Elapholaophonte decaceros n. gen., n. sp. (Copepoda: Harpacticoida, Laophontidae) from the Philippines[1]

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Abstract. A new genus is proposed to accommodate a new species of harpacticoid copepod of the family Laophontidae which was discovered from a subtidal site in Lingayen Gulf, Luzon, Philippines. The description is based on three males from coarse sand and broken mollusc shell substrate. *Elapholaophonte decaceros* n. gen., n. sp. is easily distinguished from other Laophontidae by its unique cephalosome and dorsal thoracic ornamentation, the oblique orientation of caudal rami and caudal setae V, and a P4 exopod-3 with the first outer spine modified.

Harpacticoid copepods from the Philippines have received little taxonomic consideration in recent years. Ito (1982, 1983) reported several new harpacticoid species of the families Cerviniidae, Thalestridae, and Ameridae from the abyssal waters of the Philippines off Mindanao. Huys (1993) erected a new family to accommodate a new species (*Styracothorax gladiator* Huys, 1993) from the abyssal waters of the Philippines. A new species of Ancorabolidae was reported by Baldari & Cottarelli (1987) from interstitial waters near Mindoro Island, and a new species of Paramesochridae was reported from interstitial, littoral waters off Palawan Island by Cottarelli & Altamura (1987).

Mr. Shane Hooton brought a sediment sample collected with SCUBA in the Philippines to our laboratory for identification of marine fauna. We sorted the harpacticoid copepods in the sample into at least eight species. Here we describe a remarkable new genus and species of harpacticoid copepod from the collection.

MATERIALS AND METHODS

Sediment was collected by hand using SCUBA in the Lingayen Gulf, near the town of San Fernando, Luzon, Philippines (17°00′N, 120°30′E) from 17 m depth, 24 December 1992. The water temperature was 30°C and visibility was 8 m. The sample was preserved in ethanol immediately following collection. We washed the sediment through a 500-μm sieve to separate macrofauna and added Rose Bengal to the meiofauna retained on a 63-μm sieve to facilitate

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sorting. All three specimens recovered from the sediment were covered with detritus.

Copepods were dissected in 85% lactic acid and dissected parts of the animals were placed in Hoyer's solution. Coverslips were sealed with clear fingernail polish. Illustrations were made with the aid of a camera lucida on a One-Ten Microstar® American Optics microscope and confirmed with a Laborlux 12® Leitz microscope. We adopted the terminology from Huys & Boxshall (1991). Abbreviations used throughout the text and figure legends are: P1–P6 for swimming legs 1–6; and exopod (or endopod) -1, -2, -3 to indicate the proximal, middle, and distal segment of each respective ramus. All figures are drawn from the holotype except where noted in figure legends.

Taxonomic Account

Family Laophontidae Scott, 1904

Elapholaophonte n. gen.

Diagnosis. This diagnosis should be regarded as preliminary because it is based only on the description of males of one species. Body almost cylindrical with no clear distinction between prosome and urosome. Rostrum large and elongated, fused to cephalothorax, with two sensillae and a median pore. Cephalothorax furnished with elaborate "antler-like" armature dorsally on its posterior border and extruded laterally with two spiniform cuticular processes. Ten spiniform extensions of cuticle ornament first five somites. Caudal rami directed outward with six setae (seta V strong). Antennula seven-segmented with complex ornamentation; with aesthetascs on segments IV and VII. Antenna with allobasis, apexopodal seta, and exopod (one-segmented, trisetose) present. Mandible with one-segmented palp. Maxillula with one-segmented bisetose exopod; endopod fused to basis represented by two setae. Maxilla with one-segmented endopod and two setae; precoxal endite present with one seta. Maxilliped with syncoxa furnished with two setae. P1 with two-segmented endopods and exopods. P2–P4 with three-segmented exopods and two-segmented endopods (or three-segmented for P3). P2 endopod-2 with four setae. P3 with an apophysis on endopod-2. Exopod-3 P4 with modified first outer spine. Exopod and baseoendopod of P5 with four and two setae, respectively. P6, bisetose. Female and copepodites unknown.

Type species. Elapholaophonte decaceros n. gen, n. sp.

Additional other species. None.

Etymology. The generic name is derived from the Greek word *elaphos* (deer) and *Laophonte*, the root word of the family Laophontidae, and refers to the "deer-like" armature of the cephalothorax. Gender: Masculine.

Elapholaophonte decaceros n. gen., n. sp.

Description (male). Length of holotypic male from tip of rostrum to posterior edge of caudal rami 614 μm; maximal width of cephalothorax 196 μm (Fig. 1A, B). Body slender, slightly tapering posteriorly; prosome-urosome articulation indistinct. Rostrum and cephalothorax equal in length to three succeeding somites (Fig. 1A, B). First pedigerous somite fused to cephalosome (Fig. 2A).

Cephalothorax with v-shaped ridge and scattered hair-like setae on surface; an elaborate extension, divided into four basally connected branched elements at its dorsal posterior edge extending posteriorly over the first somite (Fig. 3A). Setule on middle lobe of each outer element. Two outermost and innermost elements of cephalothoracic extension with three and two lobes, respectively; outermost elements and innermost elements each mutually symmetrical. Cephalothorax laterally broadened in two spiniform extensions ornamented with sensilla (Fig. 3B). First five somites expanded in spiniform processes ornamented with setules (Fig. 3C). In dorsal view, spiniform processes directed outward at approximately 45° to body axis. All somites except penultimate with sensilla on posterior border (anal somite with two sensilla on mid-surface) (Fig. 1A). Urosomal somites with minute spinules on dorsal posterior border. Urosomite 2 ornamented with ventroposterior row of spinules terminating near P6 lobe, with sensillum on outer side of each lobe. Urosomites 3 and 4 with approximately 15 stout spinules confined by sensilla and slender spinules; urosomite 4 with additional row of seven spinules of various sizes medially (Fig. 2B). Urosomite 5 with row of spinules. Anal somite furnished with two sensilla on dorsal surface; anal operculum furnished with rows of fine spinules. Ventrally, anal somite ornamented with long hyaline tube from pore and row of spinules near basis of each caudal ramus (Fig. 4A). Caudal rami approximately five times longer than wide, directed laterally and obliquely; with row of spinules on base of caudal setae ventrally and a pore mid-laterally (Fig. 4B). Anterolateral accessory seta (I) absent; setae II and III simple and slender, terminal seta IV simple and slender; terminal seta V strong, distally spinulated, directed downwards; accessory seta VI slender; dorsal seta VII triarticulate.

Rostrum (Fig. 5A): Fused to cephalothorax, longer than first segment of antennule, with two sensilla laterally. Median pore medially and conspicuous pore posteriorly near basis of rostrum.

Antennule (Fig. 5A): Seven-segmented, sub-chirocer with complex ornamentation. Segment I, longer than wide, with four rows of spinules and simple seta at anterior distal corner. Segment II, longer than wide, with rows of spinules at anterior proximal corner and posterior edge, six simple setae directed anteriorly and three directed posteriorly; originate near thorn-like process medially at posterior edge. Segment III almost quadrate, with seven simple setae (Fig. 5B). Segment IV highly inflated with 12 setae (one pinnate), strong spine at posterior edge and an aesthetasc; two of setae and aesthetasc originating from process on dorsal side of segment (Fig. 5C). Segment V small, naked. Segment VI, the smallest segment, with simple seta (Fig. 5D). Segment VII, anguiform with aesthetasc and simple seta near distal posterior edge, five naked biarticulate setae on anterior edge, and three setae on posterior edge (Fig. 5D). Posterior edge of segments VI and VII complexly folded (Fig. 5D).

Antenna (Fig. 6A): Coxa with three rows of spinules on anterior and posterior surfaces. Allobasis with pinnate seta and rows of spinules and row of stout spinules on apexopodal surface. Exopod one-segmented, reduced, with three small terminal setae. Endopod with rows of spinules on anterior and posterior distal surfaces; segment bearing two stout subterminal spines and thin seta on anterodistal margin, three terminal geniculate setae and two strong terminal apically curved spines.

Mandible (Fig. 6B, C): Coxa well developed. Gnathobase with three bidentate teeth, a tridentate tooth and two setae (shorter seta pinnate). Basis three times longer than wide with one simple subterminal and one pinnate terminal seta. Endopod one-segmented with three simple terminal setae. Exopod absent.

Maxillula (Fig. 6D): Precoxa with row of spinules laterally; arthrite furnished with transverse and longitudinal row of spinules, six recurved spines, pinnate seta on distal surface and one seta subterminally. Coxa without epipodite; endite with transverse row of spinules, curved spine and simple seta on distal surface. Basis with three distal setae, one pinnate; endopod represented by simple and pinnate subterminal seta. Exopod one-segmented with two terminal pinnate setae.

Maxilla (Fig. 6E): Precoxa with four rows of spinules on proximal and distal surface; endite with simple seta. Coxa with two endites; proximal endite with transverse row of spinules, pinnate seta and a fused strong pinnate spine; distal endite with two pinnate setae. Basis with strongly curved claw and two terminal pinnate setae. Endopod one-segmented with two setae, one simple and one pinnate.

Maxilliped (Fig. 6F): Prehensile. Coxa with row of spinules on anterior surface and row of spinules near basis of two pinnate setae on distal surface. Basis ovoid. Endopod one-segmented, bearing claw longer than basis and small accessory seta.

P1 (Fig. 7A): Endopod prehensile. Intercoxal sclerite well developed, elongated with no ornamentation. Precoxa triangular with row of spinules at distal surface. Coxa with 3–4 rows of spinules. Basis as long and wide as coxa with longitudinal row of stout spinules, row of spinules on basis of outer seta, and inner pinnate seta. Exopod two-segmented with proximal segment equipped with row of spinules on basis of outer pinnate spine; distal segment with three subterminal simple spines on outer surface and two terminal geniculate setae. Endopod two-segmented with proximal segment twice as long as exopod; distal segment ornamented with row of spinules on outer surface, strong claw, and minute setule.

P2–P4 (Figs. 7B, 8A, B–D): Intercoxal sclerites well developed, with no ornamentation. Precoxae triangular with row of minute spinules distally. Coxae with row of spinules near and on outer surface. Basis with long simple seta originating from process on outer surface and row of spinules on inner surface of P3. Long hyaline tubes of P2 endopod-2 and basis of P2 and P4. Exopods three-segmented and endopods two-segmented (P2, P4) or 3-segmented (P3). Exopodal spines stout and ornamented with minute spinules. First outer spine of distal segment of P4 modified, stout, blunt. Exopodal setae long, slender, plumose. Endopodal setae usually long, slender and plumose. Plow-shaped terminal apophysis on P3 endopod-2 (Fig. 8C). Setal formula is as follows:

	Exopod	Endopod
P2	0.1.123	0.220

P3	0.1.223	0.0*.022
P4	0.1.223	0.120

* An apophysis is present on P3 endopod-2 distally.

P5 (Fig. 3D): Basal seta simple, originating from cylindrical process. Long hyaline tube from pore originating between basal seta and exopodal plate. Baseoendopod and exopod well separated. Baseoendopodal lobe small, fused to basis, with two long pinnate setae. Exopod one-segmented with a row of spinules and four setae; two setae are ornamented.

P6 (Fig. 3E): Symmetrical, each lobe fused with supporting somite and two setae.

Female. Unknown.

Variation. None.

Type specimens. Three males. One male holotype dissected on four slides (USNM No. 266543). Paratypes: one specimen dissected on three slides, and one intact specimen preserved in 70% alcohol (USNM No. 266544).

Type locality. Lingayen Gulf, near town of San Fernando, Luzon, Philippines (17°00′N, 120°30′E), depth 17 m. Substrate was characterized by coarse sand and broken mollusc shells.

Etymology. The specific name is derived from the Greek words *deca* (ten) and *ceros* (horn), referring to the 10 horn-like extensions on the dorsal surface of the prosomites and the first two urosomites of the copepod.

Discussion

Elapholaophonte decaceros possesses all apomorphies proposed by Huys (1990) for the superfamily Laophontoidea: a thorn-like process on the second segment of the antennule, the presence of an apexopodal seta on the allobasis of the antenna, two-segmented P2–P4 endopods (males may have a three-segmented P3), and an apophysis on the P3 endopod of the male. However, asymmetry of the P6 was not observed.

Elapholaophonte decaceros because of its armature superficially resembles copepods from the family Ancorabolidae. Also, orientation of the caudal rami and setae of *E. decaceros* is similar to that of *Ancorabolus mirabilis* Norman, 1903. However, the presence of the antennary exopod, a seven-segmented antennule, the three outer spines on the distal segment of P1 exopod (the third spine belongs to the fused middle segment), two geniculate setae on the same ramus, a strong claw and a minute setule present on the second segment of P1 endopod, and the absence of the proximal endite in the maxillula, indicate unequivocally the taxonomic position of *E. decaceros* in the family Laophontidae. *E. decaceros* bears a trisetose antennular exopod, which is a rare condition in Laophontidae. Huys (1990) indicated that although a one-segmented quadrisetose exopod is an apomorphy for the superfamily Laophontoidae, some exceptions are found in the family Laophontidae, as in *Heterolaophonte serratula* Mielke, 1981, *H. discophora* (Willey, 1929), and *Asellopsis intermedia* (T. Scott, 1895) with two, three, and three setae, respectively. The antennary exopod of *E. decaceros* is degenerative as in *H. discophora*.

The ornamentation of the cephalothorax and body somites distinguishes *Elapholaophonte* from other genera of the Laophontidae. Although members of the genus *Echinolaophonte* Nicholls, 1941 are ornamented with conspicuous armature, the differences between these two genera are overwhelming.

Echinolaophonte spp. have a large posteriorly directed spine on the cephalothorax and two or more spines on each succeeding somite. The cephalothorax of *Elapholaophonte decaceros* is extended posteriorly in an intricate system of chitinous, sclerotized processes, and only the first five free somites are ornamented with coniform spinous extensions. The origin of the complex ornamentation of *E. decaceros* is at the posteriodorsal margin of the cephalothorax, in contrast to the spines of *Echinolaophonte* which originate middorsally on the cephalothorax. Also, the origins of the spiniform extensions of the somites of *E. decaceros* are dorsolateral instead of middorsal as in *Echinolaophonte*.

The dorsal spines or processes of *Echinolaophonte* are adaptations for a peculiar life style which is unique in the Laophontidae (Fiers, 1991). Because the three specimens of *Elapholaophonte decaceros* we examined were covered with detritus that was difficult to remove, we postulate that the spinous extensions of *E. decaceros* serve similar functions as in *Echinolaophonte*; i.e., traps to accumulate material on the surface of the copepod (Fiers, 1991). A related, but peculiar, character of *E. decaceros* is the occurrence of long hyaline tubes on the swimming legs and anal somite. Hyaline tubes are an uncommon character of the family Laophontidae, but they have been observed in the closely related family Ancorabolidae (Fiers, 1988; Schizas & Shirley, in manuscript). Fiers (1988) proposed that the hyaline tubes were adaptations of the secretorial system that accumulate the layers of exogenous material between the lateral expansions of the somites. Our observations of the three detritus-coated specimens of *E. decaceros* support Fiers' hypothesis.

The greatly elongated basis of the P1 is a diagnostic character of the genus *Echinolaophonte* (Fiers, 1991). In *Elapholaophonte decaceros,* the basis of P1 is slightly longer than wide and resembles the basis of the genera *Onychocamptus* Daday, 1903 and *Kleionychocamptus* Noodt, 1958 and of several members of *Paralaophonte* Lang, 1948; e.g., *P. hyperborea* (Sars, 1909) and *P. perplexa* (T. Scott, 1898). Also, the setation of swimming legs P3 and P5 of *E. decaceros* is similar to some members of the heterogeneous genus *Laophonte*; e.g., *L. cornuta* Philippi, 1840.

Elapholaophonte decaceros and the "horrida" group of *Echinolaophonte* erected by Cottarelli et al. (1992) have the same type of sexual dimorphism on the male P3 endopod. However, the following characters possessed by *E. decaceros* may be used as evidence against its close relationship with the "horrida" group: (1) elongated rostrum; (2) trisetose mandibular endopod; (3) P5 bisetose endopod; (4) four setae for *E. decaceros* vs. maximum of three setae on P2 endopod-2 for "horrida" species; (5) presence of a modified outer spine on P4 exopod-3; and (6) overall shape of caudal rami and caudal seta V, which are directed obliquely.

Evidently, *Elapholaophonte decaceros* cannot be assigned to the genus *Echinolaophonte* or any of the other laophontid genera because of its remarkable armature. However, the chaetotaxy of *E. decaceros* is not unique in the Laophontidae (except the blunt spine on P4 exopod-3) and is similar to that of the genera *Onychocamptus, Kleionychocamptus* and *Paralaophonte.*

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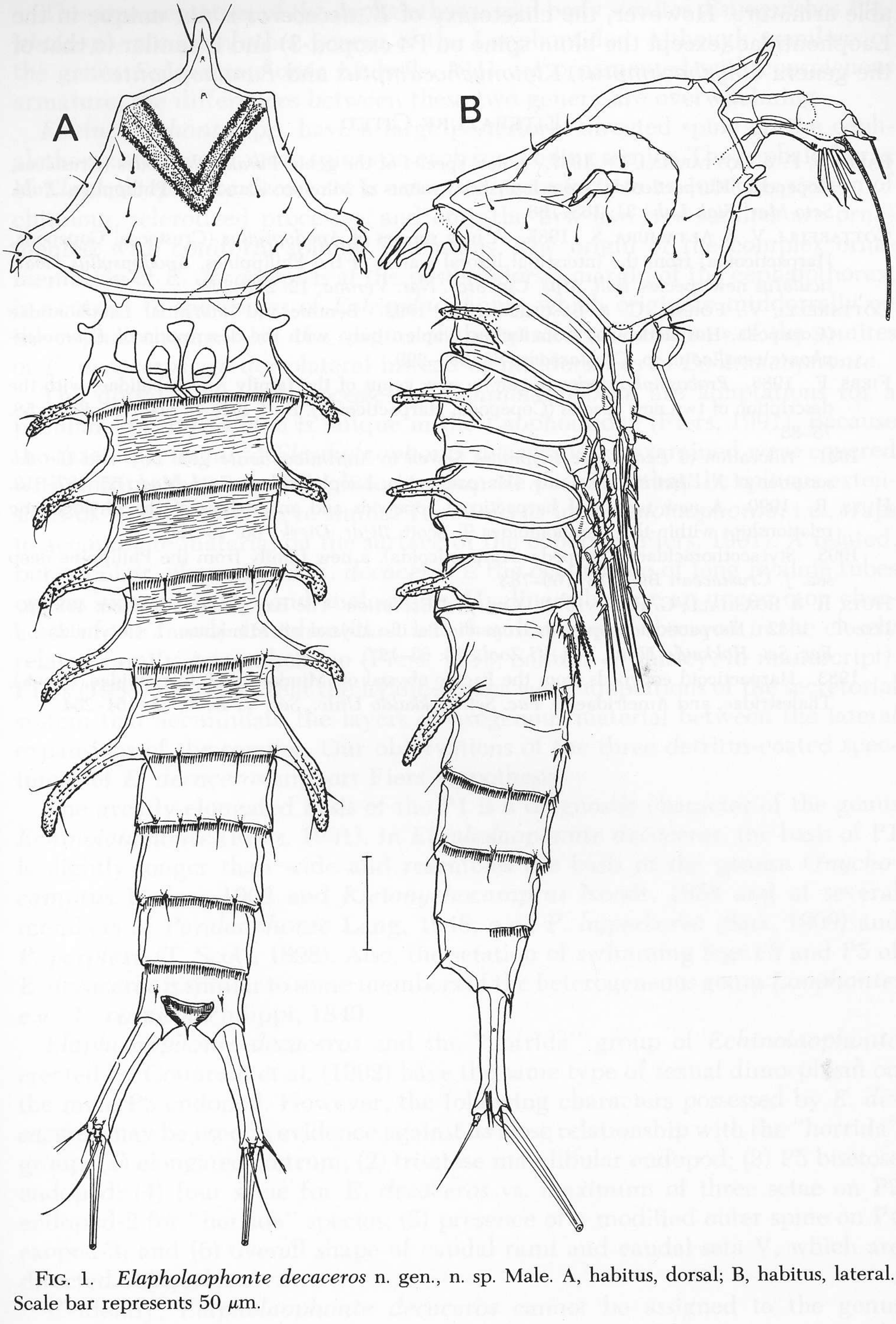

FIG. 1. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, habitus, dorsal; B, habitus, lateral. Scale bar represents 50 μm.

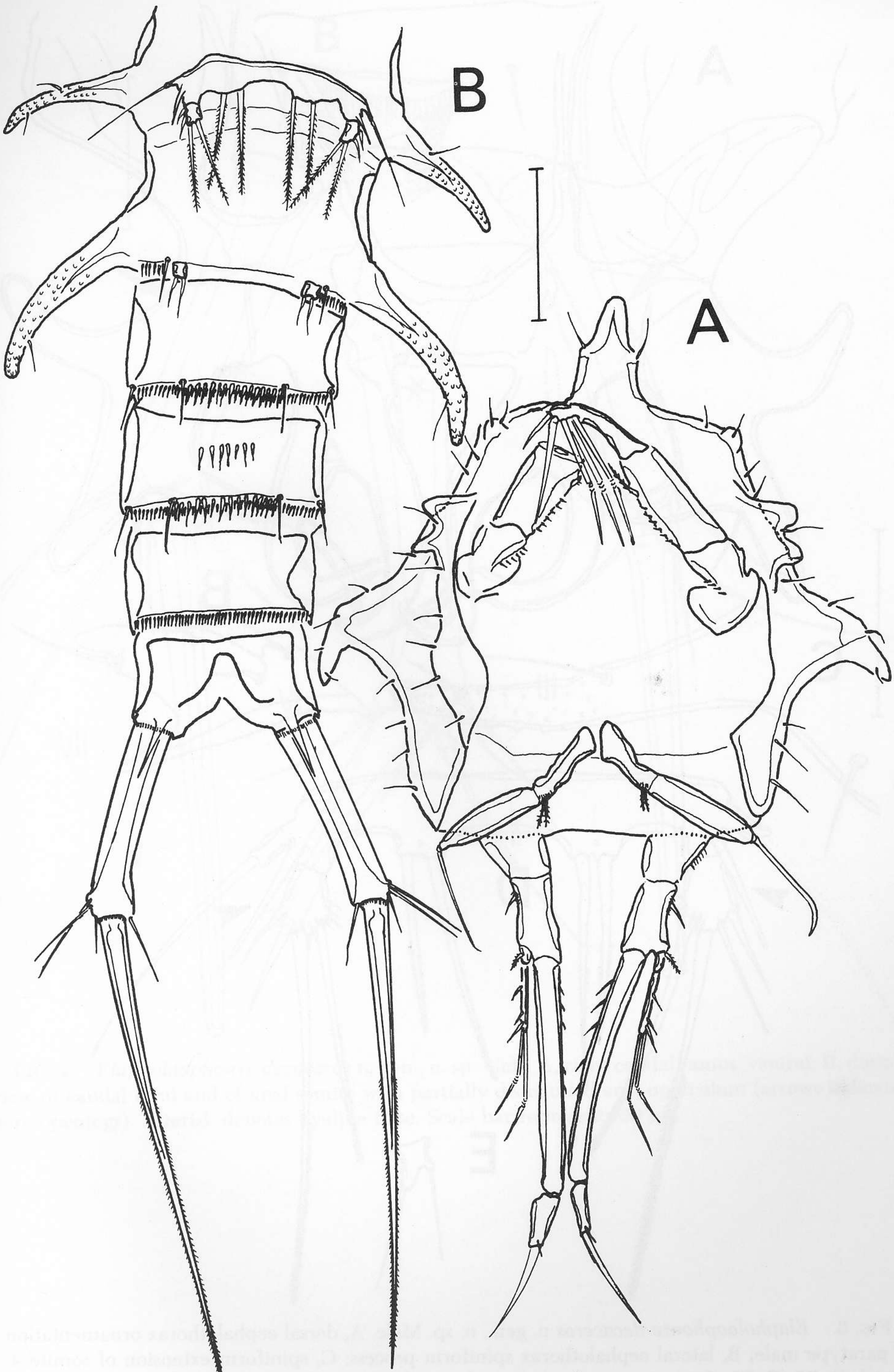

FIG. 2. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, cephalothorax, ventral; B, urosome of paratype male, ventral. Scale bar represents 50 μm.

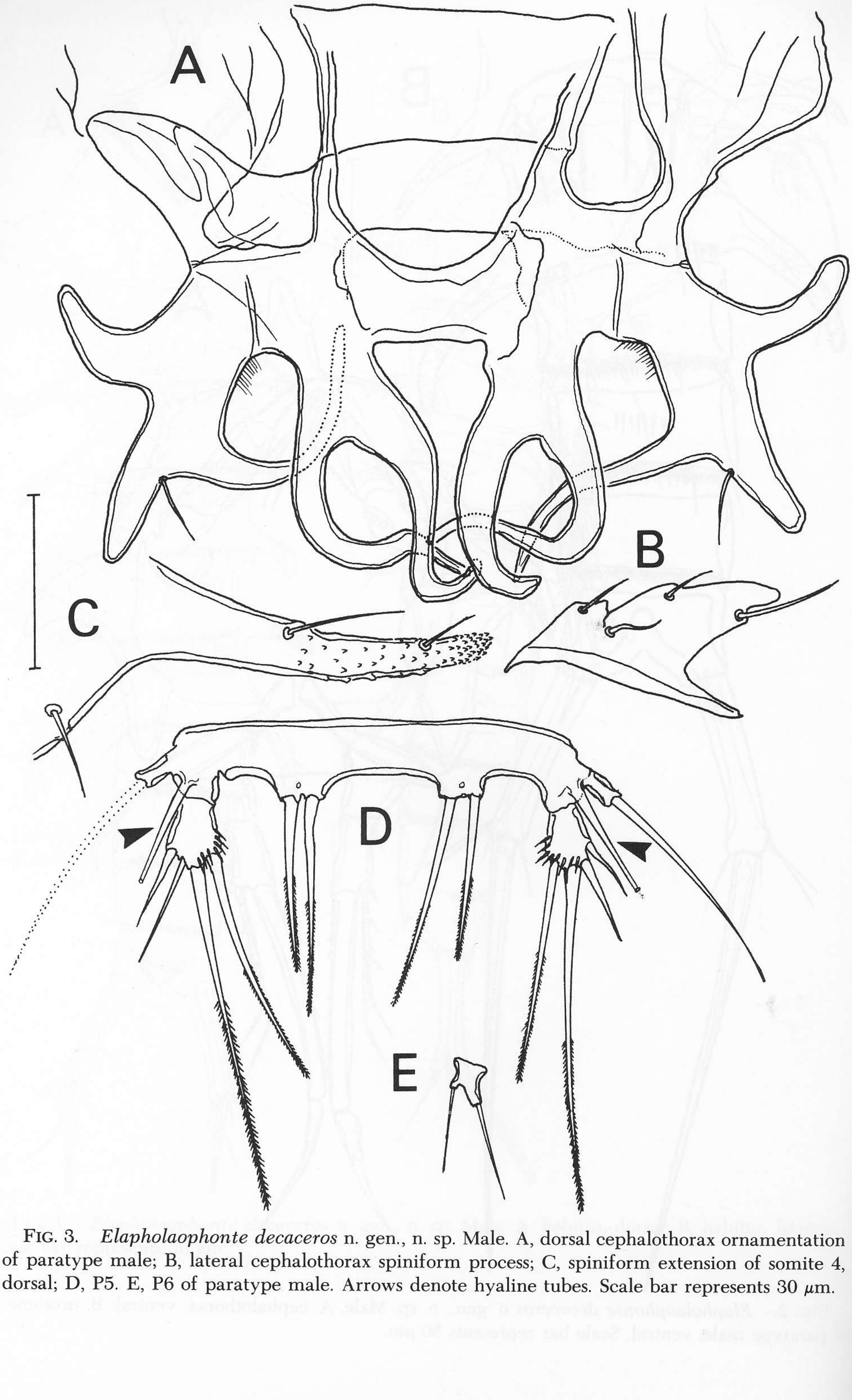

FIG. 3. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, dorsal cephalothorax ornamentation of paratype male; B, lateral cephalothorax spiniform process; C, spiniform extension of somite 4, dorsal; D, P5. E, P6 of paratype male. Arrows denote hyaline tubes. Scale bar represents 30 μm.

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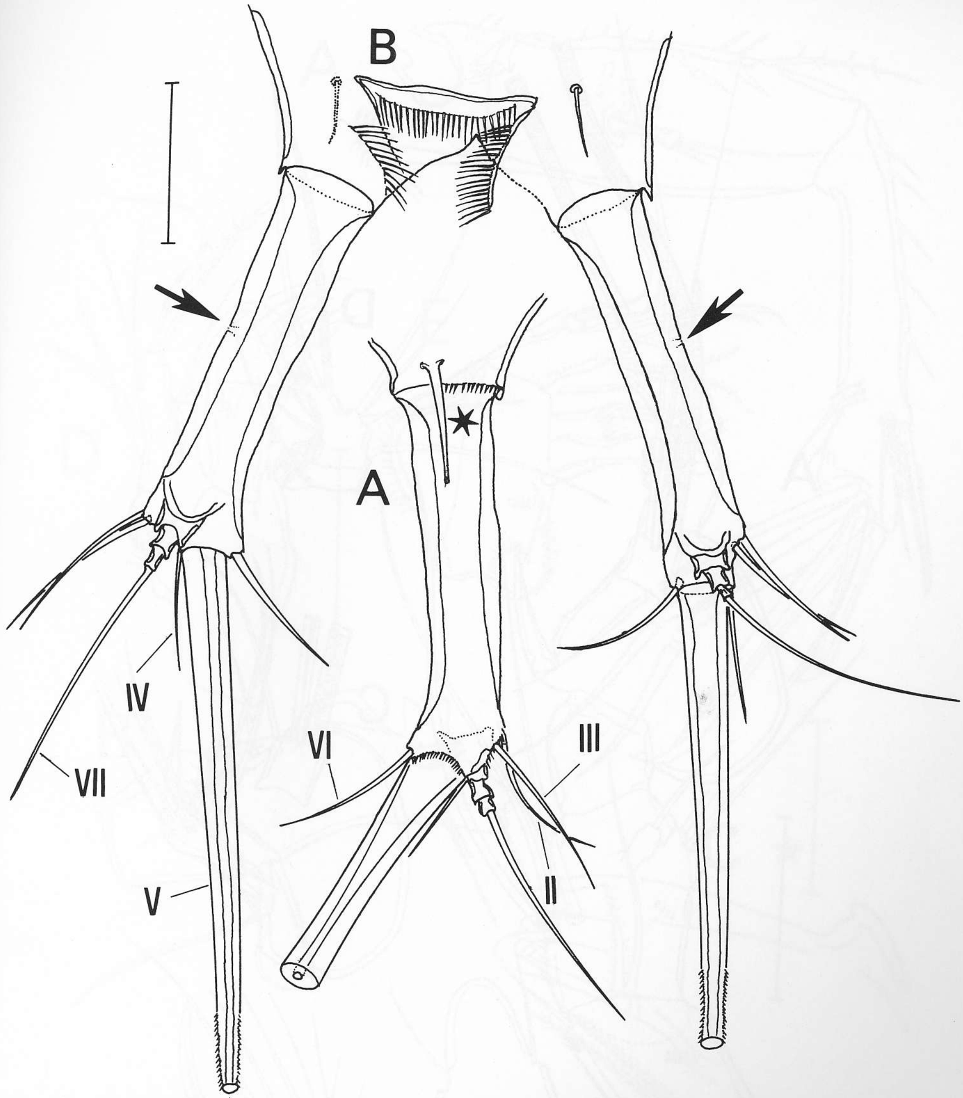

FIG. 4. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, right caudal ramus, ventral; B, dorsal view of caudal rami and of anal somite with partially dismantled anal operculum (arrows indicate pore openings). Asterisk denotes hyaline tube. Scale bar represents 30 μm.

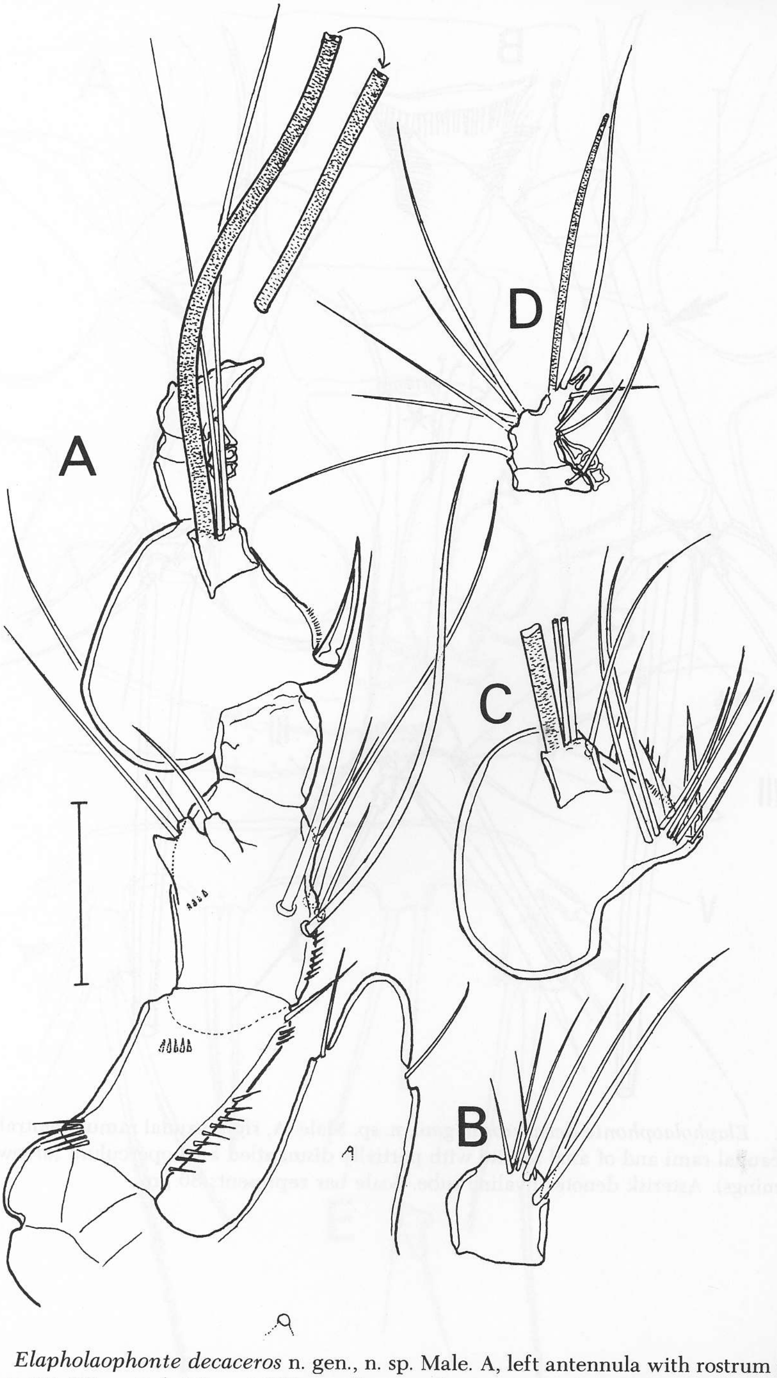

FIG. 5. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, left antennula with rostrum (setation of segments III, IV partial; VI and VII not illustrated); B, antennule segment III; C, antennule segment IV; D, antennule segments VI and VII. Scale bar represents 30 μm.

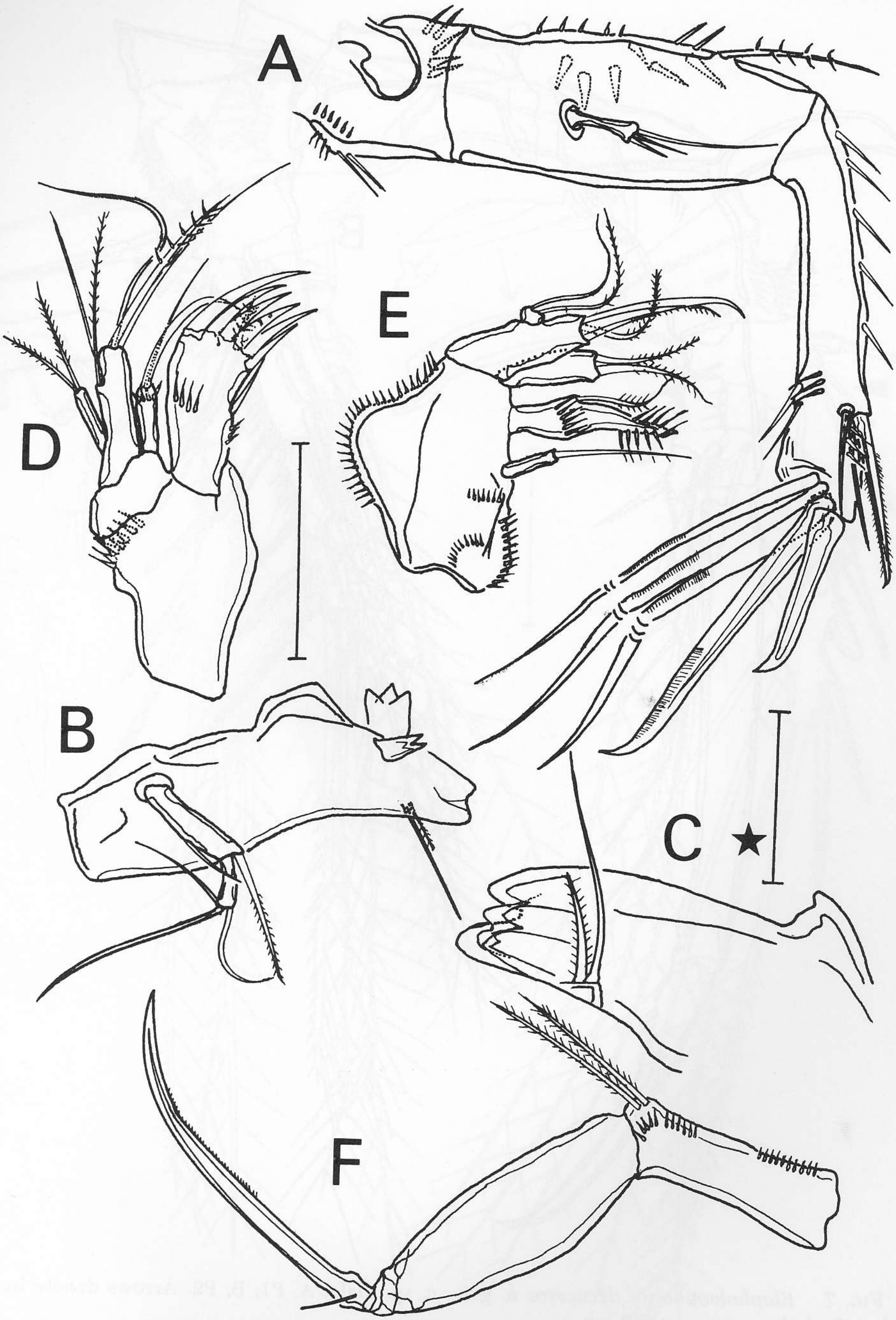

FIG. 6. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, antenna; B, mandible (bidentate and tridentate teeth were distorted during mounting and are correctly illustrated in C); C, mandible of paratype male; D, maxillula; E, maxilla; F, maxilliped. Star indicates that the scale bar for C represents 10 μm, but all others represent 30 μm.

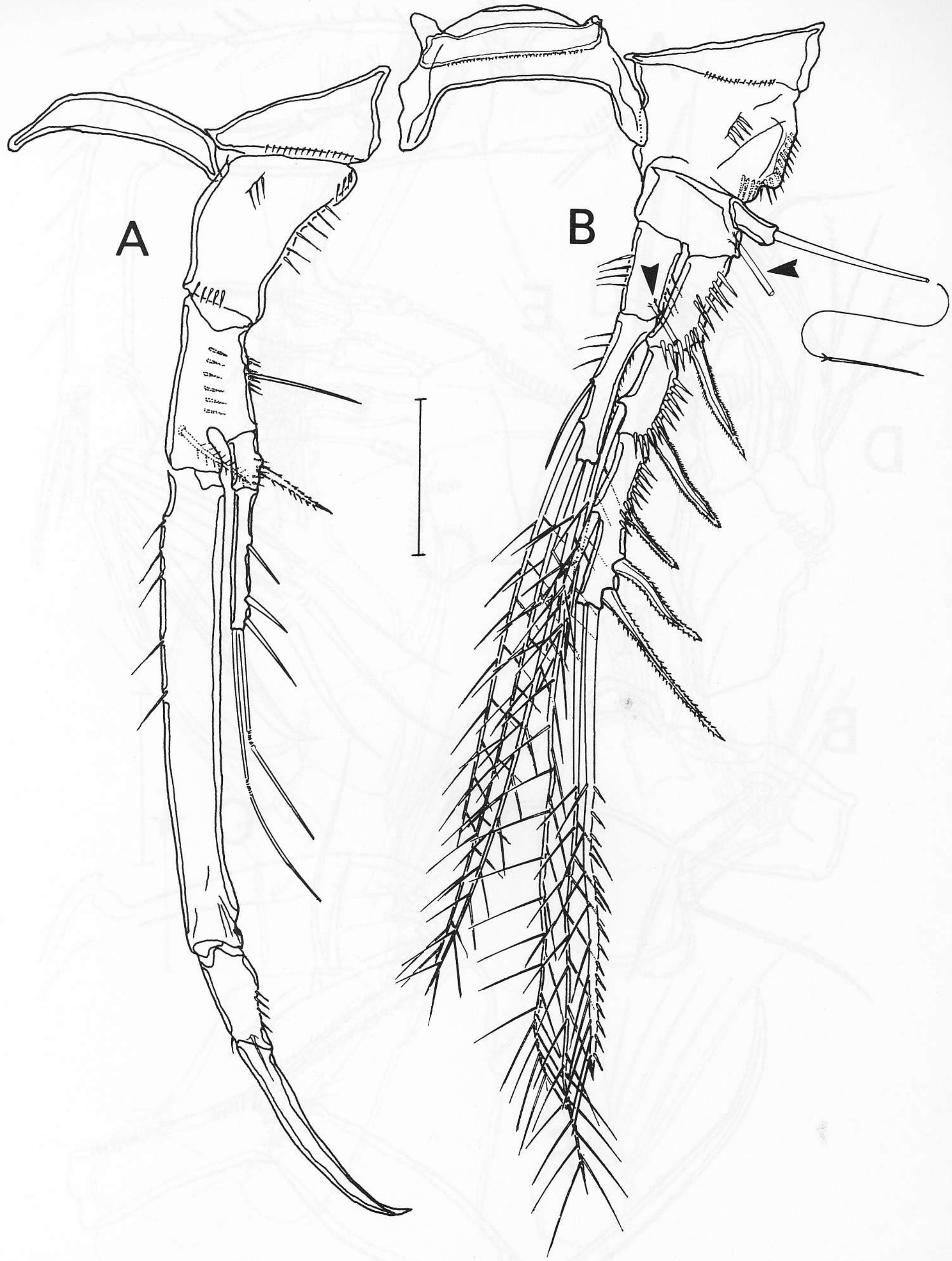

FIG. 7. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, P1; B, P2. Arrows denote hyaline tubes. Scale bar represents 30 μm.

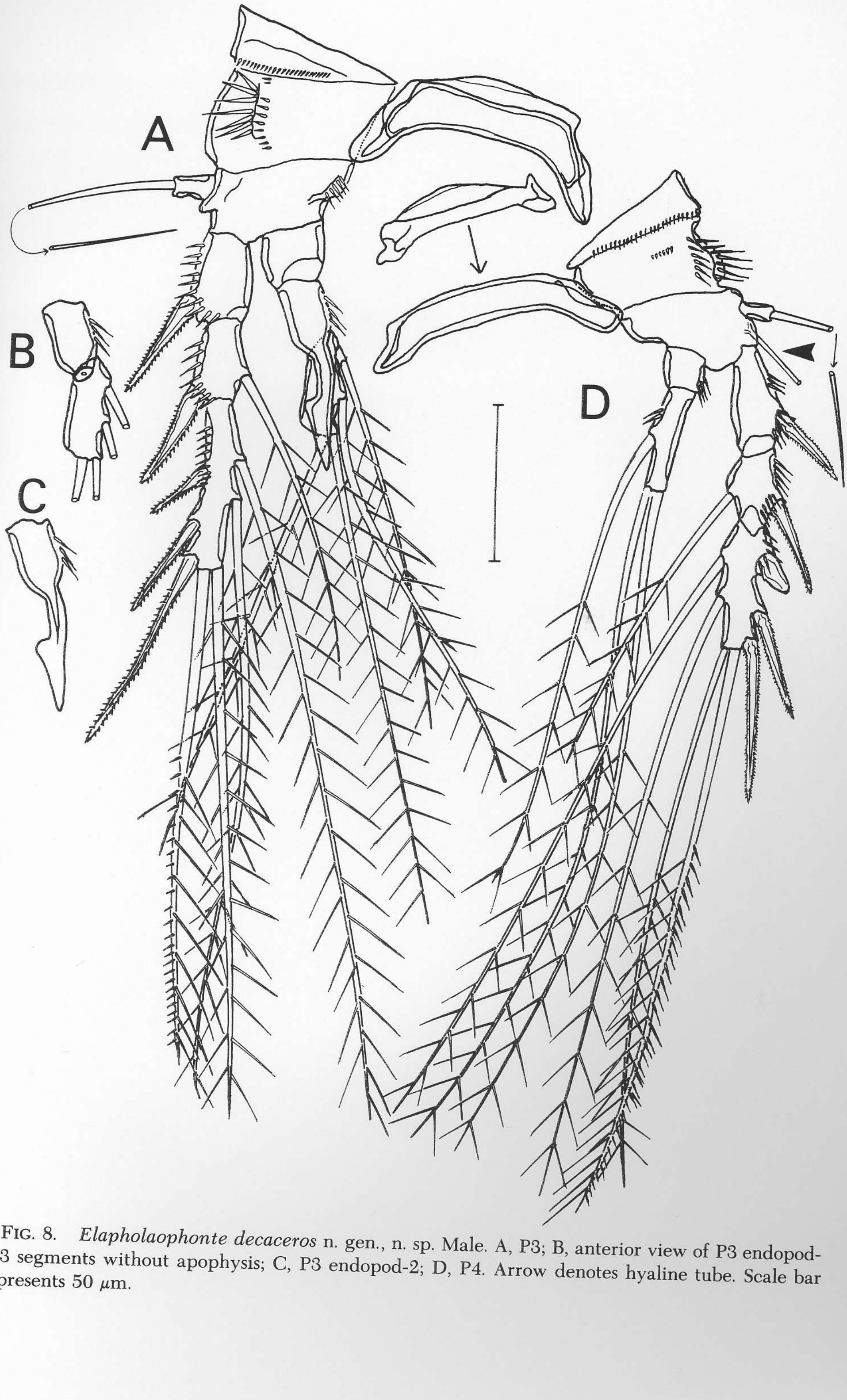

FIG. 8. *Elapholaophonte decaceros* n. gen., n. sp. Male. A, P3; B, anterior view of P3 endopod-2–3 segments without apophysis; C, P3 endopod-2; D, P4. Arrow denotes hyaline tube. Scale bar represents 50 μm.