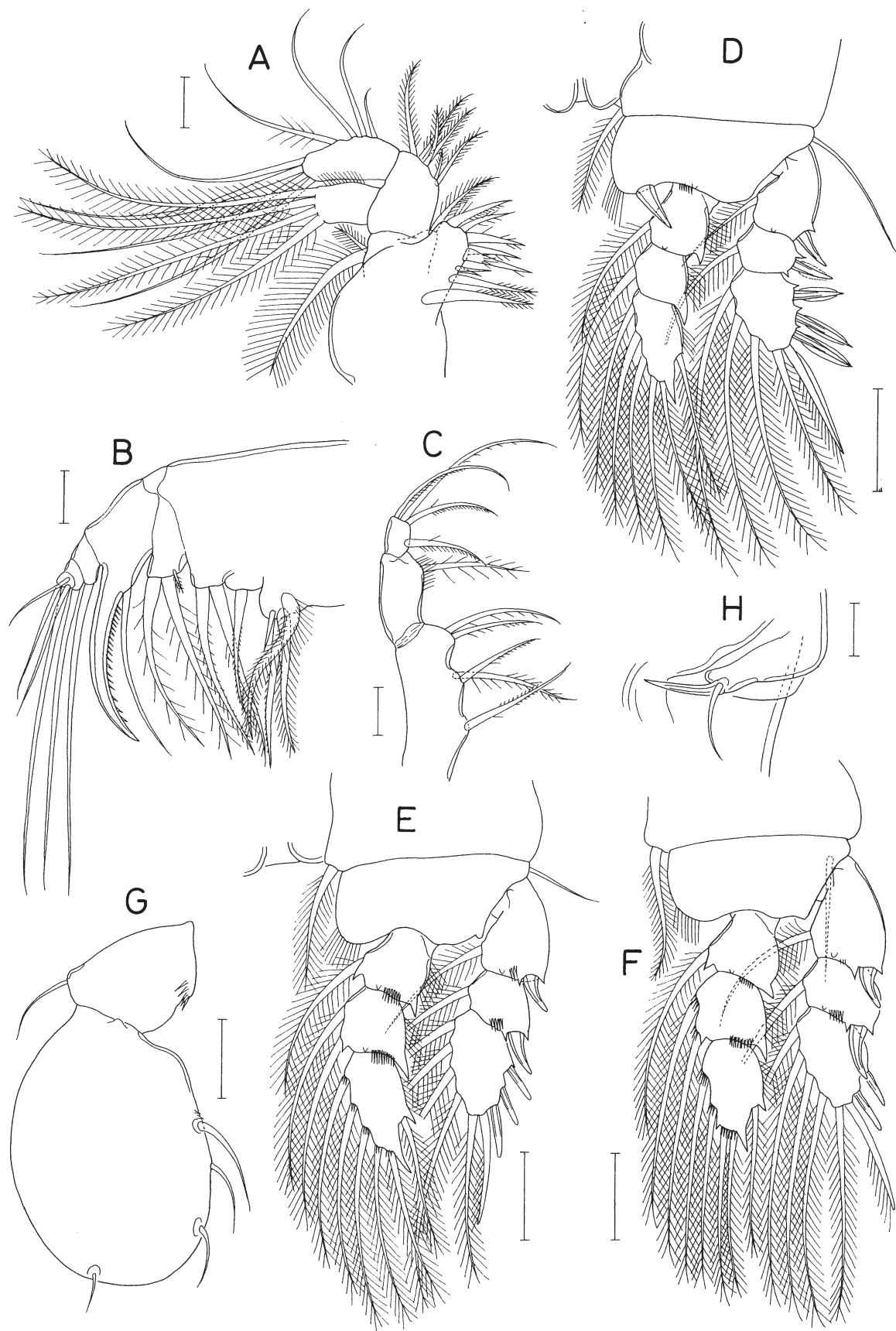


FIG. 23. *Archinotodelphys elegans* sp. nov. paratype female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5; H, right genital aperture, dorsal. Scale bars: A–C, H, 0.02 mm; D–G, 0.05 mm.

Leg 5 (Fig. 23G) protopodal segment clearly defined from somite, longer than wide, with 1 naked outer dorsal seta and ornamented with several spinules on proximo-medial surface: exopodal segment subovate, about 1.3 times longer than wide (174×130 µm) with concave medial surface; armed with 4 naked setae (1 small distal and 3 on inner margin); all setae short, less than half width of exopodal segment. Leg 6 (Fig. 23H) represented by 1 spine and 1 naked seta on genital operculum.

Male. Unknown.

Remarks. This new species differs from all its congeners and from the other new species described above in the possession of a total of only 4 setae on the compound distal segment of its 3-segmented maxilliped. The maxilliped is also 3-segmented in *A. gurneyi* **comb. nov.**, *A. momus* **sp. nov.**, and *A. reductus* **sp. nov.**, but these species have either 6 or 7 setae on the compound distal segment. Similarly, all existing species and all the new species described above have a total of 5 setae on the exopod of the mandible whereas the new species has only 4 setae. The ramus is 4-segmented in all species but the setal formula in *A. elegans* **sp. nov.** is 1, 1, 1, 1, compared with 1, 1, 1, 2 found in the majority of all existing species plus all the new species described above (see Table 2). The free exopodal segment of leg 5 is flattened and rounded in *A. elegans* **sp. nov.**, resulting in a subovate shape. This shape is unique within the family and serves to distinguish *A. elegans* **sp. nov.** from all of its congeners. The fifth leg is orientated vertically with its inner margin directed ventrally (Fig. 22C). These differences justify the establishment of a new species.

Archinotodelphys rostralis **sp. nov.**

(Figs. 24, 25)

Type material. Holotype (♀, MNHN-IU-2014-21205, dissected and mounted on a slide), in *Polycarpa nigricans* Heller, 1878, Thio, New Caledonia; paratype (♂, MNHN-IU-2014-21206 intact), in *P. nigricans*, Uie Bay, Canal Woodin, New Caledonia, Stn NC 36, depth 18m, Monniot coll., 11 March 1987.

Etymology. The name of the new species refers to the prominent, anteriorly-directed rostrum of this species.

Female. Body (Fig. 24A) slender; length 2.47 mm; prosome 1.14 mm long; greatest width 596 µm across cephalosome. First pedigerous somite only slightly narrower than second pedigerous somite. Urosome (Fig. 24B) 5-segmented; fifth pedigerous somite 286 µm wide. Genital double-somite 332×228 µm; slightly expanded laterally in anterior quarter; paired genital apertures located dorsolaterally at 27% of double-somite length. Three free abdominal somites 232×170, 173×145, and 164×136 µm, respectively. Caudal ramus (Fig. 24B), about 5.4 times longer than wide (273×51 µm) and armed with 6 setae; all setae naked and shorter than ramus; lateral seta located at 32% of ramus length.

Rostrum (Fig. 24A, C, D) large (about 200×70 µm), anteriorly-directed, with parallel lateral margins in proximal two-thirds and tapering in distal third to pointed apex visible in dorsal view (Fig. 24D), apex blunt in lateral view (Fig. 24C). Antennule (Fig. 24E) 390 µm long and 15-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked except 1 on first segment. Antenna (Fig. 24F) with unarmed coxa; basis with 1 pinnate and 1 tiny exopodal setae at outer distal corner; endopod 3-segmented with armature formula 1, 4, and 6+claw; terminal claw large and strongly curved.

Labrum (Fig. 24G) simple (without posteromedian lobe), ornamented with few spinules and setules at each posterolateral corner. Mandible (Fig. 24H) with 4 teeth and 1 seta on coxal gnathobase; proximalmost tooth with bifid tip; basis with 1 seta on medial margin: exopod 4-segmented with 1 seta on each segment; endopod 2-segmented with 4 and 9 setae on first and second segments, respectively. Maxillule (Fig. 24I) with 9 setae on precoxal arthrite; coxa with 1 seta on endite and 2 unequal setae on epipodite; basis with 4 (1+3) setae on medial margin; exopod with 4 setae apically; endopod 1-segmented with 8 setae (4 medial and 4 distal); all setae naked except weakly pinnate outermost distal seta. Paragnath (Fig. 25A) ornamented with 3 teeth at mediolateral region and setules on medial margin. Maxilla (Fig. 25B) 5-segmented; syncoxa with 4, 1, 2, and 3 setae on each of first to fourth endites, respectively; one of setae on first and fourth endites small; basis with 1 seta and strong claw bearing spinules along concave margin; endopod 3-segmented, bearing 1, 1, and 4 setae on first to third segments, respectively. Maxilliped 3-segmented with 5, 1, and 4 setae on first to third segments, respectively (Fig. 25C); setae on first segment grouped as 1, 2, and 2.

Legs 1–4 biramous with 3-segmented rami: armature formula for legs 1–4 as in generic diagnosis. Outer seta

on basis of legs 1-4 naked (Fig. 25D-F). Inner distal spine on basis of leg 1 smooth and shorter than first endopodal segment. All outer spines on exopods smooth.

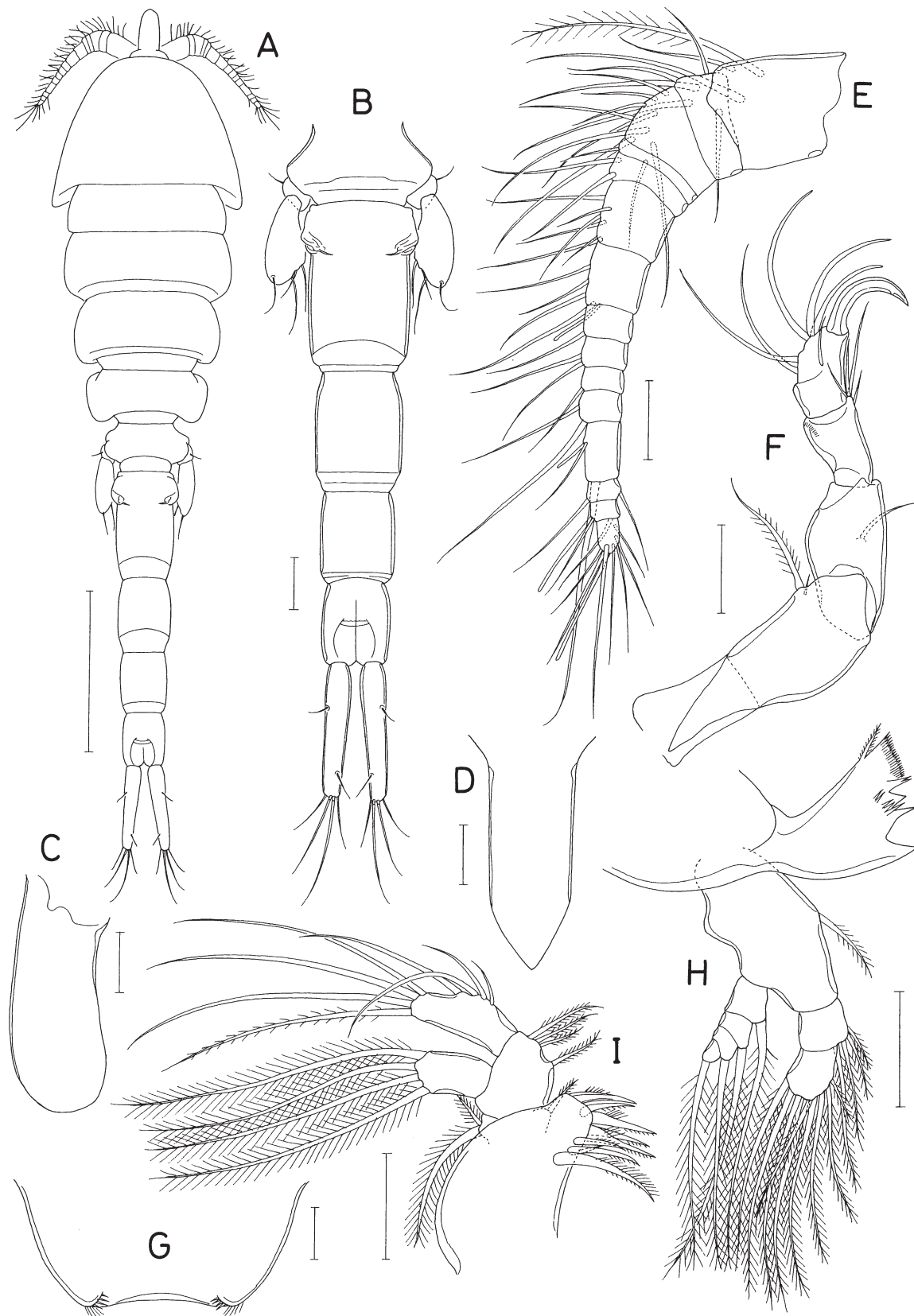


FIG. 24. *Archinotodelphys rostralis* **sp. nov.** holotype female. A, habitus, dorsal; B, urosome, dorsal; C, rostrum, lateral view from left side; D, rostrum, ventral; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C-F, H, I, 0.05 mm; G, 0.02 mm.

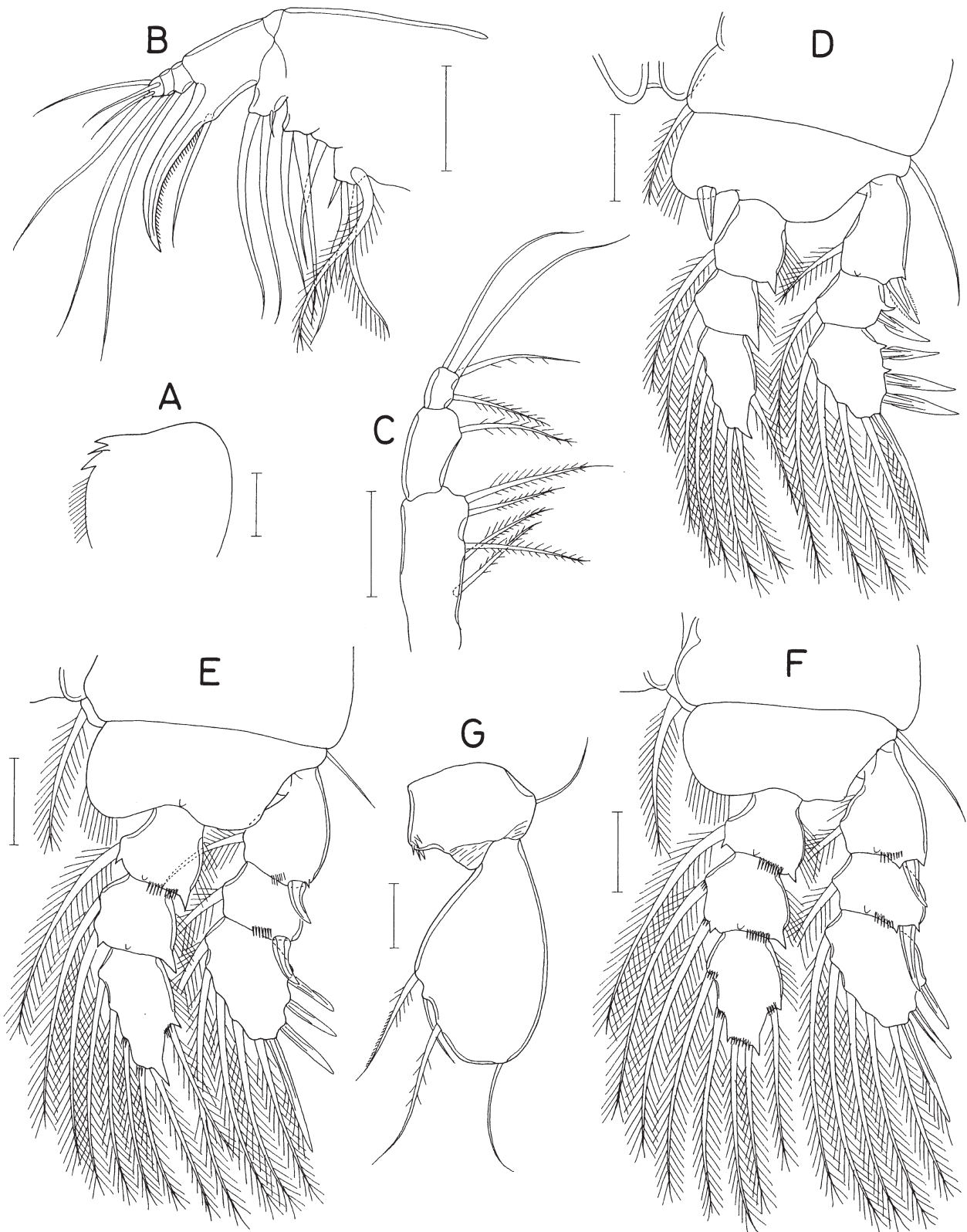


FIG. 25. *Archinotodelphys rostralis* **sp. nov.** holotype female. A, paragnath; B, maxilla; C, maxilliped; D, leg 1; E, leg 2; F, leg 4; G, leg 5. Scale bars: A, 0.02 mm; B–G, 0.05 mm.

Leg 5 (Fig. 25G) protopodal segment wider than long, armed with 1 outer seta and ornamented with several inner spinules; exopodal segment rounded, bulbous, about 1.7 times longer than wide ($176 \times 104 \mu\text{m}$), widest at 60% of length; smallest second inner seta orientated close to inner margin. Leg 6 represented by 1 spine and 1 seta.

Male. (observed undissected). Body similar to that of female. Length 1.67 mm. urosome 6-segmented. Caudal ramus 207×34 µm, about 6.1 times longer than wide.

Rostrum as in female. Antennule 13-segmented, geniculate between eleventh and twelfth segments. Antenna, labrum, mandible, maxilla, and maxilliped as in female. Maxillule with 5 (1+4) setae on basis.

Legs 1–4 as in female. Leg 5 similar to that of female, with 4 setae, but dimensions not measured. Leg 6 represented by 2 setae and 1 spinule on genital operculum.

Remarks. This new species is similar to *A. elegans* sp. nov. in having reduced setation of the mandible, the maxilla and the maxilliped. The main differences are the much more elongate caudal rami in *A. rostralis* sp. nov. with a L/W ratio 5.4:1 (compared to 3.6:1 in *A. elegans* sp. nov.), the possession of 4 (not 6) setae on the basis of the maxillule, and the shape of the rostrum and the exopod of leg 5. The elongate rostrum of *A. rostralis* sp. nov. is unique: it is directed frontally so almost its entire length is visible in dorsal view (Fig. 24A) and its apex tapers to a point in dorsal view (Fig. 24D) but is bluntly rounded in lateral view (Fig. 24C). In *A. elegans* sp. nov. the rostrum is also elongate and has a similar general shape but it is directed antero-ventrally so that it is only just visible in dorsal view (cf. Fig. 22A). The rounded shape of the free exopodal segment of leg 5 is less pronounced in *A. rostralis* sp. nov. than in *A. elegans* sp. nov., and the L/W ratio is 1.7:1 compared to 1.3:1 in the latter. This combination of features serves to distinguish between these two new species.

Archinotodelphys longicaudatus sp. nov.

(Figs. 26–28)

Type material. Holotype (♀, MNHN-IU-2014-21207, intact). Dissected paratypes (1 ♀, 1 ♂) in the collection of IHK.

Type host. *Microcosmus longicloa* Monniot C. & Monniot F., 1991 (MNHN-IT-2008-5256 = MNHN S2/MIC/96).

Type locality. The Philippines, N. Lubang, MUSORSTOM 2 cruise 17, R.V. *Coriolis*, Stn CP04 (13°59'N, 120°18'E), depth 183–190m, Bouchet coll., 20 November 1980.

17 CP 04, The Philippines (CPA 944).

Etymology. The name of the new species refers to the elongate caudal rami, which are more than 9 times as long as wide in the adult female.

Female. Body (Fig. 26A) 1.98 mm long; prosome 880 µm long; cephalosome 305×545 µm. Urosome (Fig. 26B) 5-segmented; fifth pedigerous somite 196 µm wide. Genital double-somite about 1.2 times as long as wide (240×196 µm); paired genital apertures located dorsolaterally at about 23% of somite length. Three free abdominal somites 152×138, 160×125, and 127×109 µm, respectively; second free abdominal somite longest. Caudal ramus (Fig. 26C) slender and elongate, about 9.4 times longer than wide (339×36 µm); lateral seta small, located at 23% of ramus length; dorsal seta small; other setae missing.

Rostrum (Fig. 26D) elongate (142×65 µm) tapering in distal part; directed antero-ventrally. Antennule (Fig. 26E) 376 µm long and 14-segmented; armature formula 3, 5, 6, 2, 2, 6, 4, 1, 1, 3, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked except for 2 setae on first segment; aesthetascs thin, setiform. Antenna (Fig. 26F) with unarmed coxa; basis with 1 pinnate seta and 1 minute seta representing exopod at outer distal corner, and ornamented with setules on both margins: endopod 3-segmented with 1, 4+1, and 6+claw on first to third segments; second segment with minute seta on inner margin.

Labrum (Fig. 26G) with weakly developed posteromedian lobe; both sides of labrum and posteromedian lobe ornamented with distal margin spinules and setules. Mandible (Fig. 26H) with 4 major teeth and 1 seta on coxal gnathobase; one small subsidiary tooth present between distal 2 teeth: basis with 1 seta on medial margin and row of fine spinules near base of exopod; exopod 4-segmented, each segment with 1 seta: endopod 2-segmented with 4 setae on first segment and 9 setae on second. Paragnath not observed. Maxillule (Fig. 27A) with 9 setae on precoxal arthrite; coxa with 1 seta on endite and 2 unequal setae on epipodite; basis with 4 setae on medial margin (2 proximal and 2 distal); exopod with 4 setae; endopod with 8 setae (4 medial, naked and 4 distal, weakly pinnate). Maxilla (Fig. 26I) 5-segmented; syncoxa with 4, 1, 2, and 3 setae on first to fourth endites; basis with 1 large claw and 1 seta; endopod 3-segmented with 1, 2, and 3 setae on first to third segments. Maxilliped (Fig. 27B) 3-segmented with 5 (grouped as 1, 2, and 2), 1, and 4 setae on first to third segments, respectively; second segment ornamented with tuft of needle-like spinules near base of seta.

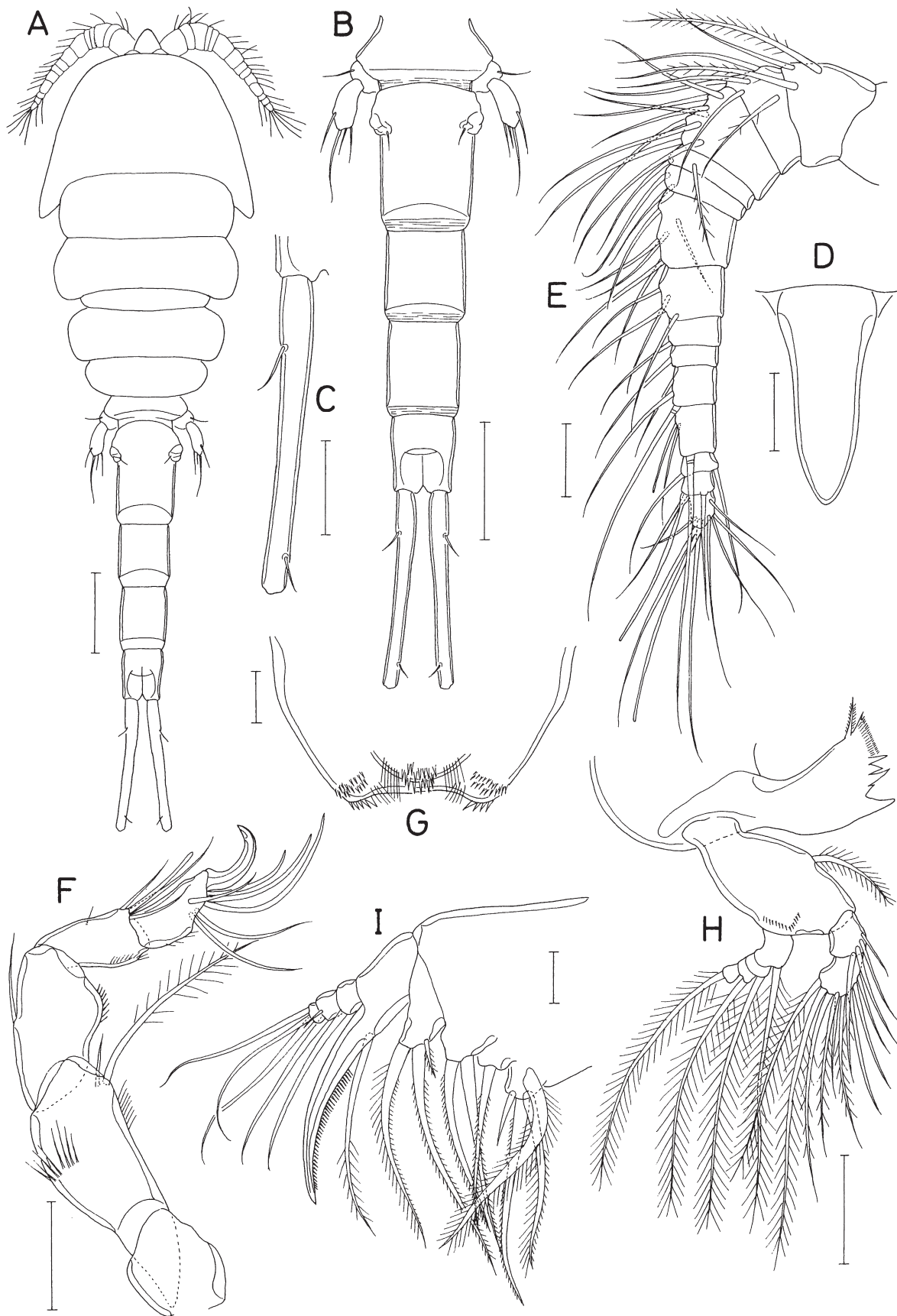


FIG. 26. *Archinotodelphys longicaudatus* **sp. nov.** paratype female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxilla. Scale bars: A, B, 0.2 mm; C, 0.1 mm; D–F, H, 0.05 mm; G, I, 0.02 mm.

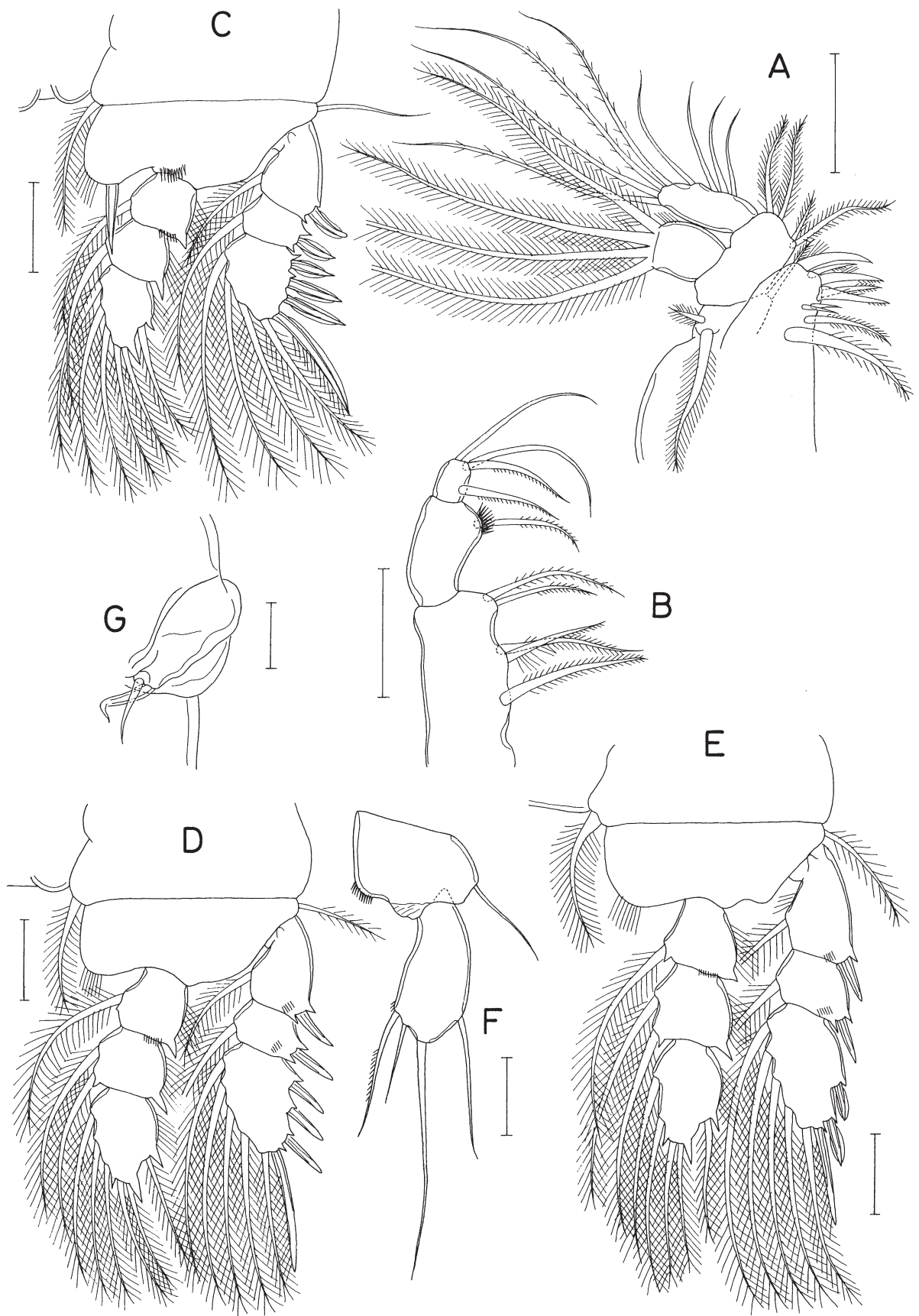


FIG. 27. *Archinotodelphys longicaudatus* **sp. nov.** paratype female. A, maxillule; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, right genital aperture, dorsal. Scale bars: A–F, 0.05 mm; G, 0.02 mm.

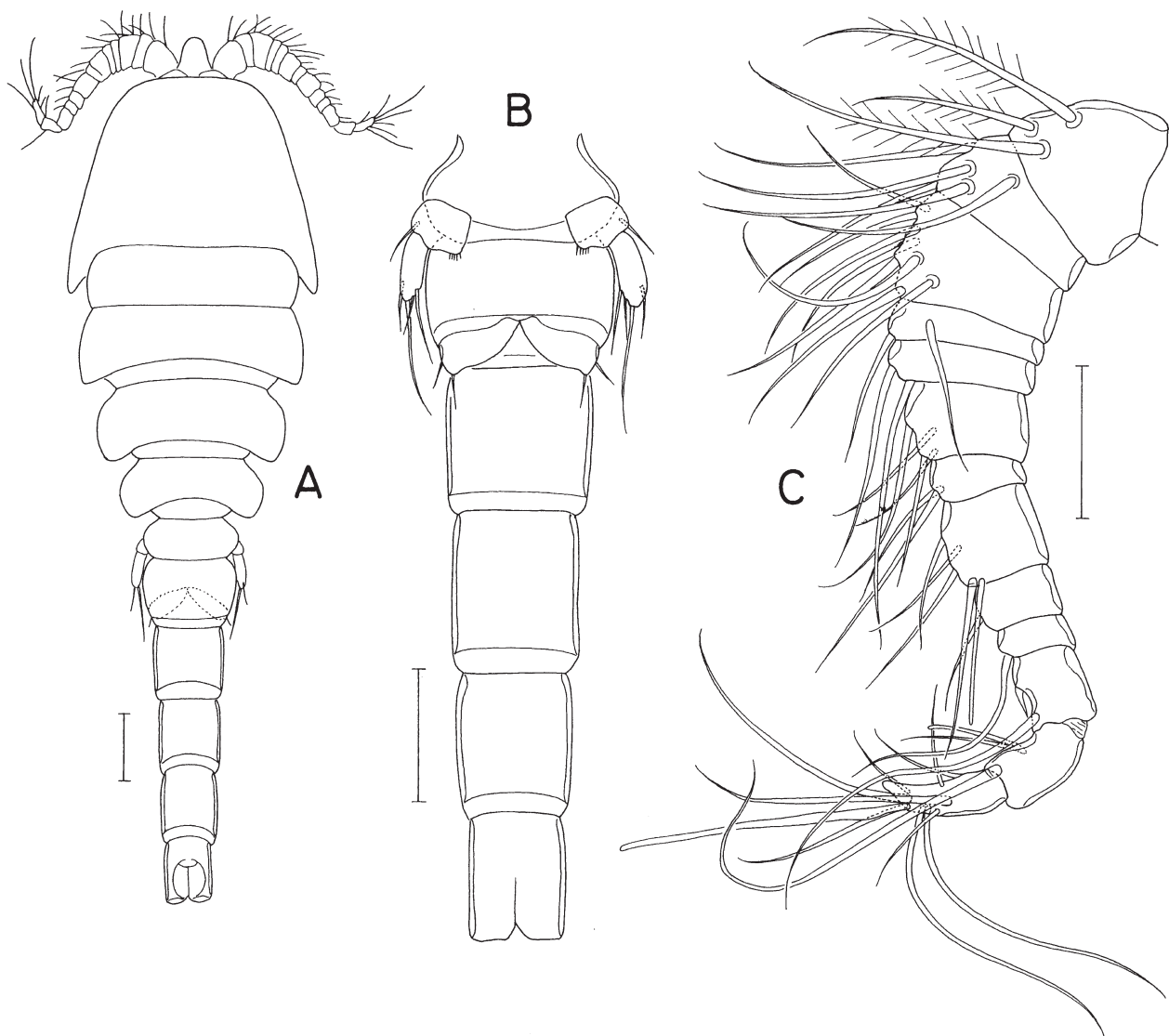


FIG. 28. *Archinotodelphys longicaudatus* **sp. nov.** paratype male. A, habitus without caudal rami, dorsal; B, Urosome without caudal rami, ventral; C, antennule. Scale bars: A, B, 0.1 mm; C, 0.05 mm.

Legs 1–4 biramous with 3-segmented rami (Fig. 27C–E); armature formula as in generic diagnosis. Outer seta on basis naked in leg 1 but pinnate in legs 2–4. Inner distal spine on basis of leg 1 smooth, 38 μm long, longer than first endopodal segment.

Leg 5 (Fig. 27F) protopodal segment wider than long with 1 outer seta; exopodal segment 2 times longer than wide (90 \times 45 μm), with 4 setae. Leg 6 (Fig. 27G) represented by 1 spine (curved distally) and 1 seta on genital operculum.

Male. Body (Fig. 28A) length 1.23 mm. Urosome (Fig. 28B) 6-segmented; fifth pedigerous somite 145 μm wide; genital somite wider than long (102 \times 141 μm); four free abdominal somites 109 \times 110, 118 \times 94, 107 \times 86, and 91 \times 72 μm , respectively. Caudal rami missing.

Rostrum as in female. Antennule (Fig. 28C) 290 μm long, 13-segmented, and geniculate between eleventh and twelfth segments; armature formula 3, 5, 8, 2, 2, 4, 2, 4+aesthetasc, 1, 1, 2, 2+aesthetasc, and 9+aesthetasc. Antenna, labrum, mandible, maxillule, maxilla, maxilliped, and legs 1–5 as in female. Leg 6 represented by 2 setae on genital operculum.

Remarks. The extremely elongate caudal rami (L/W ratio is 9.4:1 in the female) distinguishes this species from all of its congeners: in other known species this ratio does not exceed 6.3:1 as found in *A. reductus* **sp. nov.** The 14-segmented antennule of the female is a unique condition: in the great majority of species the antennule is 17-segmented, but it is 16-segmented in *A. gurneyi* **comb. nov.**, and *A. longiseta* **sp. nov.**, 15-segmented in *A. elegans*

sp. nov., *A. rostralis* **sp. nov.** and *A. nudus* **sp. nov.**, 12-segmented in *A. unisetosus* **sp. nov.**, and apparently 10-segmented in *A. profundus* according to Monniot (1968). The armature (1, 2, 3) on the three endopodal segments of the maxilla is shared only with *A. unisetosus* **sp. nov.** (described below), but these species can be distinguished by the 1, 7 formula of the mandibular endopod in the latter (cf. 4, 9 in *A. longicaudatus* **sp. nov.**). The other species that bear a total of 6 setae on the maxillary endopod have a setal formula of either 1, 1, 4 (as in *A. gurneyi*, *A. elegans* **sp. nov.**, *A. rostralis* **sp. nov.**, *A. nudus* **sp. nov.**, and *A. longiseta* **sp. nov.**), or 1, 5 (as in *A. antarcticus* **sp. nov.**). These differences support the recognition of a new species to accommodate the material from *Microcosmus longicloa*.

***Archinotodelphys nudus* sp. nov.**

(Figs. 29-31)

Type material. Holotype (♀, MNHN-IU-2014-21208), allotype (♂, MNHN-IU-2014-21209) and paratypes (14 ♀♀ plus 3 ♂♂, MNHN-IU-2014-21210, intact). Dissected paratypes (2 ♀♀ and 1 ♂) in the collection of IHK.

Type host. *Polycarpa* sp. (MNHN-IT-2008-6805 = MNHN S1/Pol.B/326).

Type locality. N. Sulawesi, Indonesia, OCDN A5, Stn Manado 12, CRRF coll., 15 May 1993.

Etymology. The name of the new species refers to the loss of the outer margin spines on the second exopodal segment of legs 2 to 4 in this species.

Female. Body (Fig. 29A) small, flattened, with thin exoskeleton; mean body length 658 µm (range 604 to 695 µm, based on 7 specimens); length of dissected specimen 667 µm: prosome 376 µm long, greatest width 306 µm across cephalosome; fourth pedigerous somite markedly narrower than other prosomites. Urosome (Fig. 29B) 5-segmented; fifth pedigerous somite 86 µm wide; genital double-somite 83×75 µm, bearing paired genital apertures dorsolaterally at 37% of double-somite length. Three free abdominal somites 54×48, 56×42, and 34×38 µm, respectively; articulations between urosomites incompletely defined. Caudal ramus (Fig. 29C) as long as wide (17×17 µm), armed with 6 naked setae; all setae located distally or subdistally.

Rostrum (Fig. 29D) broad with rounded distal margin. Antennule (Fig. 29E) 137 µm long and 15-segmented; armature formula 3, 5, 8, 2, 2, 6, 4+aesthetasc, 1, 2, 1, 2, 2+aesthetasc, 2, 2+aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 29F) with unarmed coxa; basis with 2 equal, outer distal setae representing exopod; endopod 3-segmented with armature 1, 3, and 6+claw on first to third segments, respectively.

Labrum (Fig. 29G) simple (without posteromedian lobe), unornamented. Mandible (Fig. 29H) with coxal gnathobase narrowing towards reduced biting edge, bearing minute denticles; basis with robust medial seta; exopod 4-segmented; each segment with 1 seta; endopod with 4 and 9 setae on first and second segments, respectively. Paragnath not observed. Maxillule (Fig. 29I) with 4 setae on precoxal arthrite; coxa with 1 seta each on endite and epipodite; basis with 5 setae on medial margin; exopod with 4 large setae; endopod with 8 setae (4 on medial margin and 4 distally). Maxilla (Fig. 30A) 5-segmented; syncoxa with 1, 2, and 2 setae on first to third endites; basis with 1 claw plus 1 seta; endopod 3-segmented with 1, 1, and 4 setae on first to third segments. Maxilliped (Fig. 30B) 3-segmented with 4 (2+2), 1, and 3 setae on first to third segments.

Legs 1–4 with 3-segmented rami. Third endopodal segment with well-developed, spiniform outer distal process in legs 1–4 (Fig. 30C–E): outer seta on basis of legs 1–3 large. Second exopodal segment of legs 2–4 laterally expanded, lacking outer spine. Legs 3 and 4 lacking inner coxal seta. Armature formula for legs 1–4 as follows:

| | Coxa | Basis | Exopod | Endopod |
|--------|------|-------|-------------------|----------------|
| Leg 1: | 0-1 | 1-I | I-1; I-1; II, 5 | 0-1; 0-1; 2, 4 |
| Leg 2: | 0-1 | 1-0 | I-1; 0-1; 2, 1, 3 | 0-1; 0-2; 2, 4 |
| Leg 3: | 0-0 | 1-0 | I-1; 0-1; 2, 1, 3 | 0-1; 0-2; 2, 4 |
| Leg 4: | 0-0 | 1-0 | I-1; 0-1; 3, 1, 3 | 0-1; 0-2; 2, 3 |

Leg 5 (Fig. 30F) protopodal segment broader than long, armed with outer seta; exopodal segment about 1.9 times longer than wide (28×17 µm) and armed with 4 setae. Leg 6 (Fig. 30G) represented by 1 spine, 1 seta and 1 dentiform process on genital operculum.

Male. Body (Fig. 31A) similar to that of female. Length 384 µm. Urosome (Fig. 31B) 6-segmented: fifth pedigerous somite 42 µm wide; genital somite and 4 abdominal somites 32×47, 27×35, 33×32, 33×28, and 19×26 µm. Caudal ramus 11×12 µm.

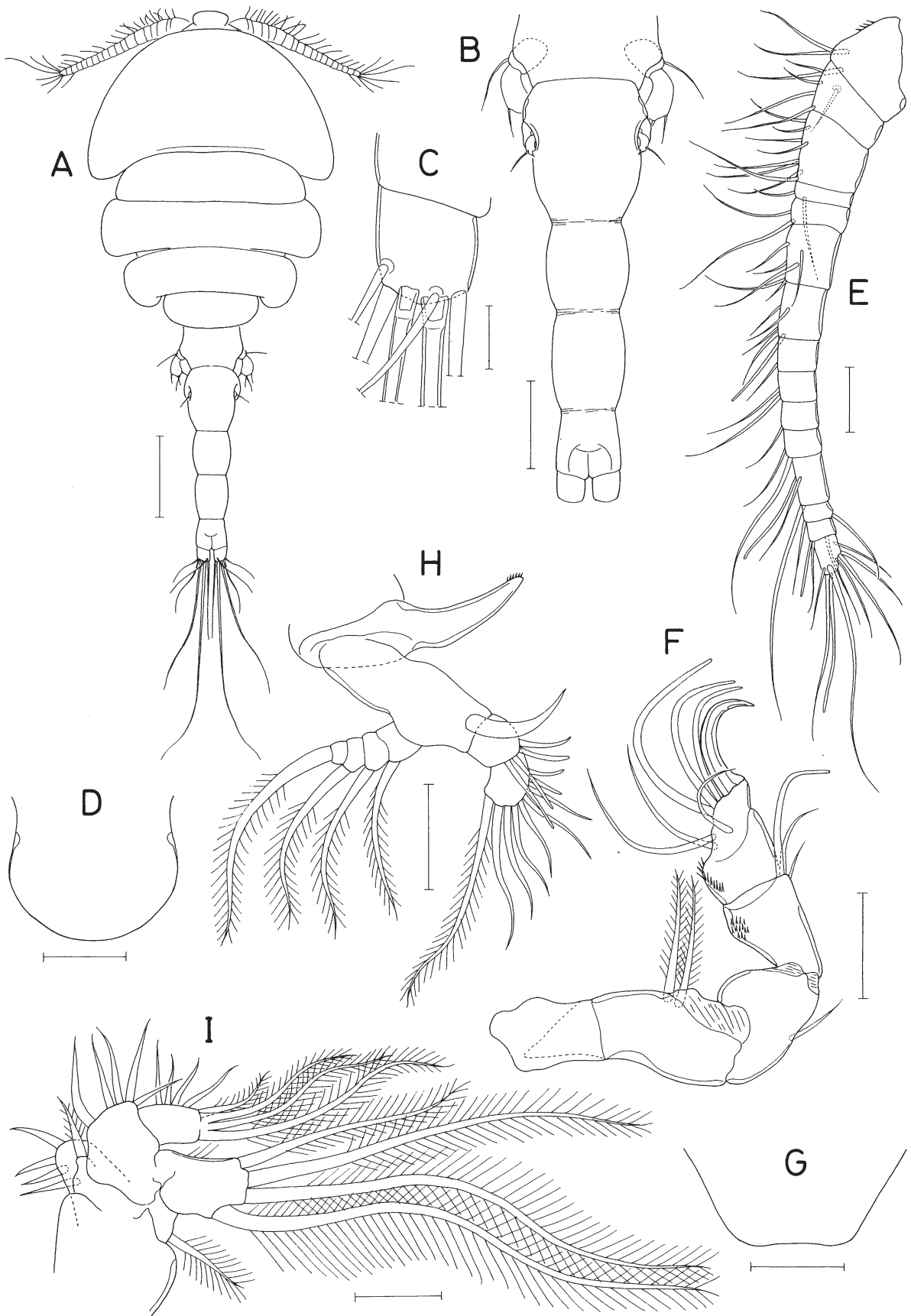


FIG. 29. *Archinotodelphys nudus* sp. nov. paratype female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule. Scale bars: A, 0.1 mm; B, 0.05 mm; C, 0.01 mm; D–I, 0.02 mm.

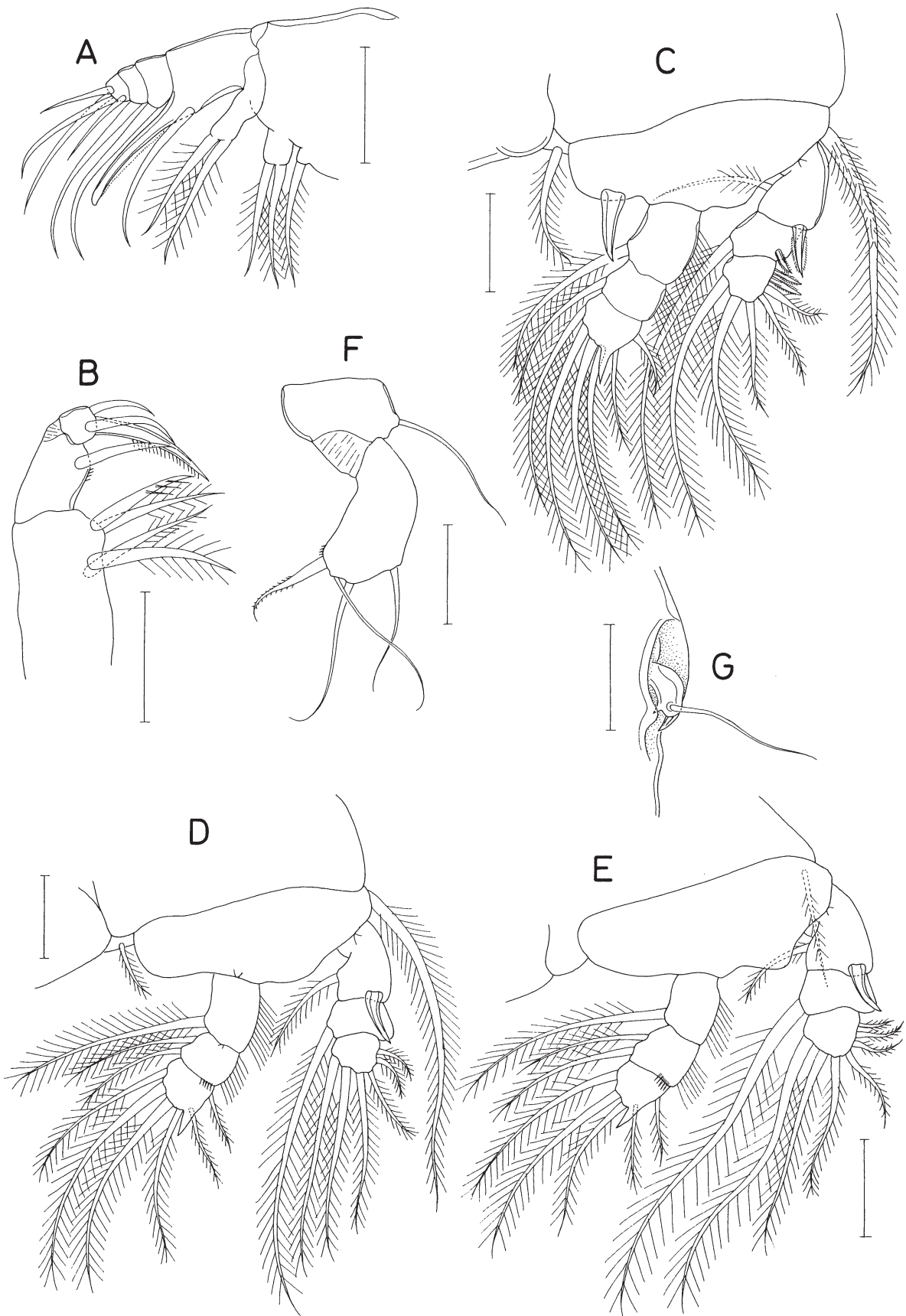


FIG. 30. *Archinotodelphys nudus* sp. nov. paratype female. A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 4; F, leg 5; G, right genital aperture, dorsal. Scale bars: 0.02 mm.

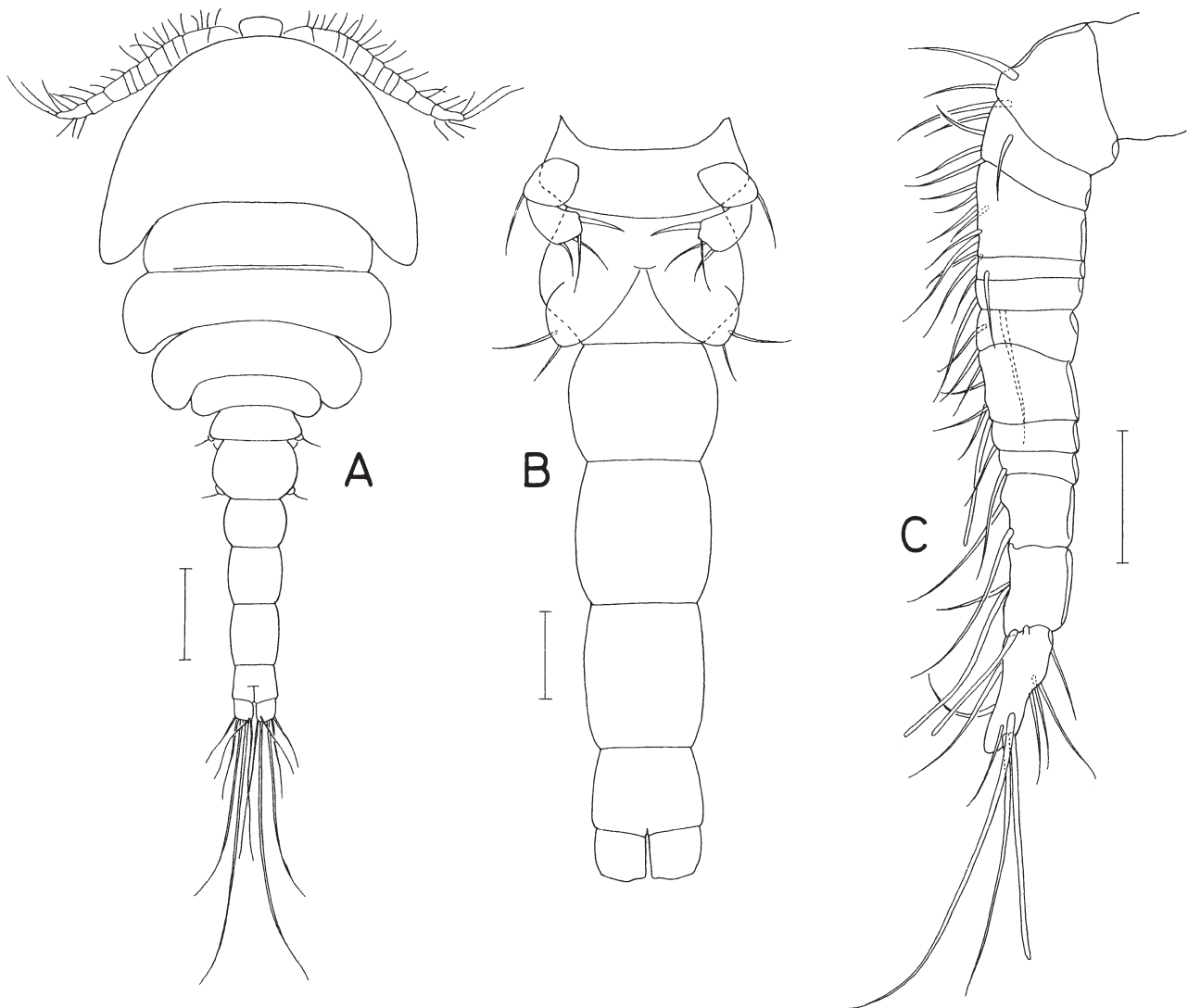


FIG. 31. *Archinotodelphys nudus* **sp. nov.** paratype male. A, habitus, dorsal; B, urosome, ventral; C, antennule. Scale bars: A, 0.05 mm; B, C, 0.02 mm.

Rostrum as in female. Antennule (Fig. 31C) 113 μ m long and 12-segmented; geniculation weakly expressed between segments 10 and 11; armature formula 3, 5, 8, 2, 2, 2, 4+aesthetasc, 1, 1, 2, 1+2 aesthetascs, and 7+aesthetasc. Antenna, labrum, maxilla and maxilliped as in female. Mandible with 2 and 7 setae on first and second endopodal segments, respectively. Maxillule with 7 setae on endopod, 3 (not 4 as in female) medial and 4 distal.

Legs 1–5 as in female. Leg 6 (Fig. 31B) represented by 2 setae on genital operculum.

Remarks. This is the smallest species known in the genus *Archinotodelphys*: the mean body length of the adult female of *A. nudus* **sp. nov.** is only 658 μ m while females of other species range in size from about 1.0 mm (*A. profundus*) up to 3.32 mm (in *A. antarcticus* **sp. nov.**). *Archinotodelphys unisetosus* **sp. nov.** (described below) is also small, with a female body length of 815 μ m. The caudal ramus of the new species is as long as wide whereas all other species have caudal rami that are longer than wide, ranging from 2.3 times longer than wide in *A. curtus* **sp. nov.** and 2.6 times longer in *A. unisetosus* **sp. nov.**, up to about 9.4 times in *A. longicaudatus* **sp. nov.** The tapering shape of the narrow coxal gnathobase of the mandible of *A. nudus* **sp. nov.** is unique within the genus; all other species have a broad biting edge. There are major differences also in the armature formula of the swimming legs: the second exopodal segment of legs 2–4 lacks an outer margin spine (which is present in all other species), the third exopodal segment of legs 2–4 carries a reduced number of armature elements (6 in legs 2 and 3 and 7 in leg 4, compared with 9 and 8 elements respectively, in all other species), and legs 3 and 4 lack the inner coxal seta (present in all other species).

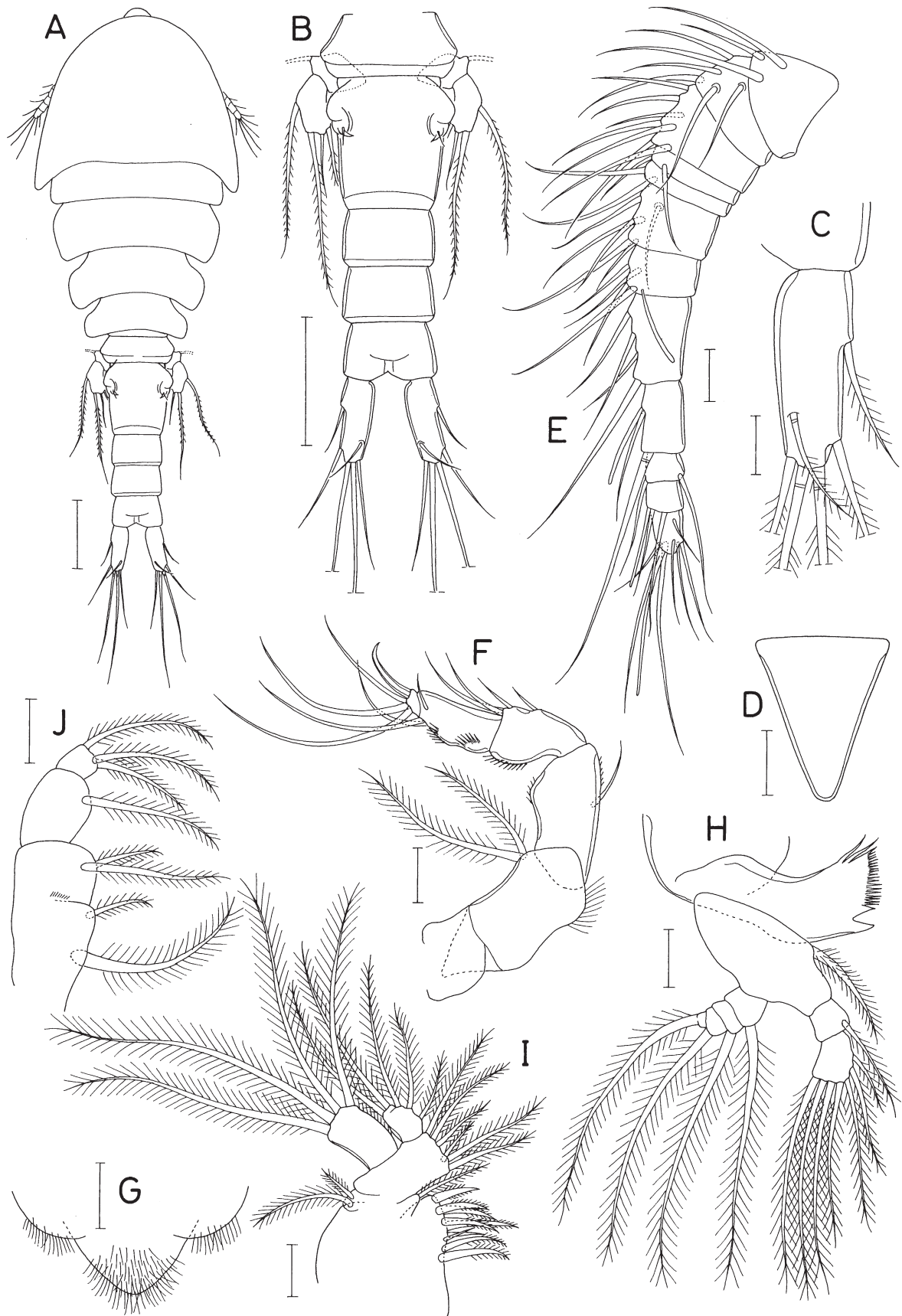


FIG. 32. *Archinotodelphys unisetosus* sp. nov. holotype female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, dorsal; D, rostrum; E, antennule; F, antenna; G, labrum; H, mandible; I, maxillule; J, maxilliped. Scale bars: A, B, 0.1 mm; C–J, 0.02 mm.

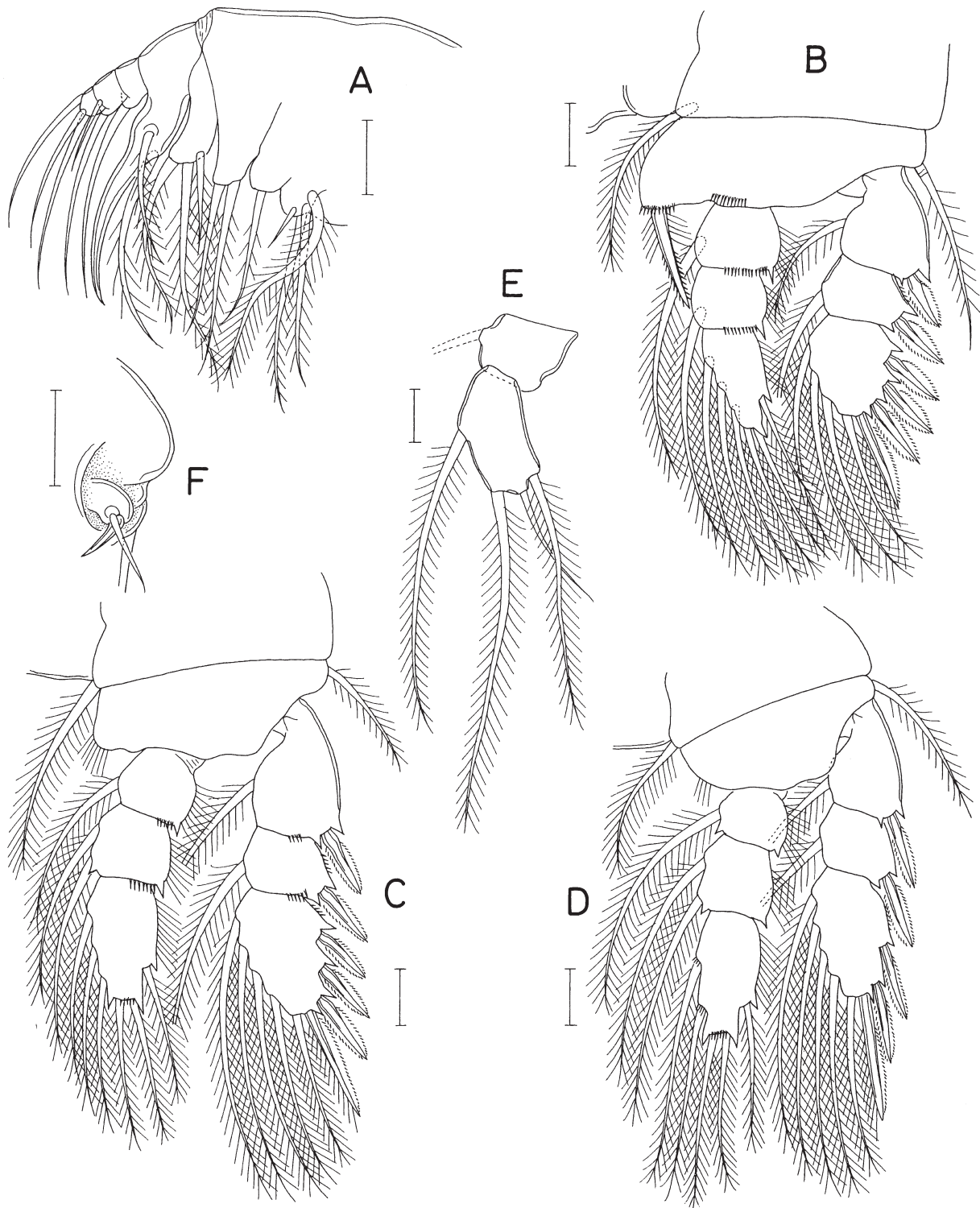


FIG. 33. *Archinotodelphys unisetosus* sp. nov. holotype female. A, maxilla; B, leg 1; C, leg 2; D, leg 4; E, leg 5; F, right genital aperture, dorsal. Scale bars: 0.02 mm.

Archinotodelphys unisetosus sp. nov.
(Figs. 32, 33)

Type material. Holotype (♀, MNHN-IU-2014-21211, dissected and mounted on a slide).

Type host. unidentified Phlébobranche.

Type locality. North Atlantic, ABYPLAINE cruise, N/0 *Cryos*, Stn DS11, 42°59.7'N, 14°05.4'W, depth 5260 m, Monniot coll., 12-13 June 1981.

Etymology. This name of the species alludes to the presence of a single seta only on the first endopodal segment of the mandible, a unique character state for the family.

Female. Body (Fig. 32A) small, length 815 µm: prosome 495 µm long; greatest width 298 µm across cephalosome. Urosome (Fig. 32B) 5-segmented; fifth pedigerous somite 107 µm wide. Genital double-somite almost as long as wide (104×100 µm); paired genital apertures located dorsolaterally at 40% of double-somite length. Three free abdominal somites 45×72, 44×71, and 45×73 µm, respectively. Caudal rami separated from each other; each ramus (Fig. 32C) about 2.6 times longer than wide (67×26 µm), armed with 6 setae, all pinnate; outer lateral seta located at 38% of ramus length.

Rostrum (Fig. 32D) triangular, 51×42 µm. Antennule (Fig. 32E) 202 µm long and 12-segmented; armature formula 3, 5, 7, 2, 2, 6, 4+aesthetasc, 4, 2+aesthetasc, 2, 2 + aesthetasc, and 7+aesthetasc; all setae naked. Antenna (Fig. 32F) with unarmed coxa; basis with 2 subequal exopodal setae at outer distal corner; endopod 3-segmented with 1, 4, and 6+claw on first to third segments, respectively; terminal segment 2.3 times longer than wide.

Labrum (Fig. 32G) with large posteromedian lobe and setulose distal margin. Mandible (Fig. 32H) with 2 teeth and 2 setae on coxal gnathobase; basis with 1 seta on medial margin; exopod 4-segmented, each segment with 1 seta; endopod with 1 and 7 setae on first and second segments. Maxillule (Fig. 32I) with 9 setae on precoxal arthrite; coxa with 1 seta on endite and 2 setae on epipodite; basis with 6 setae on medial margin; exopod with 4 setae distally; endopod with 5 setae, 3 medial and 2 distal. Maxilla (Fig. 33A) 5-segmented; syncoxa with 4 (including 1 small), 1, 2, and 3 setae on first to fourth endites; basis with 1 smooth claw and 2 setae; endopod 3-segmented with 1, 2, and 3 setae on first to third segments, respectively. Maxilliped (Fig. 32J) 3-segmented with 4 (1, 1, and 2), 1, and 3 setae on first to third segments, respectively.

Legs 1–4 biramous with 3-segmented rami (Figs. 33B–D); armature formula for legs 1–4 as generic diagnosis. All setae on legs pinnate. Inner distal spine on basis of leg 1 (Fig. 33B) 33 µm long, longer than first endopodal segment, proximally pinnate but distally spinulose.

Leg 5 (Fig. 33E) protopodal segment wider than long, probably with 1 outer seta (detached but attachment scar discernible); exopodal segment about 1.9 times longer than wide (50×26 µm), with 3 large, pinnate setae and 1 smaller, naked seta. Leg 6 (Fig. 33G) represented by 1 spine and 1 seta on genital operculum.

Male. Unknown.

Remarks. This deep-water species exhibits extreme reduction of the mandibular endopod with the fewest setae of any known species: 1 on the first segment and 7 on the second. In other species the first segment is armed with between 4 and 6 setae, and the second segment between 8 and 10 setae. The antennule of the female is 12-segmented in *A. unisetosus* **sp. nov.**, which is another unique character state. Most other species have more expressed segments (14 to 17) and only *A. profundus* has fewer, with only 10 (cf. Huys & Boxshall, 1991: Fig. 2.8.9A). The maxillule has only 5 setae on the endopod in *A. unisetosus* **sp. nov.** This compares with 8 to 11 in all other species except *A. polynesiensis* and *A. phallusiae* **comb. nov.**, each of which apparently has 12 setae (Hansen, 1923), although these counts require confirmation as 12 is more than is found in any other known member of the order Cyclopoida (Huys & Boxshall, 1991).

This is the deepest known record of any described species of Archinotodelphyidae but the family inhabits considerably deeper waters. Khodami *et al.* (2019) sequenced unidentified archinotodelphyids collected from depths of 8734 to 9013 m at the Kuril Trench in the North Pacific.

Key to species of Archinotodelphyidae

1. Exopodal segment of female leg 5 armed with 6 setae 2
Exopodal segment of female leg 5 armed with 4 setae 4
2. Inner coxal seta present in leg 4 3
Inner coxal seta absent in leg 4 *A. polynesiensis*
3. Exopodal segment of leg 5 about 2.4 times longer than wide *A. momus* **sp. nov.**
Exopodal segment of leg 5 elongate, about 3.8 times longer than wide *A. hexasetosus* **sp. nov.**
4. Mandibular exopod armed with 5 setae 5
Mandibular exopod armed with 4 setae 16
5. Caudal rami less than 2.5 times longer than wide *A. curtus* **sp. nov.**

| | | |
|-----|--|---|
| | Caudal rami at least 4 times longer than wide | 6 |
| 6. | Mandibular palp with 5 or 6 setae on first endopodal segment | 7 |
| | Mandibular palp with 4 setae on first endopodal segment | 8 |
| 7. | Mandibular palp with 6 setae on first endopodal segment; maxillary endopod armed with total of 10 setae | <i>A. illgi</i> sp. nov. |
| | Mandibular palp with 5 setae on first endopodal segment; maxillary endopod armed with total of 9 setae | <i>A. cinctus</i> sp. nov. |
| 8. | Mandibular palp with 10 setae on second endopodal segment; maxillary endopod armed with at least 10 setae | 11 |
| | Mandibular palp with 8 or 9 setae on second endopodal segment; maxillary endopod armed with 8 setae | 9 |
| 9. | Endopod of maxillule incompletely 2-segmented | <i>A. bimerus</i> sp. nov. |
| | Endopod of maxillule unsegmented | 10 |
| 10. | Female antennule 17-segmented | <i>A. typicus</i> |
| | Female antennule 10-segmented | <i>A. profundus</i> |
| 11. | Basis of maxillule armed with 8 setae; proximal segment of maxilliped bearing 10 setae | <i>A. antarcticus</i> sp. nov. |
| | Basis of maxillule armed with 6 or 7 setae; proximal segment of maxilliped bearing maximum of 9 setae | 12 |
| 12. | Basis of maxillule bearing 6 setae; maxilliped armed with total of 10–12 setae | 13 |
| | Basis of maxillule bearing 7 setae; maxilliped armed with total of 14–16 setae | 15 |
| 13. | Caudal rami about 5 times longer than wide | <i>A. gurneyi</i> |
| | Caudal rami about 6.2 to 6.3 times longer than wide | 14 |
| 14. | Endopod of maxilliped 1-segmented; setal formula of maxillary endopod 1,1,3 | <i>A. reductus</i> sp. nov. |
| | Endopod of maxilliped 2-segmented; setal formula of maxillary endopod 1,1,4 | <i>A. longiseta</i> sp. nov. |
| 15. | Endopod of maxilliped 1-segmented; maxilliped armed with 14 setae (6-2-6) | <i>A. phallusiae</i> |
| | Endopod of maxilliped 2-segmented; Maxilliped armed with 16 setae (9-1-3-3) | <i>A. monnioti</i> sp. nov. |
| 16. | First and second endopodal segments of mandible armed with 4 and 9 setae, respectively; female antennule 14- or 15-segmented | 17 |
| | First and second endopodal segments of mandible armed with 1 and 7 setae, respectively; female antennule 12-segmented | <i>A. unisetosus</i> sp. nov. |
| 17. | Caudal rami about as long as wide | <i>A. nudus</i> sp. nov. |
| | Caudal rami at least 3.5 times longer than wide | 18 |
| 18. | Caudal rami more than 9 times longer than wide | <i>A. longicaudatus</i> sp. nov. |
| | Caudal rami between 3 and 6 times longer than wide | 19 |
| 19. | Basis of maxillule armed with 6 setae | <i>A. elegans</i> sp. nov. |
| | Basis of maxillule armed with 4 setae | <i>A. rostralis</i> sp. nov. |

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Bibliography

- Bowman, T.E. & Abele, L.G. (1982) Classification of the Recent Crustacea. In: Abele, L.G. (Ed.), *The Biology of Crustacea. Vol. 1. Systematics, the fossil record, and biogeography*. Academic Press, New York and London, pp. 1–27.
- Boxshall, G.A. & Halsey, S.H. (2004) *An Introduction to Copepod Diversity*. The Ray Society, London, 966 pp.
- Hansen, H.J. (1923) Crustacea Copepoda. II. Copepoda parasita and hemiparasita. *Danish Ingolf Expedition*, 3 (7), 1–92, pls. 1–5.
<https://doi.org/10.5962/bhl.title.58675>
- Humes, A.G. (1987) Copepoda from deep-sea hydrothermal vents. *Bulletin of marine Science*, 41 (3), 645–788.
- Huys, R. (1990) Allocation of the Mantridae Leigh-Sharpe to the Cyclopoida (Crustacea: Copepoda) with notes on *Nearchinotodelphys* Ummerkuty. *Bijdragen tot de Dierkunde*, 60 (3–4), 283–291.
- Huys, R. & Boxshall, G.A. (1991) *Copepod Evolution*. The Ray Society, London, 468 pp.
- Illg, P.L. (1955) A new species of *Pararchinotodelphys* (Copepoda: Cyclopoida) with remarks on its systematic position. *Journal of the Washington Academy of Science*, 45 (7), 216–224.
[\[https://www.jstor.org/stable/24533736\]](https://www.jstor.org/stable/24533736)
- Khodami, S., McArthur, J.V., Blanco-Bercial, L. & Martínez Arbizu, P. (2017) Molecular Phylogeny and Revision of Copepod Orders (Crustacea: Copepoda). *Scientific Reports*, 7 (1), 1–11.
<https://doi.org/10.1038/s41598-017-06656-4>
- Khodami, S., Mercado-Salas, N.F., Tang, D. & Martínez Arbizu, P. (2019) Molecular evidence for the retention of the Thaumapostyllidae in the order Cyclopoida (Copepoda) and establishment of four suborders and two families within the Cyclop-

- oida. *Molecular Phylogenetics and Evolution*, 138, 43–52.
<https://doi.org/10.1016/j.ympev.2019.05.019>
- Lang, K. (1949) On a new copepod family related to Notodelphyidae and on two new copepod species from South-Georgia. *Arkiv för Zoologi*, 42B (4), 1–7.
- Martínez Arbizu, P. (2000a) A new species of *Cyclopetta* from the Laptev Sea (Arctic Ocean), with the recognition of Cyclopettidae fam. nov., a new monophylum of free-living Cyclopoida (Copepoda). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie*, 70, 91–101.
- Martínez Arbizu, P. (2000b) Giselinidae fam. nov., a new monophyletic group of cyclopoid copepods (Copepoda, Crustacea) from the Atlantic deep sea. *Helgoland Marine Research*, 54, 190–212.
<https://doi.org/10.1007/s101520000051>
- Martínez Arbizu, P. (2001a) Hemicyclopinidae n. fam., a new monophyletic group of marine cyclopinid Cyclopoida, with description of one new genus and two new species (Crustacea, Copepoda, Cyclopoida). *Senckenbergiana biologica*, 81, 37–54.
- Martínez Arbizu, P. (2001b) Psammocyclopinidae fam. n., a new monophyletic group of marine Cyclopoida (Copepoda, Crustacea), with the description of *Psammocyclopina georgei* sp. n. from the Magellan Region. *Revista Brasileira de Zoologia*, 18, 1325–1339.
<https://doi.org/10.1590/S0101-81752001000400025>
- Martínez Arbizu, P. (2006) Phylogenetic relationships within Schminkepinellidae fam. n., a new monophyletic group of marine cyclopinids (Cyclopoida: Copepoda), description of two new genera and four new species. *Invertebrate Zoology*, 3, 185–207.
<https://doi.org/10.15298/invertzool.03.2.04>
- Monniot, C. (1968) Présence dans une Ascidie de grande profondeur de Copépodes parasites de la famille des Archinotodelphyidae Lang, 1949. *Crustaceana*, Supplement 1, 112–118.
[\[https://www.jstor.org/stable/i25027357\]](https://www.jstor.org/stable/i25027357)
- Monniot, C. (1986) Variations morphologiques d'un Copépode ascidicole en fonction des hôtes et des îles en Polynésie française. *Bulletin de la Société Zoologique de France*, 111 (1–2), 149–157.
- Ohtsuka, S., Boxshall, G.A. & Torigoe, K. (2000) A new genus and species of the family Mantridae (Copepoda: Cyclopoida) infesting the bivalve *Pseudochama retroversa* from the Seto Inland Sea, western Japan. *Journal of Natural History*, 34, 1967–1976.
<https://doi.org/10.1080/00222930050144800>
- Walter, T.C. & Boxshall, G.A. (2019) World of Copepods database. Notodelphyidae Dana, 1853. World Register of Marine Species. Available from: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=106421> (accessed 22 October 2019)