

A revision of *Cylinula* and two new species of *Cylindropsyllus* (Copepoda, Harpacticoida, Cylindropsyllidae)

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Males of two new species of *Cylindropsyllus* Brady, 1880 (Cylindropsyllidae) are described. *Cylindropsyllus ibericus* sp. n. is based on a single specimen from Portugal previously misidentified as *C. laevis* Brady, 1880; *C. govaerei* sp. n. is reported from Corsican shell-gravel. The boreo-mediterranean distribution of *C. laevis* is confirmed and a key to the species of *Cylindropsyllus* is presented. Redescriptions are provided for the two species of *Cylinula* Coull, 1971, the type species *C. proxima* Coull, 1971 and *C. arganoi* Cottarelli and Venanzetti, 1989. The relationships of *Cylindropsyllus*, *Cylinula* and *Evansula* Sars, 1909 are briefly discussed.

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Introduction

The nominate subfamily Cylindropsyllinae Sars currently accommodates the interstitial genera *Cylindropsyllus* Brady, 1880, *Stenocaris* Sars, 1909, *Evansula* T. Scott, 1906, *Cylinula* Coull, 1971, *Boreopontia* Willems, 1981 and *Stenocaropsis* Apostolov, 1982.

A recent revision of the type genus was published by Huys (1988), recognizing three species, *C. laevis* Brady, 1880, *C. remanei* Kunz, 1949, and *C. kunzi* Huys, 1988. The latter species is only known from a single shallow subtidal locality off the Dutch Delta region. Compilation of all published records of *C. laevis*, excluding the doubtful record from North America (Coffin 1981), results in a typical European boreo-mediterranean distribution pattern, whereas *C. remanei* is essentially restricted to north-western Europe with a single outlier in Portugal (Huys 1988). The latter record (Wells & Clark 1965) was based on intertidal material from the Praia do Norte and Praia de Banhos adjacent to Peniche; however, the single male deposited in the collections of The Natural History Museum proved upon inspection to belong to a new species closely related to *C. laevis*. This, and the fact that a further new species of *Cylindropsyllus* has been encountered in the course of examining the interstitial copepod fauna from Corsica (Mediterranean), raise the possibility that the French Mediterranean records of *C. laevis* (Bodin 1968; Soyer 1971; Bodiou & Soyer 1973) are also based on misidentifications. Re-examination of two specimens collected from Marseille and kindly placed at our disposal by Dr Bodin, however, confirms that the distri-

bution of this species extends at least to the western Mediterranean.

In his study on the meiobenthic Harpacticoida from the North Carolina continental shelf, Coull (1971) proposed the genus *Cylinula* to accommodate a new cylindropsyllid which appeared to be intermediate between *Cylindropsyllus* and *Evansula*. Only very recently (Cottarelli & Venanzetti 1989), a second species, *C. arganoi*, also described from the Mediterranean, was added to the genus.

This paper adds an update to the recent revision of *Cylindropsyllus* (Huys 1988), including the description of two new species and a key to the species, and presents a revision of the genus *Cylinula* based on the types of *C. proxima* and new material of *C. arganoi* collected by one of us (KAW) from Corsican shell-gravel.

Material and methods

Specimens were dissected in lactic acid and the dissected parts were placed in polyvinyl lactophenol (*C. govaerei*, *C. arganoi*) or lactophenol (*C. ibericus*, *C. proxima*) mounting medium. Preparations were sealed with glyceel (Gurr[®], BDH Chemicals Ltd, Poole, England). All drawings have been prepared using a camera lucida on a Leitz Dialux 20 or Leitz Diaplan differential interference contrast microscope. The descriptive terminology is adopted from Huys & Boxshall (1991).

Abbreviations used in the text and figures are P1–P6 for thoracopods 1–6; exp(enp)-1 (-2, -3) to denote the proximal (middle, distal) segment of a ramus.

Institutes and museums are indicated by the following abbreviations: BMNH (The Natural History Museum, London), STARESO (Station de Recherches Sous-Marines et Océanographiques, Calvi), KBIN (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels), USNM (National Museum of Natural History, Smithsonian Institution, Washington, D.C.).

Systematics

Family CYLINDROPSYLLIDAE

Genus *Cylindropsyllus* Brady, 1880*Cylindrosoma* Brady, 1878***Cylindropsyllus ibericus* sp. n. (Figs 1–2)**

Type material. Holotype male labelled *C. remanei*, mounted *in toto* on slide; deposited in BMNH, reg. No. 1964.12.1.14.

Type locality. Portugal, Atlantic coast, Peniche; exposed oceanic beach (Praia do Norte or Praia de Banhos; not specified on slide); littoral sand; July 1964, leg. J. B. J. Wells.

Etymology. The species name alludes to the Iberian peninsula.

Description

Male. Body length 645 μm measured from tip of rostrum to posterior margin of caudal rami. Body slender (Fig. 1A), cylindrical, brownish-yellow; no distinct separation between prosome and urosome. Anal somite 1.5 times as long as wide (85 \times 55 μm). Caudal ramus (Fig. 1B) about twice as long as maximum width; with 6 setae (seta I absent) and 2 pores; seta VII tri-articulate at base; seta V long, consisting of proximal styliform part and long, flagellate part distally, fused at base with seta IV.

Rostrum triangular, defined at base, not exceeding first antennular segment; with 2 sensillae.

Antennule indistinctly 9-segmented (Fig. 1C); geniculation between segments 7 and 8. Segment 1 with 1 small seta and 3 spinular rows; segment 2 longest, with 1 plumose and 8 naked setae; segment 3 with 6 setae (1 vestigial; arrowed in Fig. 1C); segment 4 an incomplete ring, only visible in dorsal aspect, with 2 setae; segment 5 slightly swollen, with 5 anterior setae and distal cylindrical process bearing large aesthetasc (67 μm) and 1 seta; segment 6 with 1 seta; segment 7 with 1 naked seta, 1 non-articulating spiniform process and 1 articulating knob (arrowed in Fig. 1C); segment 8 with spiniform process and spinulose knob (arrowed in Fig. 1C); segment 9 with 5 posterior setae, a distal trithec and 2 anterior setae.

Antenna (Fig. 1E, F) with small unarmed coxa; basis and first endopod segment complete fused to form allobasis, with tiny spinules along abexopodal margin; exopod an elongate segment with 2 apical setae; endopod with 2 lateral spines and distal armature consisting of 2 bipinnate spines, 2 geniculate setae and 1 large geniculate spine bearing spinules at about mid-margin and fused at base with vestigial seta.

Mandible, maxillule, maxilla and maxilliped as in *C. laevis* (see Huys 1988).

Swimming legs P1–P4 (Fig. 2A–D; viewed in lateral aspect) with 3-segmented exopods and 2-segmented endopods; intercoxal sclerites minute; praecoxae small unarmed sclerites; basis of P1 without outer seta; length of legs increasing in antero-posterior direction. Sexual dimorphism typical of the genus: (1) basis of P2 forming a recurved projection at inner distal corner (Fig. 2B), (2) distal exopod segment of P2 with inner margin extended to form a rounded process from which a big claw arises; inner margin of this claw with long setules along distal half and tiny spinules along distal half (Fig. 2B); (3) P3

endopod with short proximal segment drawn-out into inner barbed apophysis and distal segment bearing 2 long apical setae (Fig. 2C).

Seta and spine formulae as follows:

	Exopod	Endopod
P1	0.0.112	1.111
P2	0.0.022	1.010
P3	0.0.122	Modified
P4	0.0.122	0.110

Fifth pair of legs (Fig. 2E) minute, not fused medially, no intercoxal sclerite. Baseoendopod and exopod forming a semi-circular plate with 3 secretory pores on anterior surface and 5 setae plus a pinnate spine at distal margin.

Sixth pair of legs (Fig. 1D) asymmetrical; each plate with 3 setae, innermost shortest.

Female. Unknown.

***Cylindropsyllus govaerei* sp. n. (Figs 3–4)**

Type material. Holotype male dissected and mounted on 3 slides; deposited in BMNH, reg. No. 1992.1097.

Type locality. Mediterranean, Corsica, Bay of Calvi; collected by scuba-diving in front of STARESO; shell-gravel between *Posidonia* beds, depth 11 m; 24 July 1978, leg. K. A. Willems.

Etymology. This species is dedicated to our colleague and friend Dr Jan Govaere (KBIN).

Description

Male. Body length 940 μm measured from tip of rostrum to posterior margin of caudal rami. Body slender, cylindrical, brownish-yellow; no distinct separation between prosome and urosome. Anal somite 1.19 times as long as wide (100 \times 84 μm). Caudal ramus (Fig. 3H) about 1.3 times as long as maximum width; with 6 setae (seta I absent) and 3 pores; seta VII tri-articulate at base; seta V long, consisting of proximal styliform part and long, distal flagellate part, fused at base with vestigial seta IV.

Rostrum triangular, defined at base, slightly exceeding first antennular segment; with 2 sensillae; short tube pore arising from subapical ventral pore (Fig. 3D).

Antennule indistinctly 10-segmented (Fig. 3A–C); geniculation between segments 7 and 8. Segment 1 with 1 small seta and 2 spinular rows; segment 2 longest, with 1 plumose and 8 naked setae; segment 3 with 3 long and 4 short setae (1 fused at base); segment 4 a complete ring not discernible in ventral aspect, with 2 basally fused setae (Fig. 3B); segment 5 slightly swollen, with 5 anterior setae and distal cylindrical process bearing large aesthetasc (65 μm) and 1 seta; segment 6 with 1 seta; segment 7 with 4 setae, 2 being vestigial and spiniform (Fig. 3C); segment 8 with spiniform process and spinulose knob (Fig. 3C); segment 9 small, incompletely separated from segment 8, unarmed; segment 10 with 5 posterior setae, a distal trithec and 2 anterior setae.

Antenna (Fig. 3E) with small unarmed coxa; basis and first endopod segment incompletely fused to form allobasis, with tiny spinules along abexopodal margin; exopod an elongate segment with 2 apical setae; endopod with 2 lateral spines and distal armature consisting of 2 bipinnate spines, 2 geniculate setae and 1 large geniculate spine bearing spinules at about mid-margin and fused at base with vestigial seta.

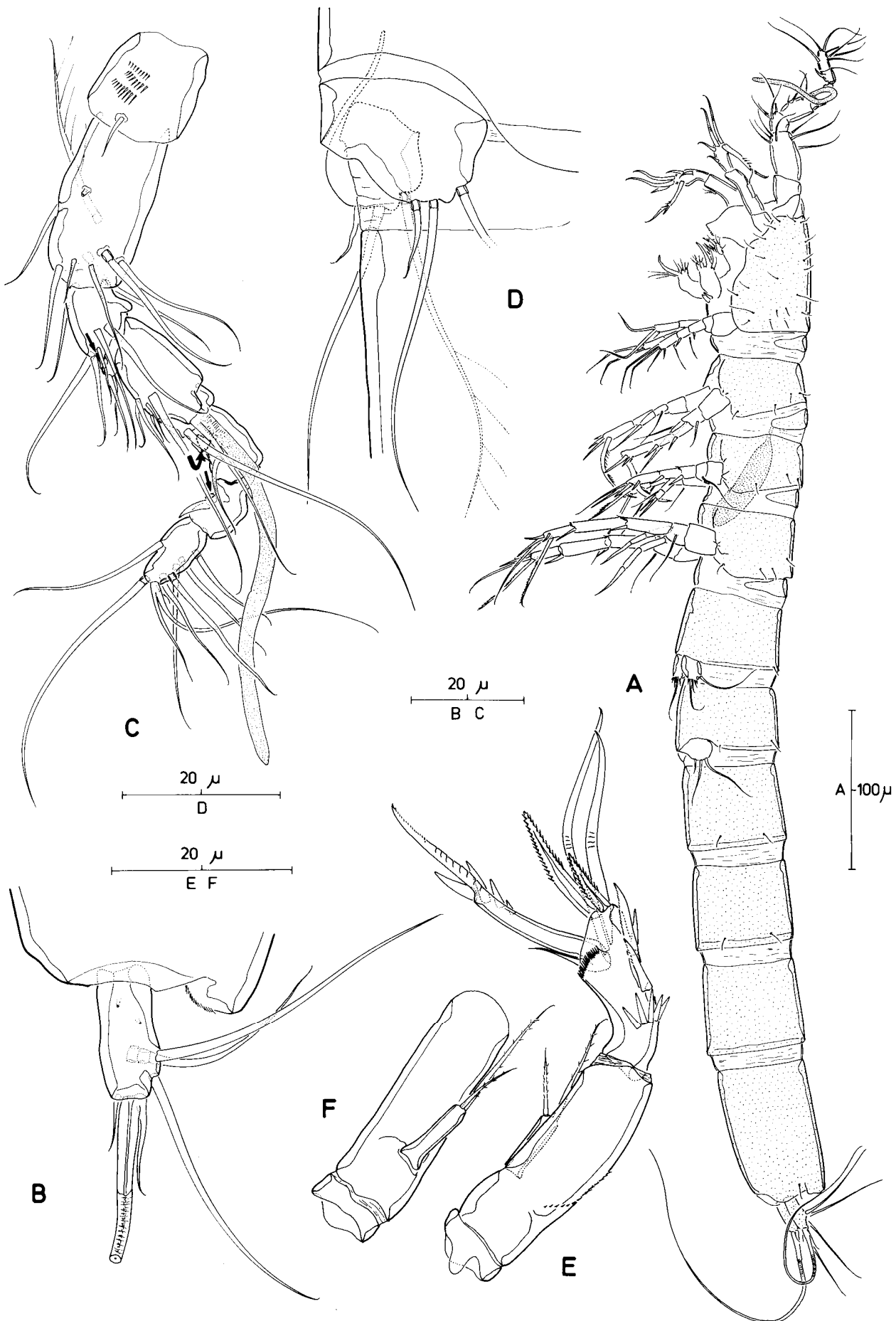


Fig. 1. *Cylindropsyllus ibericus* sp. n. (♂).—A. Habitus, lateral.—B. Caudal ramus and posterior margin of anal somite, lateral.—C. Antennule.—D. Sixth pair of legs, lateral.—E. Antenna, inner.—F. Antennary coxa and allobasis, outer.

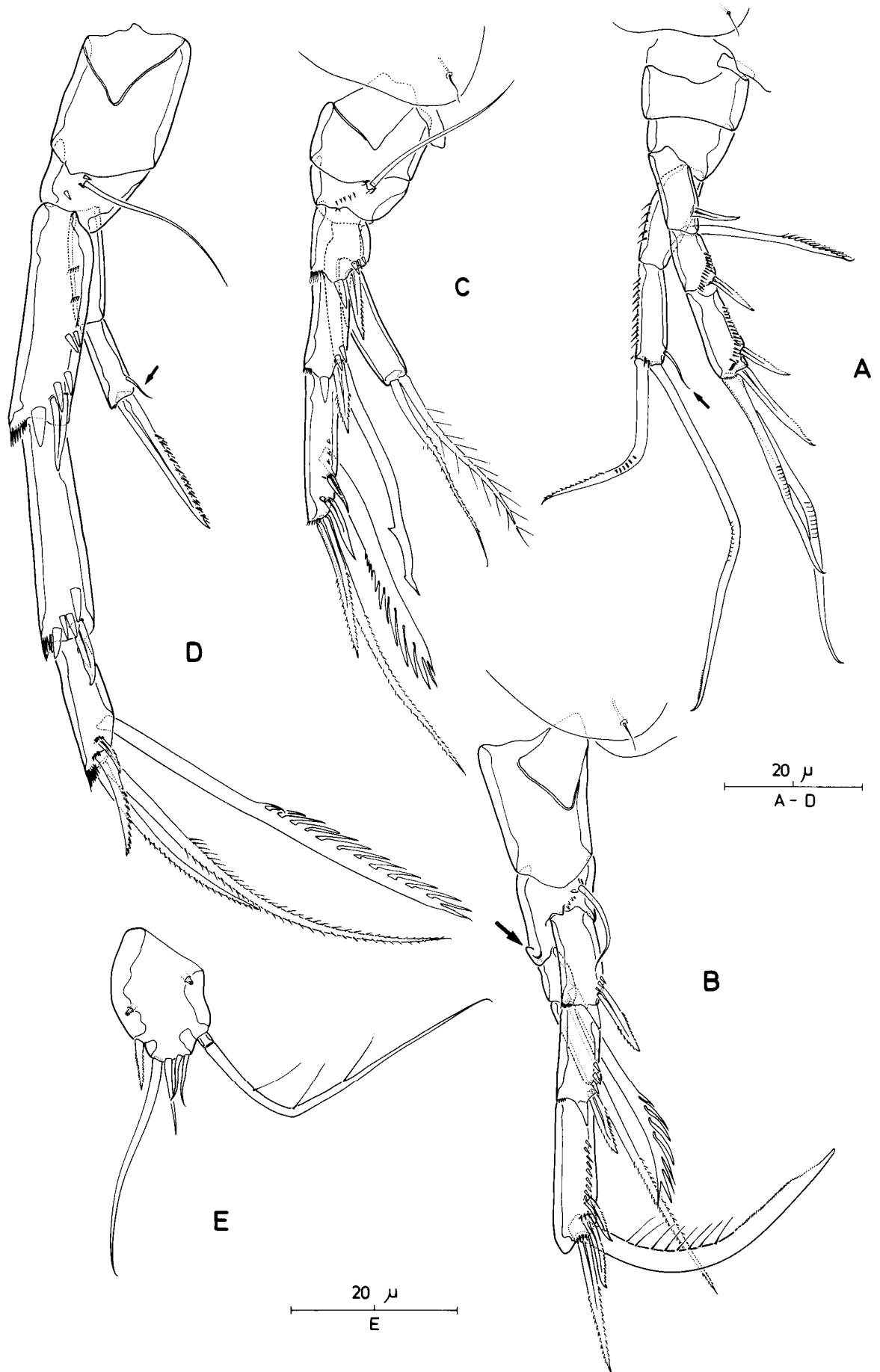


Fig. 2. *Cylindropsyllus ibericus* sp. n. (δ).—A. P1, lateral (small seta arrowed).—B. P2, lateral (sexually dimorphic process on basis arrowed).—C. P3, lateral.—D. P4, lateral (small seta arrowed).—E. P5, anterior.

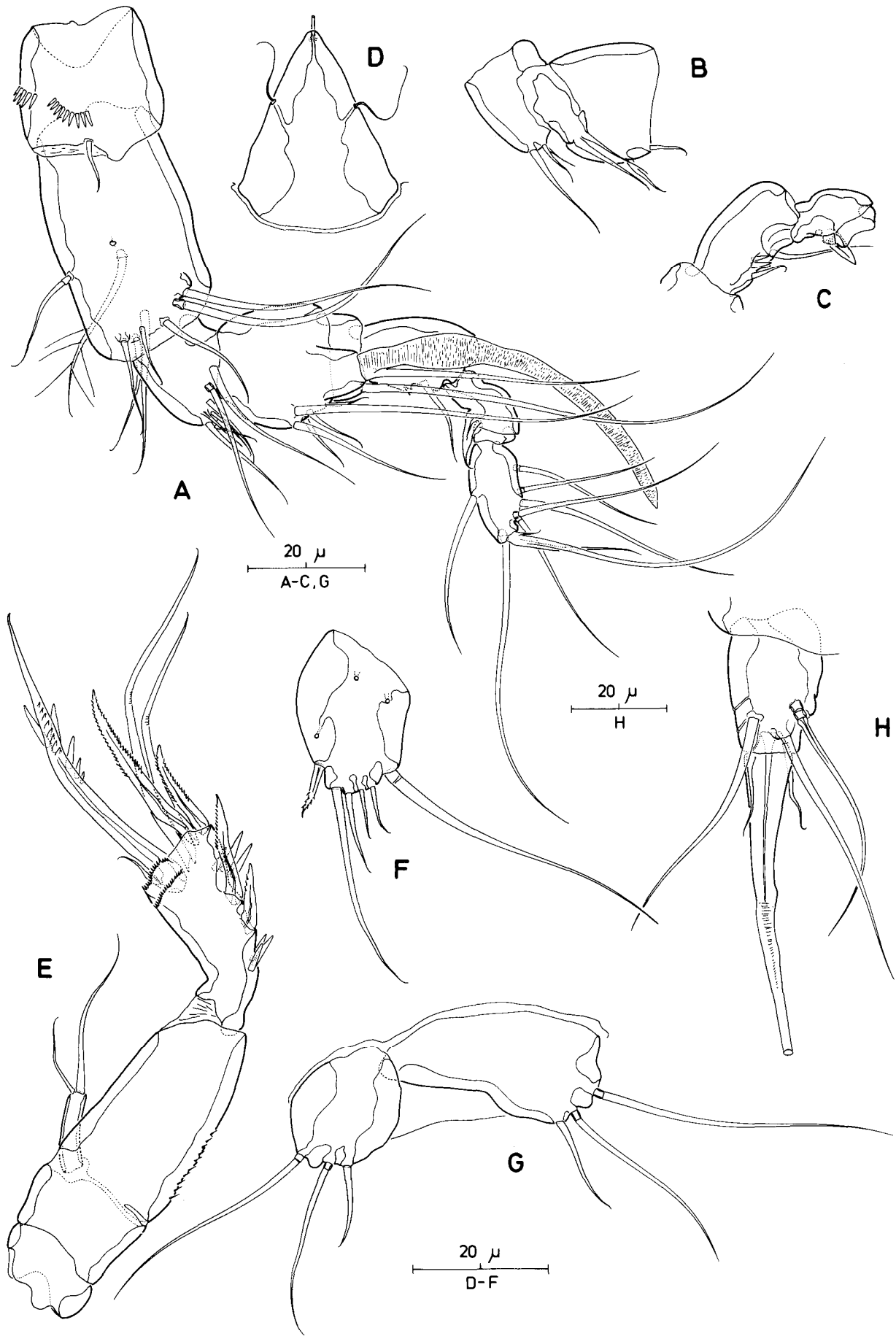


Fig. 3. *Cylindropsyllus govaerei* sp. n. (♂).—A. Antennule, ventral.—B. Antennule, segment 4 and position of dorsal setae on segment 3 and 5.—C. Antennule, segments around geniculation, dorsal.—D. Rostrum.—E. Antenna, inner.—F. P5, anterior.—G. Sixth pair of legs.—H. Caudal ramus, dorsal.

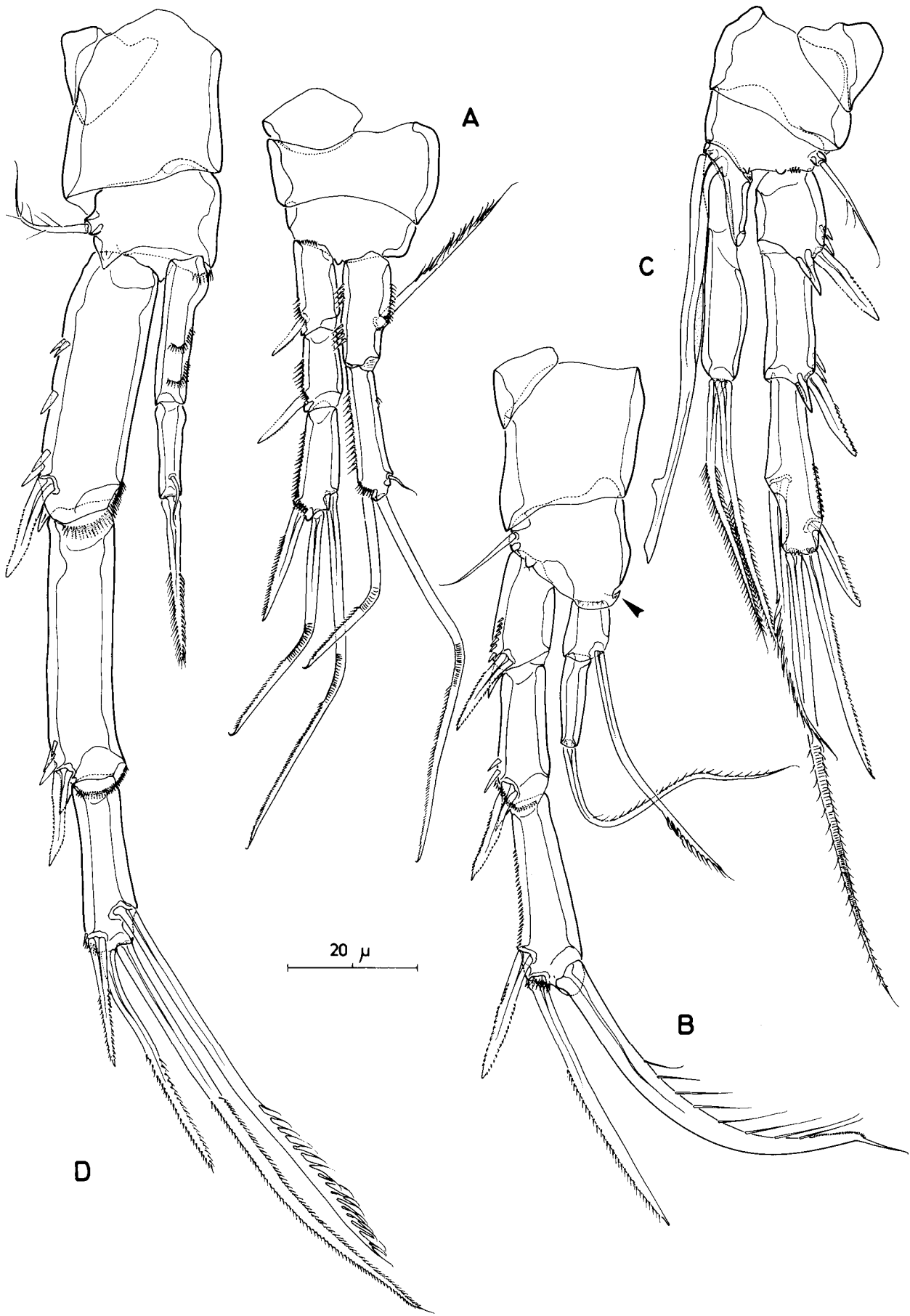


Fig. 4. *Cylindropsyllus govaerei* sp. n. (♂).—A. P1, anterior.—B. P2 (sexually dimorphic process on basis arrowed), posterior.—C. P3, anterior.—D. P4, posterior.

Mandible, maxillule, maxilla and maxilliped as in *C. laevis* (see Huys 1988).

Swimming legs P1–P4 (Fig. 4A–D) with 3-segmented exopods and 2-segmented endopods; intercoxal sclerites minute; praecoxae small, unarmed sclerites; basis of P1 without outer seta; length of legs increasing in antero-posterior direction. Sexual dimorphism typical of the genus: (1) basis of P2 forming a hook-shaped projection at inner distal corner (arrowed in Fig. 4B); (2) distal exopod segment of P2 widening distally and inner margin extended to form a rounded process from which a big claw arises; inner margin of this claw with long spinules along distal 2/3 except for apical part which is ornamented with tiny spinules (Fig. 4B); (3) P3 endopod with short proximal segment drawn-out into inner barbed apophysis and distal segment bearing 2 long apical setae (Fig. 4C).

Seta and spine formulae as follows:

	Exopod	Endopod
P1	0.0.111	1.111
P2	0.0.021	1.010
P3	0.0.121	Modified
P4	0.0.121	0.110

Fifth pair of legs (Fig. 3F) minute, not fused medially, no intercoxal sclerite. Baseoendopod and exopod forming a semi-circular plate with 3 secretory pores on anterior surface and 5 setae plus a pinnate spine at distal margin.

Sixth pair of legs (Fig. 3G) asymmetrical; each plate with 3 setae, innermost shortest.

Female. Unknown.

Remarks

The present descriptions raise the number of species in the genus *Cylindropsyllus* to five. All species are extremely similar in swimming leg sexual dimorphism and fifth leg structure, characters which are usually regarded as fine level discriminants in harpacticoid taxonomy. The number of outer spines on the distal exopodal segment of P1–P4 appears to be the most significant character to divide the genus in two species groups. Members of the *laevis*-group, including the type species and *C. ibericus*, possess two spines whereas species belonging to the *remanei*-group retain a single spine, resulting in a total of only three armature elements on the distal exopodal segment of P1—an unusual condition in the *Cylindropsyllidae*. *Cylindropsyllus laevis* is the largest species in the genus and, in addition to body size ($\delta\delta$: 1200 μm as opposed to 645 μm), can be differentiated from *C. ibericus* by the number of setae on the antennary exopod.

Within the *remanei*-group, the new species *C. govaerei* appears to be most similar to *C. kunzi* because of the armature on the distal endopod segment of P1, that is, 2 geniculate setae and an accessory setule. Both species can be distinguished on the base of differences in: (1) body size (590 μm in *kunzi* ♀♀, 940 μm in *govaerei* ♂♂; given that *Cylindropsyllus* ♀♀ are always distinctly larger than ♂♂, this size difference is significant); (2) L:W ratio of anal somite (2.1 in *kunzi*, 1.2 in *govaerei*); (3) relative lengths of endopodal segments in P1 (proximal one longer than distal in *kunzi*, shorter in *govaerei*); (4) armature of distal endopod segment of P4 (lateral and distal spines well-developed and of equal size in *kunzi*, lateral one

dwarfed in *govaerei*); and (5) L:W ratio of caudal ramus (1.9 in *kunzi*, 1.3 in *govaerei*).

Key to species of *Cylindropsyllus*

1. Distal exopod segment P1–P4 with 1 outer spine 2
Distal exopod segment P1–P4 with 2 outer spines 4
2. Distal endopod segment P1 with 2 geniculate setae only
Distal endopod segment P1 with 2 geniculate setae and 1 accessory setule 3
3. Distal endopod segment P4 with 2 well-developed setae; anal somite 2.1 times as long as wide *kunzi* Huys, 1988
Distal endopod segment P4 with minute lateral and well-developed apical seta; anal somite 1.2 times as long as wide ... *govaerei* sp. n.
4. Antennary exopod with 1 seta; body length 1370 μm in ♀, 1200 μm in ♂ *laevis* Brady, 1888
Antennary exopod with 2 setae; body length 690 μm in ♂, presumably only slightly larger in ♀ *ibericus* sp. n.

Genus *Cylinula* Coull, 1971

Amended diagnosis

Cylindropsyllidae. Body slender, cylindrical and vermiform. Rostrum triangular, defined at base. Antennule 7-segmented and with aesthetasc on segment 4 in ♀, segment 2 with 7–8 setae; indistinctly 9-segmented, haplocer and with aesthetasc on segment 5 in ♂. Antenna with allobasis and bisetose 1-segmented exopod. Mandible with 1-segmented, uniramous palp bearing 1 lateral and 3 distal setae. Maxillipeds vestigial, represented by paired, minute, triangular processes between bases of maxillae. P1–P4 with 3-segmented exopods and 2-segmented endopods. P1 exopod with outer spine on middle segment and 2 geniculate setae plus 1–2 spines on distal segment; endopod prehensile, proximal segment elongated with inner seta, distal segment with setule, claw and geniculate seta. Basis with outer spine in P2, with outer seta in P3–P4. P3 endopod of ♀ with anterior spinous process on distal segment. Inner setae of P2 exp-2 and P3–P4 exp-3 pectinate. Armature formula of swimming legs:

	Exopod	Endopod
P1	0.0.11[1–2]	1.111
P2	0.0.02[1–2]	1.010
P3	0.0.12[1–2]	0.110
P4	0.0.12[1–2]	0.110

P5 baseoendopod and exopod fused, forming semi-circular plate in both sexes; with 8 setae/spines in ♀, 6 in ♂, P6 asymmetrical in ♂, with 3 setae each; represented by small operculum with 3 tiny setules in ♀.

Sexual dimorphism in antennule, P2 basis (with hook-shaped process at inner corner) and exopod (inner seta of distal segment transformed into claw), P3 endopod (proximal segment reduced in size, with barbed apophysis; distal segment with 2 long setae), P5, P6 and in genital segmentation.

Caudal ramus short; with 6 setae; seta V with defined flexure zone between proximal styliiform and distal flagellate parts, fused to vestigial seta IV.

Type species. *Cylinula proxima* Coull, 1971 (by monotypy).

***Cylinula proxima* Coull, 1971 (Figs 5–8)**

Type locality. North Carolina continental shelf, between Cape Lookout and Cape Hatteras (type series taken from three different stations 12 (34°36.9'N, 76°25.1'W; 20 m; 4 February 1969), 13 (34°45.0'N, 75°45.0'W; 41 m; 25 November 1968) and 14 (34°49.0'N, 75°40.0'W; 43 m; 25 November 1968); leg. R/V EASTWARD and S.S. ADVANCE II, Higgins meiobenthic sled.

Material (1) From Professor Dr B. C. Coull: 2♀ and 1♂ in alcohol from type locality

(2) USNM: Holotype ♀ (reg. No. 128177) and 7 paratypes (4♀, 3♂; reg. No. 128178) in alcohol (from station 13).

Redescription

Female. Body length 780 µm measured from tip of rostrum to posterior margin of caudal rami. Body slender (Fig. 5A, B), cylindrical, transparent; no distinct separation between prosome and urosome. Genital double-somite completely fused, original segmentation marked by small internal ribs dorsolaterally. Anal somite 1.8 times as long as wide (135 × 73 µm). Caudal ramus about 1.8 times as long as maximum width; with 6 setae (seta I absent) and 3 pores; seta VII tri-articulate at base; seta V long, consisting of proximal styliform part and long distal flagellate part, fused at base with vestigial seta IV.

Rostrum about as long as first antennular segment; with 2 sensillae.

Antennule 7-segmented (Fig. 6A). Segment 1 with 1 spinular row; segment 2 longest; segment 4 with distal cylindrical process bearing large aesthetasc (85 µm). Armature formula: 1-[1], 2-[7+1 plumose], 3-[4], 4-[2+ae], 5-[1], 6-[2], 7-[7+trithek].

Antenna (Fig. 6B) with small unarmed coxa; basis and first endopod segment completely fused to form allobasis, with tiny spinules along abexopodal margin; exopod an elongate segment with 2 apical setae; endopod with 2 lateral spines and distal armature consisting of 2 bipinnate spines, 2 geniculate setae and 1 large geniculate spine bearing spinules at about mid-margin and fused at base with vestigial seta.

Mandible (Fig. 6C). Gnathobase well-developed, with pinnate seta at dorsal corner; palp uniramous and 1-segmented, with 1 lateral and 3 distal setae.

Maxillule (Fig. 6D). Praecoxal arthrite with 7 spines and 2 setae along distal margin and 1 seta on anterior surface; coxal endite with 1 pinnate spine; basis with 1 spine and 2 setae on endite; exopod and endopod represented by a single seta each.

Maxilla (Fig. 6E). Syncoxa with 2 endites, proximal with pinnate spine and plumose seta, distal with 2 spines and 1 seta. Endopod completely incorporated into basis. Allobasis drawn out into pinnate claw and armed with a total of 5 setae (3 of them probably derived from incorporated endopod).

Maxilliped vestigial, represented by minute triangular process located basally at the inner margin of the maxillary syncoxa.

Swimming legs P1–P4 (Fig. 7A–D). Intercoxal sclerites minute; praecoxae small, unarmed sclerites. P1 basis without outer seta or inner spine. P1 endopod prehensile, proximal segment 1.25 times as long as exopod, with inner pectinate seta; second segment with subdistal setule (arrowed in Fig. 7A), and claw plus geniculate seta

distally. Length of legs increasing in antero-posterior direction. Basis with naked, outer spine in P2, with plumose, outer seta in P3–P4. P3 endopod of ♀ with anterior spinous process on distal segment. Inner setae of P2 enp-1 and P3–P4 exp-3 pectinate.

Seta and spine formulae as follows:

	Exopod	Endopod
P1	0.0.112	1.111
P2	0.0.022	1.010
P3	0.0.122	0.110
P4	0.0.122	0.110

Fifth pair of legs (Figs 5B, 8D) minute, not fused medially, no intercoxal sclerite. Baseoendopod and exopod forming a semi-circular plate with outer, plumose, basal seta, and 2 pinnate spines plus 5 naked setae along the distal margin.

Sixth legs (Fig. 5D) represented each by small operculum bearing minute pore and 3 vestigial setae. Genital apertures not fused medially. Copulatory pore large, located far posteriorly; leading via chitinized copulatory duct to paired seminal receptacles positioned anteriorly to genital apertures. Copulatory duct flanked by two large secretory pores (Fig. 5D).

Male. Body length 550 µm measured from tip of rostrum to posterior margin of caudal rami. Spermatophore 115 µm long (Fig. 5C).

Antennule (Fig. 8A) indistinctly 9-segmented; geniculation between segments 7 and 8; segment 1 with 1 minute seta and 1 spinular row; segment 2 longest, with 1 plumose and 7 naked setae; segment 3 with 3 long and 3 short setae; segment 4 an incomplete ring, only discernible in dorsal aspect, with 2 setae; segment 5 swollen, with 5 setae along the anterior margin and with distal cylindrical process bearing basally fused seta and large aesthetasc (75 µm); segment 6 with 1 seta; segment 7 with 2 setae; segment 8 with spinous process, distal segment with 5 posterior setae, an apical trithek and 2 anterior setae.

Swimming legs with sexual dimorphism typical for the genus: (1) basis of P2 forming an anterior spinous projection at inner distal corner (see inset of Fig. 8B); (2) distal exopod segment of P2 widening distally and inner distal portion dilated to form a rounded process from which a large, posteriorly directed claw arises; inner margin of this claw with few long spinules except for subapical part which is ornamented with tiny spinules (Fig. 8B); (3) P3 endopod with short proximal segment drawn-out into inner, curved, barbed apophysis and distal segment with 2 long apical setae (Fig. 8C).

Fifth leg (Fig. 8E) almost circular, with outer plumose seta, 3 naked setae and 2 spines (inner one pinnate).

Sixth pair of legs (Fig. 8F) asymmetrical, with 3 setae each, inner one shortest, outer one plumose.

***Cylinula arganoi* Cottarelli & Venanzetti, 1989 (Figs 9–10)**

Type locality. Mediterranean, Italy, Archipelago Toscano, Isola di Montecristo; 6 m depth.

Material. Mediterranean, Corsica, Bay of Calvi, leg. K. A. Willems (scuba-diving); (a) 2♂ collected in front of STARESO; shell-gravel between *Posidonia* beds, depth 11 m; 25 July 1978; (b) 1♀ collected

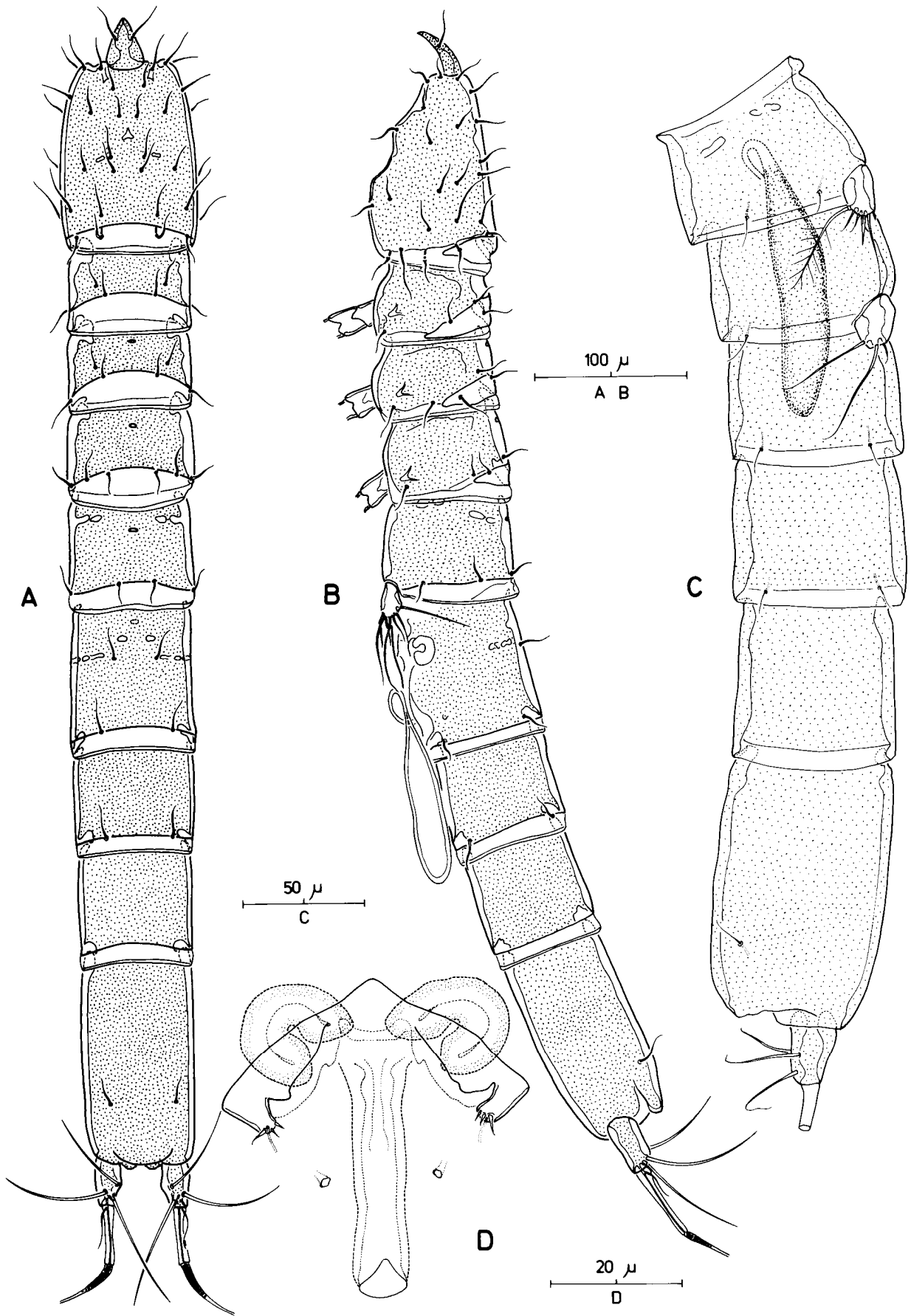


Fig. 5. *Cylinula proxima* Coull, 1971.—A. Habitus (♀), dorsal.—B. Habitus (♀), lateral.—C. Urosome (♂), lateral.—D. Genital field (♀).

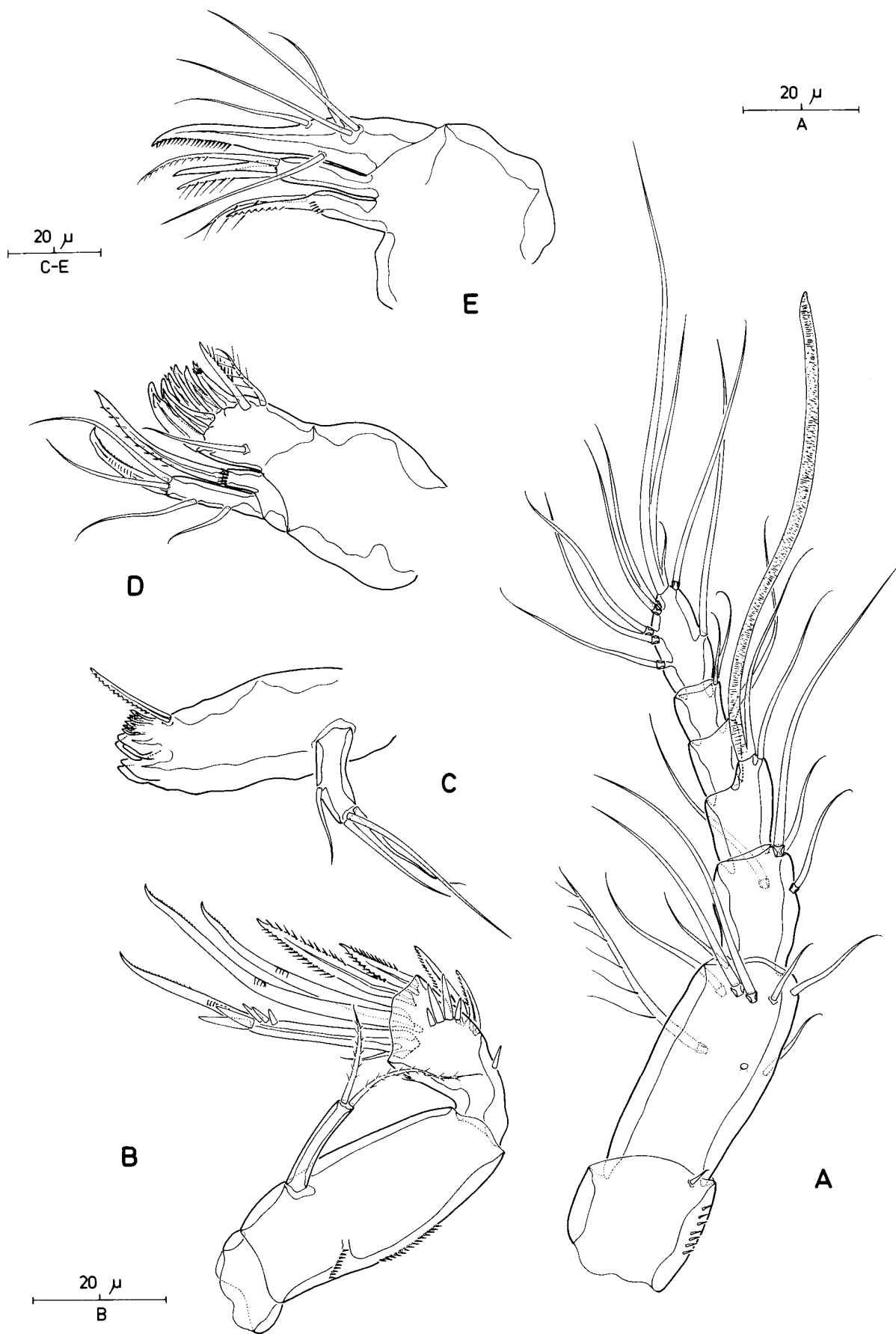


Fig. 6. *Cylindula proxima* Coull, 1971 (♀).—A. Antennule.—B. Antenna.—C. Mandible.—D. Maxillule.—E. Maxilla.

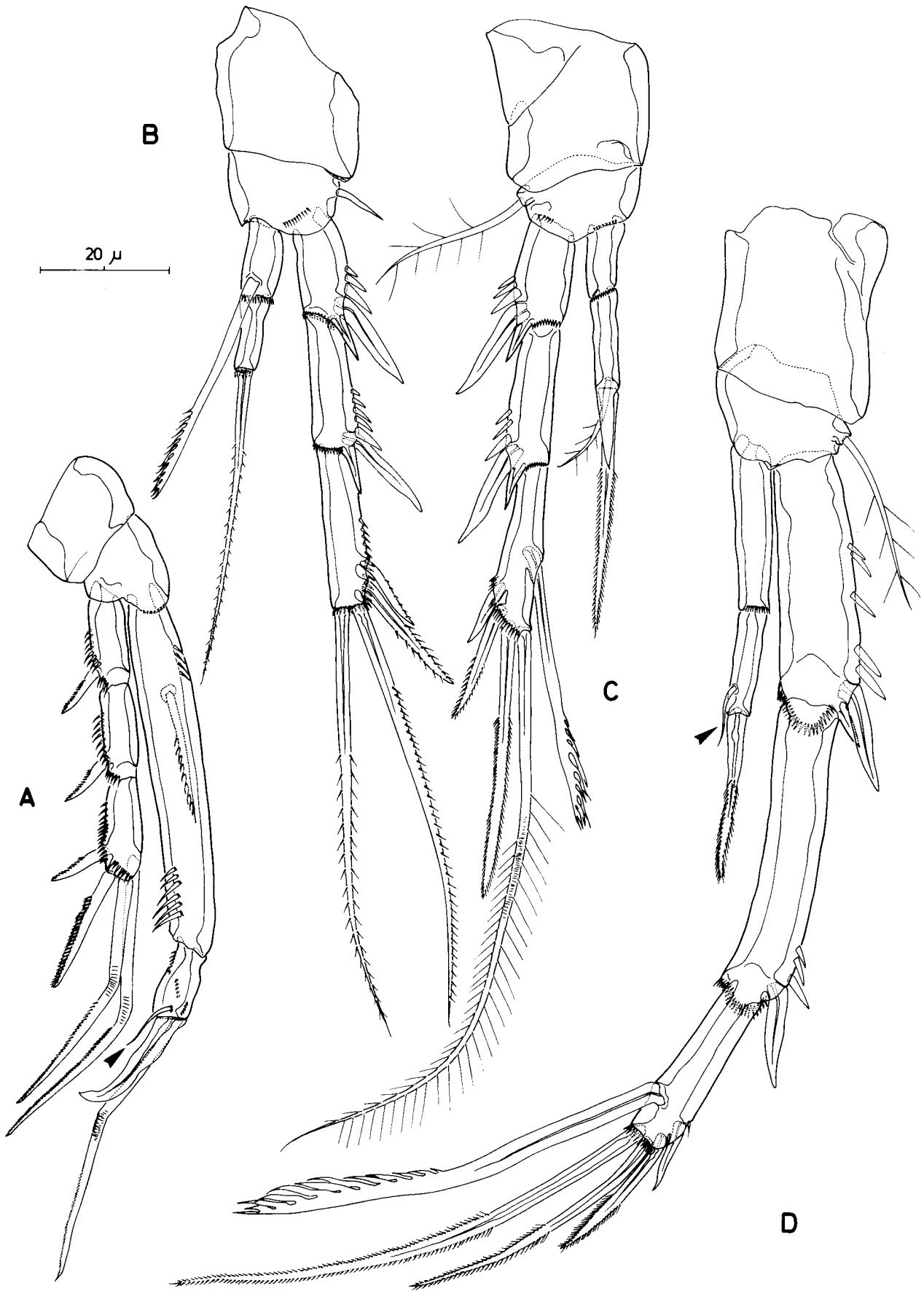


Fig. 7. *Cylinula proxima* Coull, 1971 (♀).—A. P1, anterior.—B. P2, posterior.—C. P3, anterior.—D. P4 (small seta arrowed), posterior.

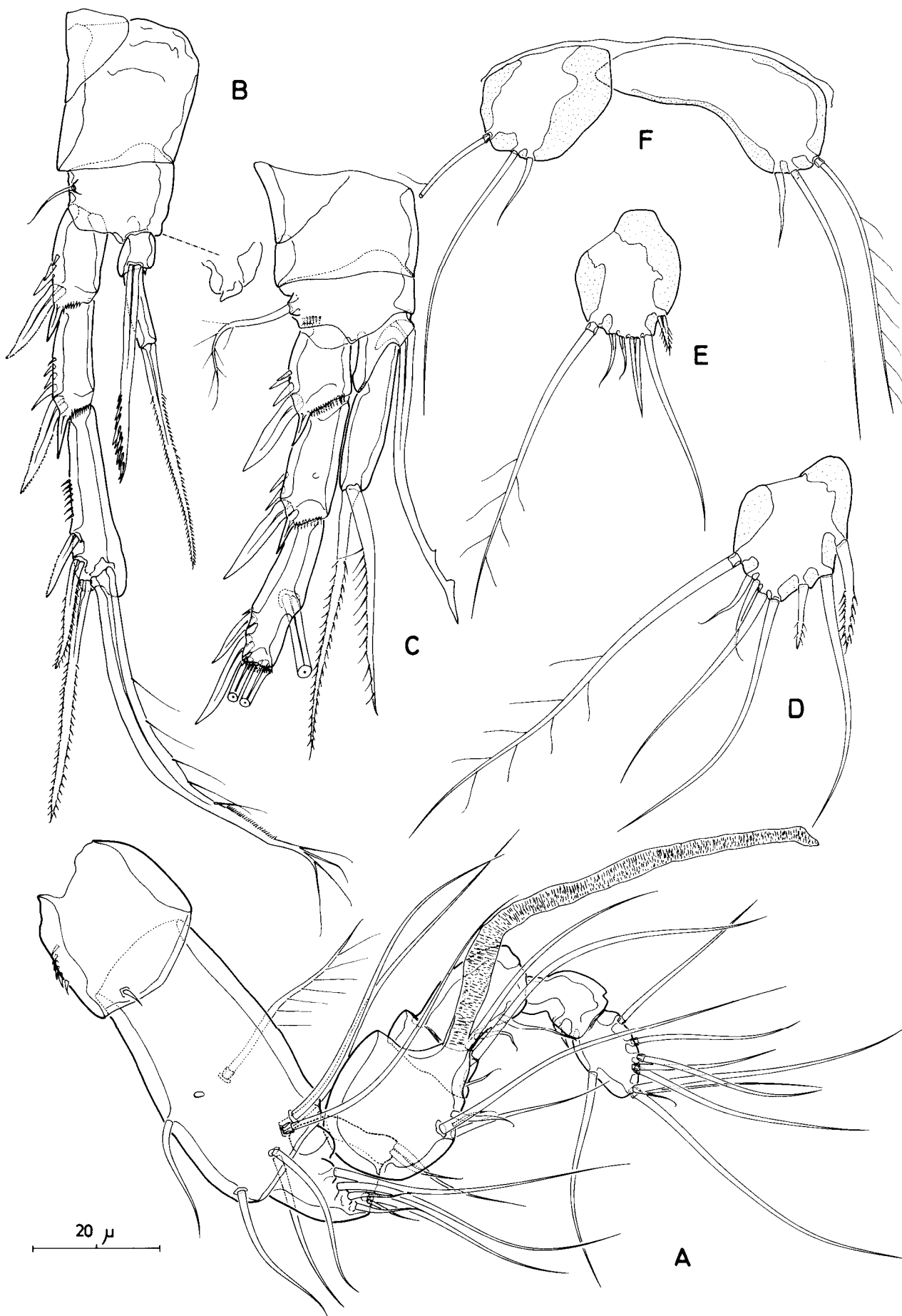


Fig. 8. *Cylindula proxima* Coull, 1971.—A. Antennule (♂).—B. P2 (♂), posterior; inset showing sexually dimorphic process on basis, anterior.—C. P3 (♂), anterior.—D. P5 (♀).—E. P5 (♂).—F. Sixth pair of legs.

from Pte. Oscelluccia; *Amphioxus*-sand; 16 September 1976. All specimens dissected and mounted on 3 slides each; deposited in BMNH, reg. No. 1992.1098.

Redescription

Female. Body length 830 μm measured from tip of rostrum to posterior margin of caudal rami. Genital double-somite completely fused, original segmentation marked by small internal ribs dorsolaterally. Anal somite 1.4 times as long as wide ($130 \times 93 \mu\text{m}$).

Caudal ramus (Fig. 10H) about 1.75 times as long as maximum width; with 6 setae (seta I absent) and 2 pores; seta VII tri-articulate at base; seta V long, consisting of proximal styliform part and long distal flagellate part, fused at base with vestigial seta IV.

Rostrum (Fig. 10A) about as long as first antennular segment; with 2 sensillae; a long, apical tube pore arises from the ventral surface.

Antennule 7-segmented (Fig. 10A). Armature as in *C. proxima* except that second segment bears 1 plumose and 6 naked setae.

Antenna to maxilliped as in *C. proxima*.

Swimming legs P1–P4 (Fig. 9A–F). Intercoxal sclerites minute; praecoxae small, unarmed sclerites. P1 basis without outer seta or inner spine. P1 endopod prehensile, proximal segment as long as exopod, with inner pectinate seta; second segment with subdistal setule, and claw plus geniculate seta distally. Length of legs increasing in antero-posterior direction. Basis with naked, short, outer seta in P2, with plumose outer seta in P3–P4. P3 endopod of ♀ with anterior spinous process on distal segment (arrowed in Fig. 9D, E). Inner setae of P2 enp-1 and P3–P4 exp-3 pectinate.

Seta and spine formulae as follows:

	Exopod	Endopod
P1	0.0.111	1.111
P2	0.0.021	1.010
P3	0.0.121	0.110
P4	0.0.121	0.110

Fifth pair of legs (Fig. 9G) minute, not fused medially, no intercoxal sclerite. Baseoendopod and exopod forming a semi-circular plate with outer, plumose, basal seta, and 2 closely set setae plus 5 naked setae along the distal margin.

Male. Body length 710 μm measured from tip of rostrum to posterior margin of caudal rami.

Antennule (Fig. 10B) indistinctly 9-segmented; geniculation between segments 7 and 8; segment 1 with 1 minute seta and 2 spinular rows; segment 2 longest, with 1 plumose and 7 naked setae; segment 3 with 5 setae; segment 4 an incomplete ring, only discernible in dorsal aspect, with 2 setae; segment 5 swollen, with 2 long and 3 short setae along the anterior margin and with distal cylindrical process bearing basally fused seta and large aesthetasc (88 μm); segment 6 with 1 seta; segment 7 with 2 setae; segment 8 with spinous process, distal segment with 5 posterior setae, an apical trithec and 2 anterior setae.

Swimming legs with sexual dimorphism typical for the genus: (1) basis of P2 forming an anterior spinous projection at inner distal corner (Fig. 10D, E); (2) distal exopod

segment of P2 widening distally and inner distal portion dilated to form a rounded process from which a large, posteriorly directed claw arises; inner margin of this claw with few long spinules except for subapical part which is ornamented with tiny spinules (Fig. 10C); (3) P3 endopod with inner margin of short proximal segment drawn-out into slender, barbed apophysis, and distal segment with 2 long apical setae (Fig. 10F).

Fifth leg (Fig. 9H) elongated, with outer plumose seta, 4 naked setae and 1 apical spine.

Sixth pair of legs (Fig. 10G) asymmetrical, with 3 setae each, inner one shortest, outer 2 plumose.

Remarks

Both Coull's (1971) and Cottarelli & Venanzetti's (1989) original descriptions contain several inaccuracies or misinterpretations, making a detailed species comparison impossible. Cottarelli & Venanzetti reckon that *C. arganoi* shows sexual dimorphism in the distal part of the antennary endopod but this is undoubtedly the result of observations made from female and male antennae mounted in different positions. Similarly, the supposed sexual dimorphism recorded for leg 1, that is, the inner seta of enp-1 being distinctly shorter and not pectinate in the male, is probably due to observations of a slightly damaged specimen, as no such difference could be detected in our material. Cottarelli & Venanzetti listed a number of differences between both species but most of them were based on erroneous observations, such as the different armature on the antennary endopod and the caudal ramus. *Cylinula arganoi* and *C. proxima* can mainly be distinguished by their different exopodal setal formulae of P1–P4, the relative length of the P1 endopod, and the shape and armature of the fifth legs in both sexes.

Discussion

The major reason why Coull (1971) linked *Cylinula* to *Evansula* is the apparent similarity of the prehensile endopod of leg 1 in both genera. In *Evansula*, however, the armature of the distal segment consists of 2 geniculate claws and a minute seta (Mielke 1975), whereas in *Cylinula* one claw, one geniculate seta and a minute seta are found. As pointed out by Huys (1988), there is little doubt that *Cylinula* and *Cylindropsyllus* are sistergroups. Evidence for this relationship is found in the extremely reduced maxillipeds, a unique character in the *Cylindropsyllinae*. Conversely, the position of the genus *Evansula* within the subfamily is not clear. It represents the only genus that lacks sexual dimorphism on the basis of the P2. Males of all other genera, *Stenocaris*, *Stenocaropsis*, *Boreopontia*, *Cylinula* and *Cylindropsyllus* possess an anteriorly directed process at the inner distal corner which is only slightly developed in the latter two genera but can be quite elaborate in some species of *Stenocaris* [*S. minor* (T. Scott, 1892), *S. gracilis* Sars, 1909 and *S. arenicola* Wilson, 1932]. Regarding this modification as a synapomorphy for this genus group would imply that either *Evansula* had split off early in the evolution of the subfamily or that this character has secondarily been lost. Both alternative

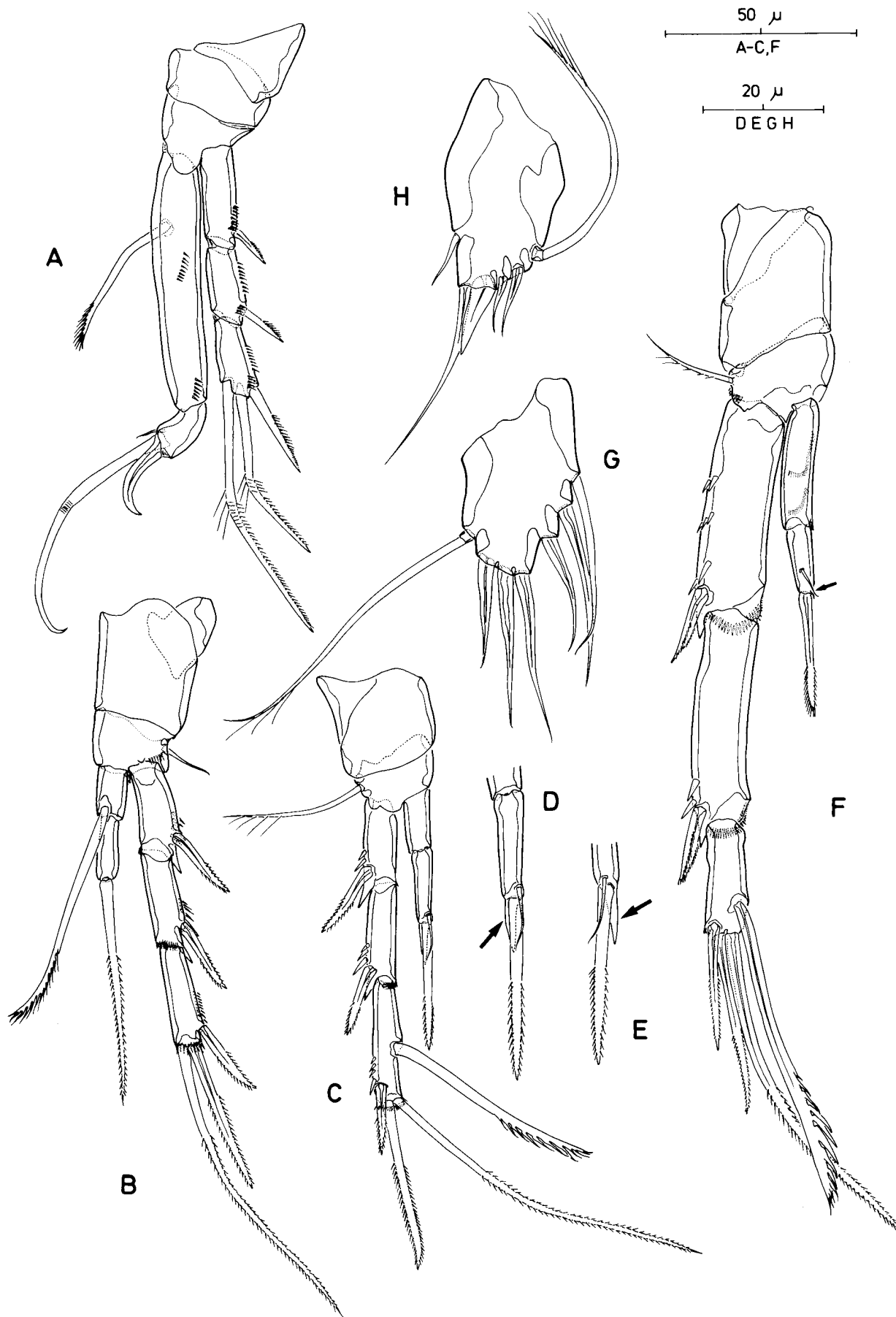


Fig. 9. *Cylinula arganoi* Cottarelli & Venanzetti, 1989 (♀).—A. P1, anterior.—B. P2, posterior.—C. P3, posterior.—D. P3, distal endopod segment, posterior.—E. Same, lateral.—F. P4, posterior.—G. P5.—H. P5 (♂).

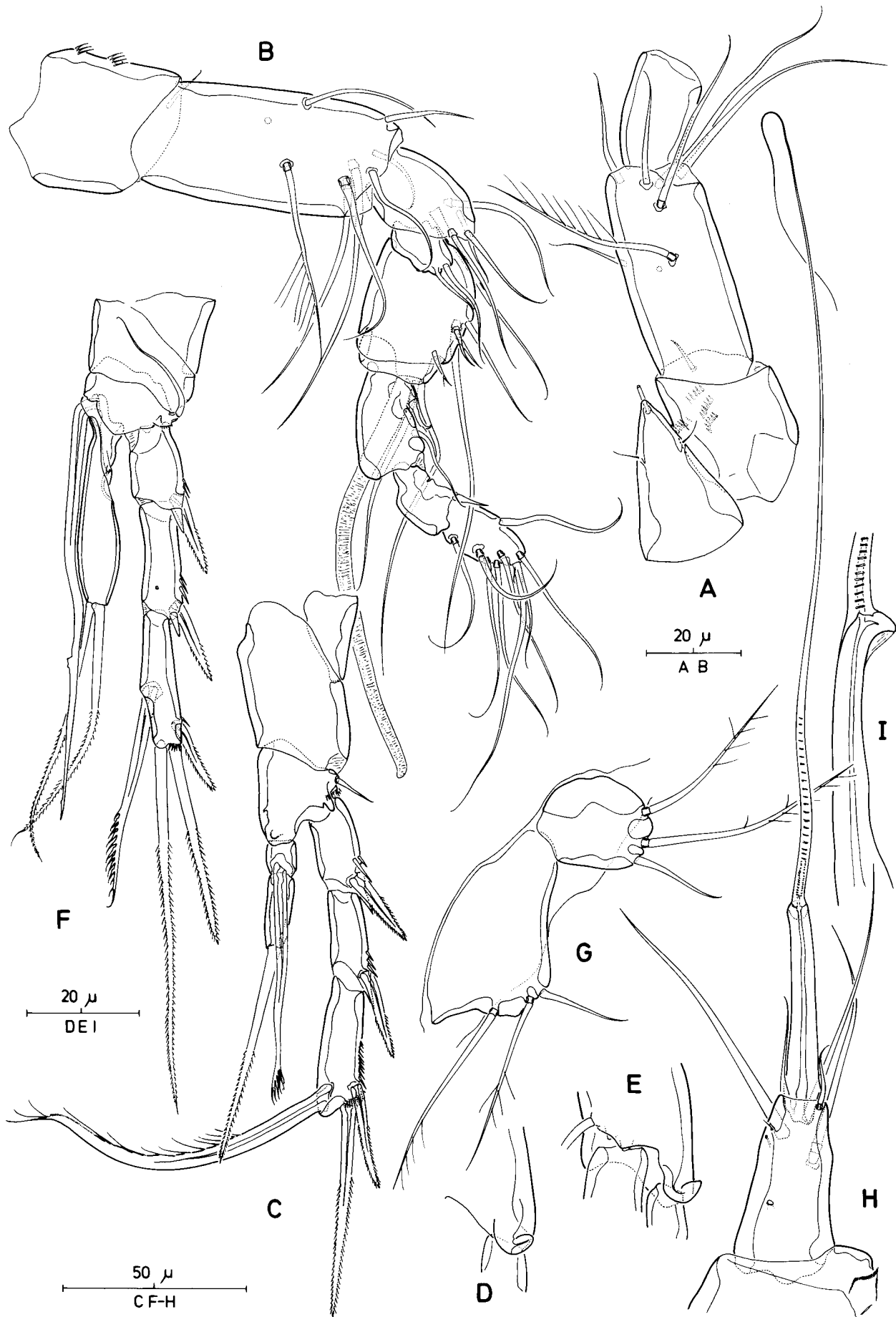


Fig. 10. *Cylinula arganoi* Cottarelli & Venanzetti, 1989.—A. Rostrum and proximal antennary segments (♀).—B. Antennule (♂).—C. P2 (♂), posterior.—D. P2, process on basis (♂), anterior.—E. Same, lateral.—F. P3 (♂), anterior.—G. Sixth pair of legs (♂).—H. Caudal ramus, ventral.—I. Caudal ramus, specialized flexure zone of seta V, lateral.

scenarios, however, exclude a close relationship of *Evansula* to either *Cylindropsyllus* or *Cylinula*. Other atypical features of *Evansula* include the elongated first antennular segment which approaches the second in length (in all other genera it is the second that is elongated), and the strongly developed, subchelate maxilliped.

The isolated position of *Evansula* within the family is interpreted as evidence that the prehensile P1 endopod shared with *Cylinula* represents a product of convergence. In addition to this character, other autapomorphies for *Cylinula* include the uniramous mandibular palp and the modification of the outer distal spine of P3 enp-2 into an anterior spinous process in the female.

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