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# New species of benthopelagic calanoid copepods from Kongsfjorden (Spitsbergen, Svalbard Archipelago)

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**SARSIA**

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Two new species of calanoid Copepoda of the families Mesaiokeratidae and Scolecitrichidae are described from both sexes collected in the glacial fjord Kongsfjorden on the west coast of Spitsbergen island, Svalbard Archipelago. ***Mesaiokeras spitsbergensis* sp. nov.** is the first mesaiokeratid to be reported from the Arctic region, with other congeners confined to near-bottom environments from boreal to tropical regions of the Atlantic Ocean. The species may be distinguished from its congeners by an exceptionally large body size and in details of the male and female fifth legs. Also, ***Xantharus siedleckii* sp. nov.** is the first representative of this scolecitrichid genus from the Arctic region and raises to three the number of species known in the genus. The species differs from congeners by its large body size, three subequal spine-like projections on the distal segment of the female fifth legs, and in the lack of an endopod segment on both rami of the male fifth legs.

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## INTRODUCTION

Very little is known of the benthopelagic copepod fauna of the Arctic Ocean and adjacent seas, including seas surrounding Svalbard. At present, the only data on the benthopelagic copepod fauna of the Arctic seas are available from the German–Russian expedition to the Laptev Sea (Siberian Arctic) in 1993 from depths of 51–3042 m (Sirenko & al. 1996). However, these authors did not discover any representative of the family Mesaiokeratidae nor of the genus *Xantharus* Andronov, 1981. During zooplankton research related to studies of the Kongsfjorden marine ecosystem, an unnamed species each of the genera *Mesaiokeras* Matthews, 1961 and *Xantharus* was obtained at mesopelagic depths and close to the sea-bed. The studies were part of an international research initiative aimed at understanding fjordic ecosystem functioning and its contemporary modifications, and they were coordinated by the Institute of Oceanology, Polish Academy of Sciences (IO PAS) in Sopot and the Norwegian Polar Institute (NP) in Tromsø.

## MATERIAL AND METHODS

Samples containing the new species were collected in the glacial fjord Kongsfjorden located on the west coast of Spitsbergen, the largest island in Svalbard Archipelago, in the European Arctic. Kongsfjorden is part of the Kongsfjorden–Krossfjorden glacial fjord system formed by two submarine channels that meet at the common mouth, which lacks a sill (Fig. 1). Maximum depths in the inner part of Kongsfjorden do not exceed 100 m, while in the outer fjord, depths may exceed over 400 m at its mouth. A detailed synopsis of the Kongsfjorden marine ecosystem can be found in Svendsen & al. (2002) in respect of the physical environment, and in Hop & al. (2002) as regards its biota.

For the purpose of this paper it is worth mentioning that the fjord environment is shaped by a complex of oceanographic processes related to the presence of glaciers, fresh water run-off and strong seasonality. Because of the lack of a sill, of primary importance for the fjord ecosystem functioning is the strong inflow of Atlantic waters connected with the west Spitsbergen current, alternating with the inflow of Arctic and shelf waters related to undefined coastal currents stemming from the current system of the northern Barents Sea (Svendsen & al. 2002). Measurements carried out in Kongsfjorden in the years 1996–2002 have shown that in summer (July) the temperature of the bottom and deep-water layers (390–200 m) can vary between −1.8

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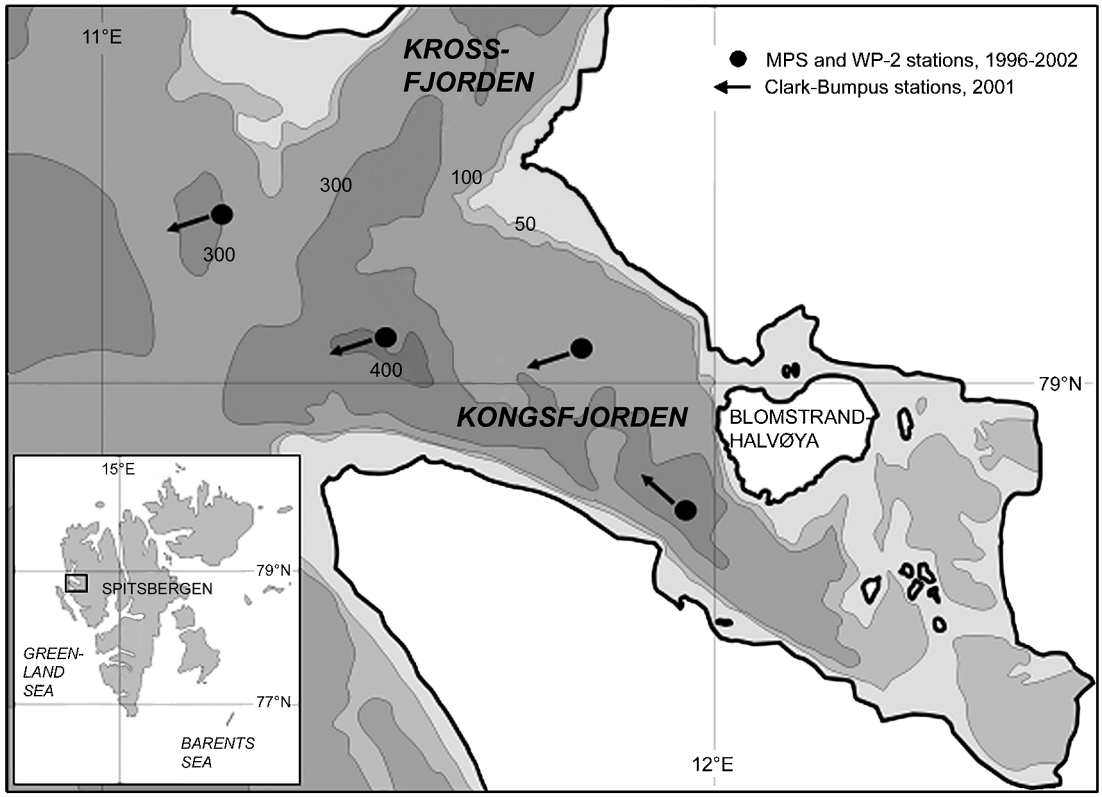


Fig. 1. Sampling sites in Kongsfjorden (Spitsbergen).

and 3°C, while salinities may oscillate between 34.60 and 34.95 PSU.

Because of the influence of both Atlantic and Arctic/Polar hydrographic domains, the Kongsfjorden marine ecosystem is classified within the Atlantic Subarctic Province of the Atlantic Polar Biome (Longhurst 1998). The biota of the Kongsfjorden marine ecosystem is taxonomically relatively diverse, but a complete faunistic inventory is still lacking. With respect to the copepod fauna, 20 species have been identified so far from plankton samples taken in Kongsfjorden (Hop & al. 2002; Kwasniewski, unpublished). The majority of the recorded species are typical components of the pelagic realm, although two species, *Neoscolecithrix farrani* Smirnov, 1935 and *Bradyidius similis* (Sars 1902), appear to be confined to deep and near-bottom layers, comparable with other Arctic locations where these species have been noted (Fosshagen 1972; Shih & Stallard 1982; Markhaseva 1996; Sirenko & al. 1996).

Zooplankton samples from Kongsfjorden which contained the two new species of benthopelagic copepods were collected during research cruises organized by the IO PAS and the NP on RY *Oceania* and RV *Lance*, as well as by University Courses at Svalbard (UNIS) on RV *Jan Mayen*. The cruises usually took place in summer (July), but also in spring (April) and early autumn (September) in the years 1996–2002. Three different types of sampling gear were used, all equipped with nets of 0.180 mm mesh aperture. The majority of samples were taken with a 0.25 $m^2$ multiple plankton sampler (MPS, Hydro-Bios, Kiel). Some of the samples were taken with a set of two 0.025 $m^2$ Clark-Bumpus (C-B) plankton samplers, and a few samples were collected with 0.25 $m^2$ WP-2 plankton net. The MPS and WP-2 nets were operated vertically. In order to protect the MPS and WP-2 nets from damage, the lower limit of the sampled layer was always set a few metres above the seafloor. However, the actual distance to the sea-bed and the precise depth of the copepod habitat remain unknown. C-B samplers were used to make horizontal hauls above the bottom with two nets attached to a wire, 1 m from the wire end with an attached load of 30 kg of an anchor chain behind so as to slide on the bottom, and a distance of 1 m from each

other. The nets were towed along a selected route for 20 min at a speed of *ca* 1.5 knots with the chain touching the bottom.

So far, 16 specimens of a new species of the genus *Mesaiokeras* and 25 specimens of a new *Xantharus* species have been identified from these samples. In addition, a single male of a probably undescribed species of the genus *Stygocyclopia* Jaume & Boxshall, 1995 (family Pseudocyclopiidae) has been recognized in the material, but was unfortunately partly lost during descriptive work.

Sorted copepods were observed whole in glycerine or lactic acid, and dissected parts mounted unstained, or slightly stained with chlorazol black E. All figures have been prepared using a camera lucida on a Zeiss Axioskop compound microscope fitted with differential interference contrast. The descriptions of both species are based on specimens from the paratype series. Descriptive morphological terminology follows Huys & Boxshall (1991).

The holotype and most paratype material are deposited in the Museum of Natural History, Wroclaw University (NHMW); additional paratypes of both species are kept in the Zoological Museum Hamburg (ZMH), either in vials or as microscope slides.

## TAMONOMIC PART

Family Mesaiokeratidae Matthews, 1961
Genus *Mesaiokeras* Matthews, 1961
***Mesaiokeras spitsbergensis* sp. nov.** (Figs 2–5)

### *Material examined*

An undissected adult female (total length 0.94 mm) from the WP-2 net, vertical haul 355–0 m, bottom depth 359 m, is designated as the holotype and is deposited in the NHMW (reg. no. MP 889a) in Wroclaw. One undissected paratype female (reg. no. MP 889b) and one paratype male (reg. no. MP 889c) from the type locality are also deposited in the NHMW collections. Additional specimens are in the collection of the co-author (SK). One dissected female from the C-B sampler, horizontal haul 365–350 m, bottom depth 365–350 m (78°57.60′–78°57.99′N 11°55.70′–11°53.40′E), 24 July 2001, 05:00 GMT; one dissected female from the C-B sampler, horizontal haul 350–327 m, bottom depth 350–327 m (79°01.02′–79°01.00′N 11°23.34′–11°19.11′E), 24 July 2001, 20:00 GMT; one dissected male from the C-B sampler, horizontal haul 311–273 m, bottom depth 311–273 m (79°01.68′–79°02.21′N 11°13.84′–11°10.76′E), 25 July 2001, 01:00 GMT, and another dissected male from the MPS net, vertical haul 377–254 m, bottom depth 380 m (79°00.90′N 11°23.00′E), 1 September 1997, 11:00 GMT are deposited as paratypes in the collections of ZMH (reg. no. 40427) in Hamburg. Collected by S. Kwasniewski.

### *Type locality*

RV *Jan Mayen*, UNIS AB310, Stn 1135, Kongsfjorden, Spitsbergen (78°59.92′N 11°30.19′E) collected 12 September 2002, 06:30 GMT.

### *Description*

Adult female. Body length 0.88–1.05 mm (mean ± standard deviation = 0.95 ± 0.06 mm, n = 10), with prosome approximately 2.9 times as long as urosome. Body (Fig. 2A, B) relatively slender, widest at first pedigerous somite, slightly tapering posteriorly; cephalosome separate from first pedigerous somite, fourth and fifth pedigerous somites completely fused. Posterolateral margins of fifth somite bluntly rounded both in dorsal and lateral aspect, somewhat asymmetrical, extending slightly further on the left. Rostrum (Fig. 2C, D) short, bearing single slender filament directed posteriorly.

Urosome four-segmented (Fig. 2E, F); genital double-somite with a group of spinules on both left and right sides at midlength; symmetrical in dorsal view, only slightly produced posteroventrally; common operculum widely rounded posteriorly; left and right seminal receptacles small, forming dorsal short lobes; posterior margin of genital double-somite to third urosomal somite bearing hyaline frill; urosomal somites 2 and 3 similar, but latter slightly shorter; anal somite slightly shorter than preceding somite, without hyaline frill; caudal rami (Fig. 2G–I) about as long as wide, slightly asymmetrical along left and right medial margins, armed with five setae and foliaceous spinules on dorsal and lateral margins; setae III–VI plumose and implanted distally; seta VII subdistally along medial margin, left one distinctly stronger, naked and implanted anterior to short right plumose counterpart.

Antennules (Fig. 2K, L) relatively short, symmetrical, 24-segmented and extending to posterior margin of second pedigerous somite; fusions involving ancestral segments II–IV, X–XI and XXVII–XXVIII, with articulation between segments III and IV incompletely expressed; armature elements as follows: segment 1 (corresponding to ancestral segment I) three setae; segment 2 (ancestral II–IV) six setae + aesthetasc; segments 3–4 (ancestral V–VI) two setae each; segment 5 (VII) two setae + aesthetasc; segments 6–7 (VIII–IX) two setae each; segment 8 (X–XI) four setae + aesthetasc; segments 9–10 (XII–XIII) one seta each;

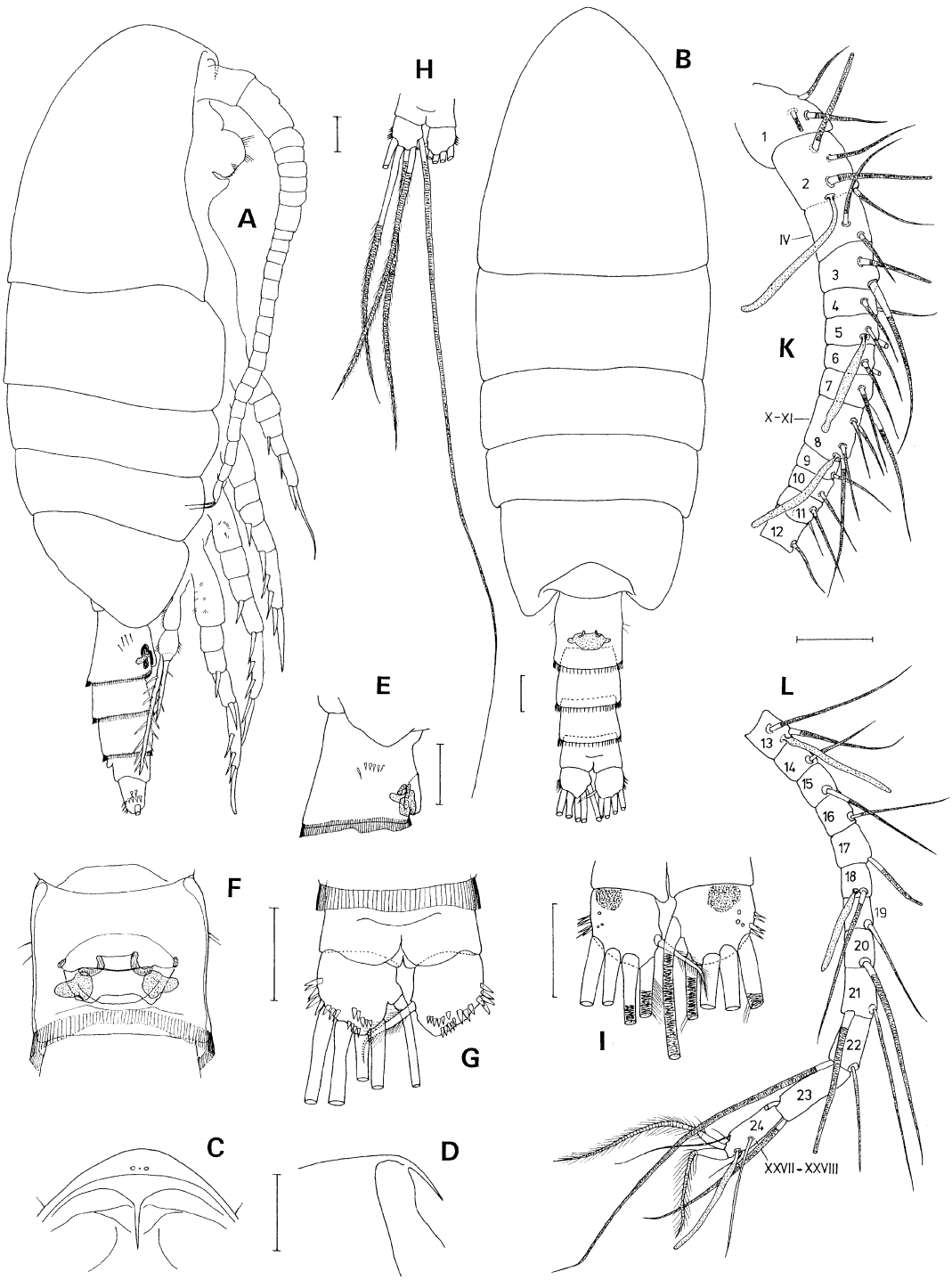


Fig. 2. *Mesaiokeras spitsbergensis* sp. nov.; female. A. Habitus, lateral. B. Same, dorsal. C. Rostrum, anteroventral. D. Same, lateral. E. Genital double somite, lateral. F. Genital double somite, ventral. G. Anal somite and caudal rami, dorsal. H. Caudal setae of left ramus, dorsal. I. Caudal rami, ventral. K. Antennule, segments I–XV. L. Antennule, segments XVI–XXVIII. Scale lines 0.05 mm.

segment 11 (XIV) two setae; segment 12 (XV) one seta; segment 13 (XVI) two setae + aesthetasc; segments 14–17 (XVII–XX) one seta each; segment 18 (XXI) one seta + aesthetasc; segments 19–20 (XXII–XXIII) one seta each; segments 21–23 (XXIV–XXVI) one + one seta each; segment 24 (XXVII–XXVIII) six setae + aesthetasc.

Antenna (Fig. 3A) biramous, with coxa and basis almost fused; coxa with row of long setules and inner distal seta; basis with two distal setae on inner margin. Endopod distinctly shorter (*ca* two thirds) and more slender than exopod, two-segmented, with both segments elongate, but proximal longer, bearing two unequal setae at two thirds of distance along inner margin; distal segment lacking distinct inner lobe, about four fifths length of proximal segment, with inner margin having five + two setae subdistally and seven terminal setae. Exopod seven-segmented, first to sixth segments with one, four, one, one, one, one setae, respectively; terminal segment very short and armed with three setae.

Mandible (Fig. 3B, C): gnathobase with eight teeth, four interdental spines and one dorsal spinulose seta; mandibular palp comprising basis bearing four inner setae of differing lengths, two-segmented endopod having four and 11 setae, respectively, and five-segmented exopod, about same length as endopod, with six long setae.

Maxillule (Fig. 4A): praecoxal arthrite with nine marginal, one short anterior and four posterior setae; coxal epipodite produced bearing nine setae; coxal endite with three setae; first and second basal endites carrying two and four setae; first endopod segment almost fused to basis, with five setae; second segment with five setae; exopod bearing eight setae.

Maxilla (Fig. 3D) slender, comprising separate praecoxa and coxa, basis mostly incorporated into coxa, and four-segmented endopod. First praecoxal endite with three long marginal and two submarginal setae, proximal one distinctly smaller; second praecoxal endite and both coxal endites armed with three setae each; basal endite with four unequal setae, one small and slender. Endopod short, with setal formula 1, 2, 1, 1.

Maxilliped (Fig. 3E): syncoxa with five setae in three groups along medial margin; formula 1, 1, 3; distalmost seta straight, with wide base and shorter than remaining syncoxal setae, syncoxa distally with patch of short setules. Basis shorter than syncoxa, with three unequal slender setae along medial margin and submarginal row of spinules; two setae distally corresponding to armature of incorporated first endopodal segment. Free endopod five-segmented, setal formula 4, 4, 3, 3 + 1, 4.

Swimming legs (Fig. 3F–I) increasing in size from 1 to 4, each with three-segmented exopod; endopod of leg 1 unisegmented, that of leg 2 bisegmented; those of legs 3 and 4 three-segmented.

Leg 1 (Fig. 3F) with coxa bearing few spinules laterally; basis with straight inner seta distally; endopod with five setae and slightly undulating lateral margin, two of setae weakly developed on inner margin. Exopod with slender outer distal spines on segments 1–3, that on first segment markedly smaller than those on distal segments. Leg 2 (Fig. 3G): coxa with inner seta and long spinules on posteromedial margin; second endopod segment with two rows of spinules on outer anterior surface; outer distal spine of first exopod segment extending to base of spine on second segment; spine of second segment surpassing base of proximal outer spine on third exopod segment; terminal spine of third exopod segment slightly shorter than lengths of second and third segments combined.

Legs 3 and 4 (Fig. 3H, I) similar to leg 2 but with endopods three-segmented and anterior surface of second and third endopodal segments bearing rows of lateral spinules as figured; terminal spine slightly longer (leg 3) or shorter (leg 4) than combined lengths of second and third exopodal segments; coxa of leg 4 longer than that of preceding leg, bearing smaller and more sparsely distributed spinules on outer margin; outer distal spine of third exopod segment longer than corresponding spines of legs 2 and 3.

Legs 5 (Fig. 4B) slightly asymmetrical, uniramous, three-segmented, with right ramus longer than left counterpart and extending when reflexed to the right caudal ramus; both coxae fused with intercoxal sclerite to form common base; coxa and basis ornamented with spinules on posterodistal surface, few spinules implanted anteromarginally as figured; terminal segment (exopod) bifurcate, with outer spiniform process about 60% length of segment, both processes sparsely ornamented with strong spinules.

Adult male. Body length 0.94–1.01 mm (mean ± standard deviation = 0.98 ± 0.03 mm, n = 6). Body (Fig. 4C, D) resembling female but with prosome slightly more compact and 2.7 times as long as urosome. Posterolateral margins clearly asymmetrical, rounded in dorsal and lateral aspect, with right margin extending to end of genital somite. Rostral filaments wanting (Fig. 4E). Urosome five-segmented; genital somite with gonopore on left side; rest of urosomal somites similar to female; caudal rami (Fig. 5A) with asymmetrical inner margins, bearing small, plumose seta VII implanted more anteriorly on left than on right ramus.

Antennules (Fig. 5B, C) symmetrical, 24-segmented, extending to end of second pedigerous somite; fusions

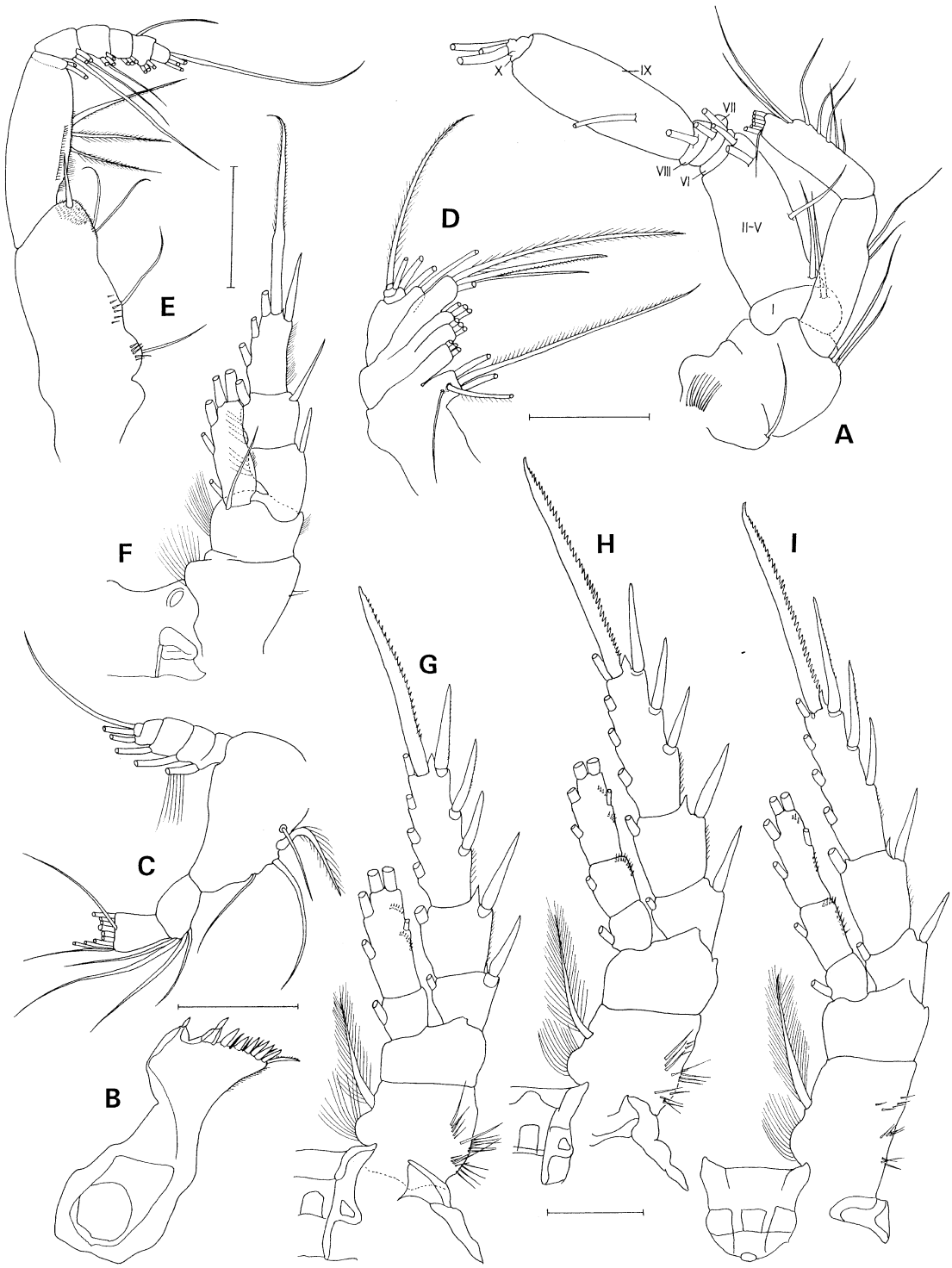


Fig. 3. *Mesaiokeras spitsbergensis* sp. nov.; female. A. Antenna. B. Mandible, coxa. C. Mandible, palp. D. Maxilla. E. Maxilliped. F. Leg 1. G. Leg 2. H. Leg 3. I. Leg 4. Scale lines 0.05 mm.

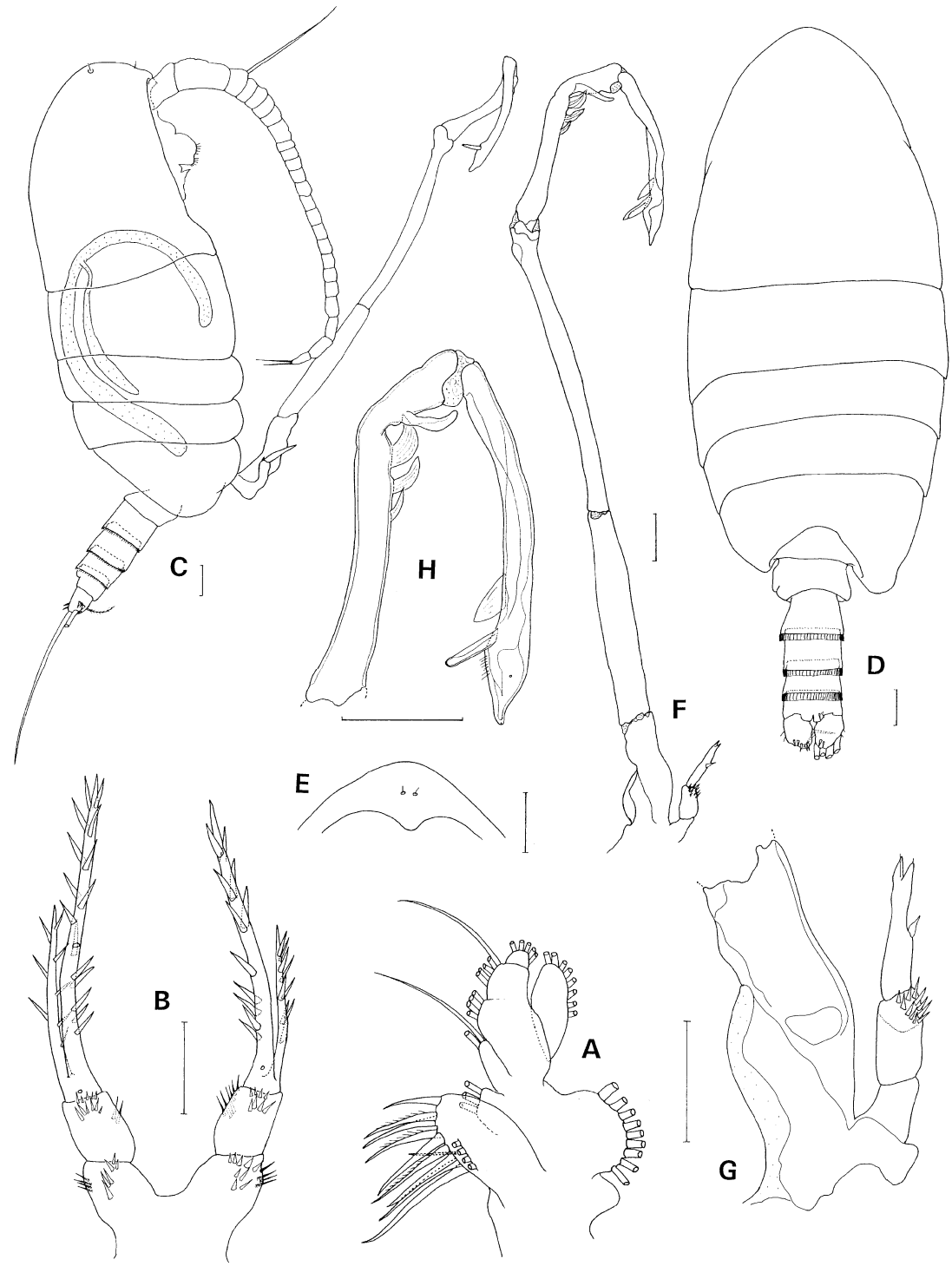


Fig. 4. *Mesaiokeras spitsbergensis* sp. nov.; female (A–B), male (C–H). A. Maxillule. B. Legs 5. C. Habitus, lateral. D. Habitus, dorsal. E. Rostrum, ventral. F. Legs 5. G. Legs 5, right ramus plus left first segment. H. Distal two segments of left leg 5. Scale lines 0.05 mm.

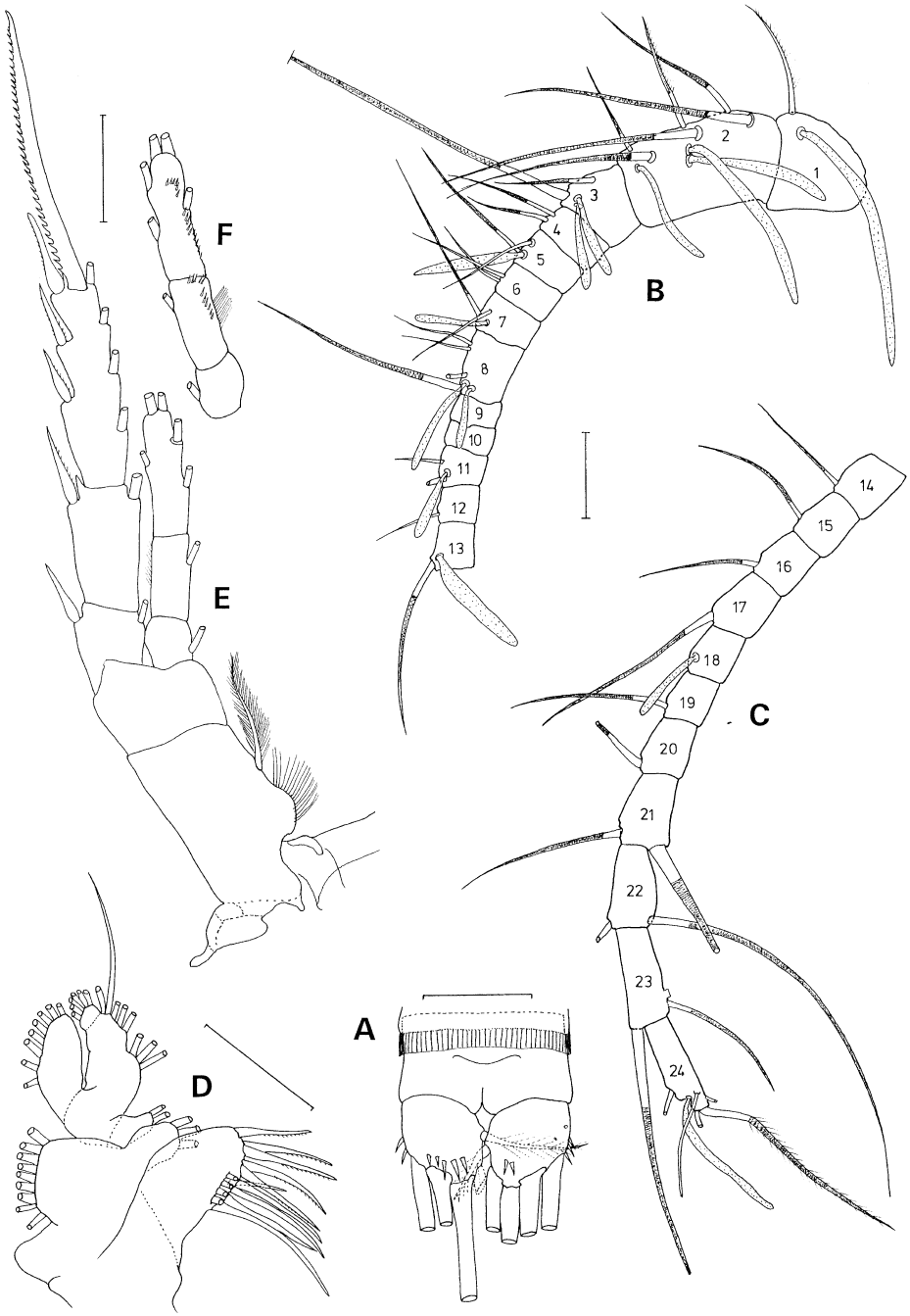


Fig. 5. *Mesaiokeras spitsbergensis* sp. nov.; male. A. Anal somite plus caudal rami, dorsal. B. Antennule, segments I–XVI. C. Antennule, segments XVII–XXVIII. D. Maxillule. E. Leg 4, posterior. F. Endopod of leg 4, anterior. Scale lines 0.05 mm.

as in female, but ancestral segments II–IV completely fused; armature differing from female as follows: segment 1 (I) one seta + aesthetasc; segment 3 (V) two setae + two aesthetascs; segment 7 (IX) two setae + aesthetacs; segment 8 (X–XI) four setae + two aesthetascs; segments 9–10 (XII–XIII) naked; segment 11 (XIV) two setae + aesthetasc; segment 13 (XVI) one seta + aesthetasc; segment 18 (XXI) aesthetasc.

Antenna, mandible, maxilla, maxilliped and legs 1–3 similar to those of female. Maxillule (Fig. 5D) with second basal endite bearing three setae, instead of four in female, and endopod armed with six setae distally (five in female). Leg 4 (Fig. 5E, F) distinct in that coxa and endopod lacking any spinulation and third exopodal segment armed with comparatively small outer spines.

Legs 5 (Fig. 4F–H) uniramous, strongly asymmetrical; both coxae completely fused with intercoxal sclerite to form common base. Right ramus short, three-segmented; second segment ornamented with patch of spinules at outer distal corner; distal segment longer and more slender than second, bearing small, weakly developed spine midway of outer margin, and produced into two distal spinous processes. Left ramus five-segmented comprising coxa, basis and three-segmented exopod, very elongate (ramus about 1 mm in length) and equalling combined length of prosome and urosome when extended; relative lengths of individual segments from shortest to longest: 1, 5, 4, 2, 3. Left segment 1 longer than right leg 5; segment 4 bent inwards at three quarters length, armed with three lamellate processes of increasing size along inner margin and one digitate, slightly curved projection at three quarters length of inner margin; segment 5 slightly curved inwards, bearing lamellate, weak process and straight digitate projection subdistally along inner margin; apical part ornamented with row of spinules distal to digitate projection, tapering into rounded apex.

*Etymology*

The specific name *spitsbergensis* refers to the geographical origin of the species, the island of Spitsbergen, the largest island in the Svalbard Archipelago.

*Remarks*

To date, the genus *Mesaiokeras* Matthews, 1961 contains the following species: *M. heptneri* Andronov, 1973, *M. kaufmanni* Fosshagen, 1978 (female unknown), *M. marocanus* Andronov, 1995 (female unknown), *M. mikhailini* Andronov, 1995 (female unknown), *M. nanseni* Matthews, 1961, *M. semiplenus* Andronov, 1973, *M. tantillus* Andronov, 1973. Above all, the new species is distinguished from its congeners by its markedly larger size of both female (0.88–1.05 mm) and male (0.94–1.01 mm), contrary to all remaining species that have a size range of 0.29–0.54 mm, the latter hitherto maximum length for congenerics being reported for the male of *M. mikhailini.* The new species, together with *M. heptneri*, forms a group that may be considered as the most plesiomorphic within the genus (Fosshagen 1978), because (1) ancestral segments XXVI and compound segment XXVII–XXVIII of the antennule are still separate, with the consequence of displaying 24 free antennular segments, whereas remaining species exhibit the fusion of both these segments resulting in a 23-segmented antennule; (2) the first and second exopodal segments of leg 1 carry an outer distal spine each (these spines being absent in the other species, in *M. mikhailini* the second exopodal segment bears a spine as well); (3) female fifth legs with both (left and right) rami being present (only a single ramus expressed in other congeners); (4) male fifth legs with a three-segmented right ramus instead of being unsegmented, as in remaining species (Fosshagen 1978). The new species may easily be differentiated from *M. heptneri* by (1) a distinctly larger size, (2) the female first and second segments of the fifth legs being ornamented with spinules, and (3) the terminal segment having a long outer spiniform process of about 0.6 times the length of the inner one. Male *M. spitsbergensis* differs from *M. heptneri* in that pedigerous somites 4 and 5 are separate (fused in the latter) and segment 4 of the left ramus of the fifth legs is bent inwards at three quarters length, whereas in *M. heptneri* this segment is straight.

The previously recognized seven species of *Mesaiokeras* were all reported close to the bottom in shallow (20 m) to deep (780 m) water around the coasts of Colombia and the USA in the western Atlantic and from off southwest Africa, Morocco, and Norway in the eastern Atlantic (Andronov 1973, 1995; Fosshagen 1978). As the eighth species, *M. spitsbergensis* is the first record of the genus in the Arctic. Of the 10 females collected in Kongsfjorden, five were found in the MPS samples obtained from the depth range 363–60 m and two were found in the WP-2 sample from the entire water column 355–0 m. Three female individuals were caught in the C-B sampler hauled in close proximity of the sea-bed at depths of 365–269 m. All specimens were collected from the outer fjord.

Family Scolecitrichidae Sars, 1902
Genus *Xantharus* Andronov, 1981
***Xantharus siedleckii* sp. nov.** (Figs 6–9)

*Material examined*

An undissected adult female (total length 1.54 mm) from the WP-2 net, vertical haul 355–0 m, bottom depth 359 m is designated as the holotype and is deposited in the NHMW (reg. no. MP 890a) in Wroclaw. One undissected paratype female (reg. no. MP 890b) from the MPS sampler, vertical haul 320–220 m, bottom depth 330 m (79°02.67′N 11°07.96′E), 29 July 2002,

12:30 GMT, and one undissected paratype male (reg. no. MP 890c) from the same sample, are also deposited in the NHMW collections. Additional specimens are in the collection of the co-author (SK). One dissected female from the MPS sampler, vertical haul 327–200 m, bottom depth 380 m (79°01.06′N 11°24.36′E), 13 July 1996, 09:00 GMT; one dissected female from the MPS sampler, vertical haul 285–170 m, bottom depth 300 m (78°56.70′N 11°57.00′E), 2 September 1997, 08:00 GMT; one dissected male from the MPS sampler, vertical haul 377–254 m, bottom depth 380 m (79°00.90′N 11°23.00′E), 1 September 1997, 11:00 GMT; one dissected male from the MPS sampler, vertical haul 350–330 m, bottom depth 355 m (79°00.90′N 11°24.93′E), 24 July 2001, 19:00 GMT) are deposited as paratypes in the collections of ZMH (reg. no. 40428) in Hamburg. Collected by S. Kwasniewski.

*Type locality*

RV *Jan Mayen*, UNIS AB310, Stn 1135, Kongsfjorden, Spitsbergen (78°59.92′N 11°30.19′E) collected 12 September 2002, 06:30 GMT.

*Description*

Adult female. Body length 1.20–1.54 mm (mean ± standard deviation = 1.40 ± 0.11 mm, n = 8). Body (Fig. 6A, B) compact, ovoid in dorsal aspect. Rostrum (Fig. 6C, D) strong, directed ventrally, bearing pair of slender filaments directed posteriorly on tip. First pedigerous somite integrated into cephalosome; fourth and fifth pedigerous somites separate except ventrolaterally; lateral margins of prosome symmetrical, produced posteriorly into angular blunt tip reaching about two-thirds length of genital double-somite. Sensillae distributed on prosomal somites as figured. Urosome (Fig. 6E) four-segmented; genital double-somite (Fig. 6F) symmetrical in dorsal aspect, in lateral view weakly produced ventrally; seminal receptacles comparatively large, bean-shaped. Urosomal somites 1–3 with dentate hyaline frill on posterior margin; somite 3 longer than 2; anal somite very short, about 10% length of preceding somite and completely concealed beneath its hyaline frill. Caudal rami (Fig. 6G) symmetrical, longer than wide; armature consisting of six setae; seta II reduced, implanted on lateral edge; setae III–VI strong, implanted distally; seta VII reduced, displaced ventrally.

Antennules (Fig. 7A, B) symmetrical, short, 24-segmented, reaching posterior margin of cephalothorax; compound segments involving ancestral segments II–IV, X–XI and XXVII–XXVIII. Armature pattern as follows: segment 1 (corresponding to ancestral segment I) three setae; segment 2 (II–IV) six setae + aesthetasc; segment 3 (V) two setae + aesthetasc; segment 4 (VI) two setae; segment 5 (VII) two setae + aesthetasc; segment 6 (VIII) two setae; segment 7 (IX) two setae + aesthetasc; segment 8 (X–XI) four setae + aesthetasc; segments 9–10 (XII–XIII) one seta each; segment 11 (XIV) two setae + aesthetasc; segment 12 (XV) one seta; segment 13 (XVI) two setae + aesthetasc; segments 14–16 (XVII–XIX) one seta each; segment 17 (XX) two setae; segment 18 (XXI) one seta + aesthetasc; segments 19–20 (XXII–XXIII) one seta each; segments 21–23 (XXIV–XXVI) one + one seta each; segment 24 (XXVII–XXVIII) five setae + aesthetasc.

Antenna (Fig. 6H) biramous, with exopod slightly longer than endopod. Coxa with patch of long spinules along outer margin and one long inner seta; basis with two unequal inner setae; endopod two-segmented, first segment with two unequal setae subdistally, second with two lobes, medial lobe having eight setae, apical lobe armed with six setae; exopod indistinctly eight-segmented, setal formula 0, 1, 1, 1, 1, 1, 1, 3.

Mandible (Fig. 7C) with coxal gnathobase cutting edge bearing major group of three large, acute teeth and four smaller teeth plus two pinnate dorsal spines. Mandibular palp carrying on basis three unequal setae and patch of denticles subdistally; endopod as long as exopod, two-segmented; first segment bearing three unequal setae, second bearing nine distal setae; exopod five-segmented carrying six setae, distal-most reduced in size.

Maxillule (Fig. 8A): praecoxal arthrite with nine marginal and three posterior setae; coxal epipodite with row of nine setae; coxal endite with two setae; basal endites with four setae each; exopod with eight marginal setae; endopod unsegmented, armed with three + two + five setae. Praecoxal arthrite, basis and exopod ornamented with denticles as figured.

Maxilla (Fig. 6I): proximal praecoxal endite with four setae; distal praecoxal and both coxal endites each with three setae, one of them shorter; basal endite carrying one stout spine, one strong curved seta plus two slender setae. Endopod indistinctly three-segmented, armed with five subequal brush-like sensory setae having small compact heads, and three long worm-like sensory setae.

Maxilliped (Fig. 7D) elongate; syncoxa with four slightly developed endites with armature formula 1, 2, 3, 3; proximal-most seta distinctly longer than rest of syncoxal setae, reaching to distal end of syncoxa; third endite with one short, one long sclerotized and one long sensory seta having small brush-like tip; syncoxal

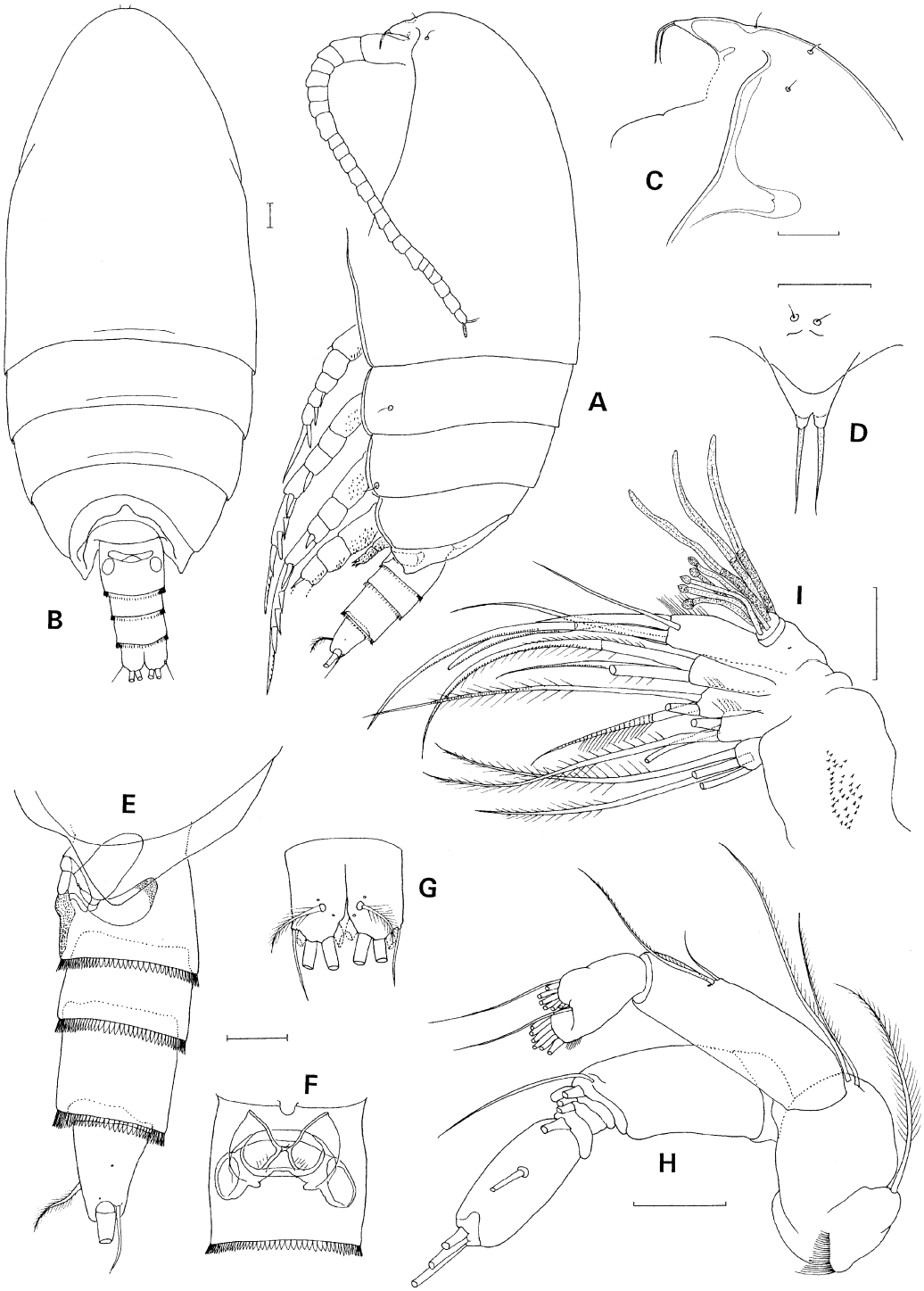


Fig. 6. *Xantharus siedleckii* sp. nov.; female. A. Habitus, lateral. B. Same, dorsal. C. Rostrum, lateral. D. Same, anteroventral. E. Urosome, lateral. F. Genital double somite, ventral. G. Caudal rami, ventral. H. Antenna. I. Maxilla. Scale lines 0.05 mm.

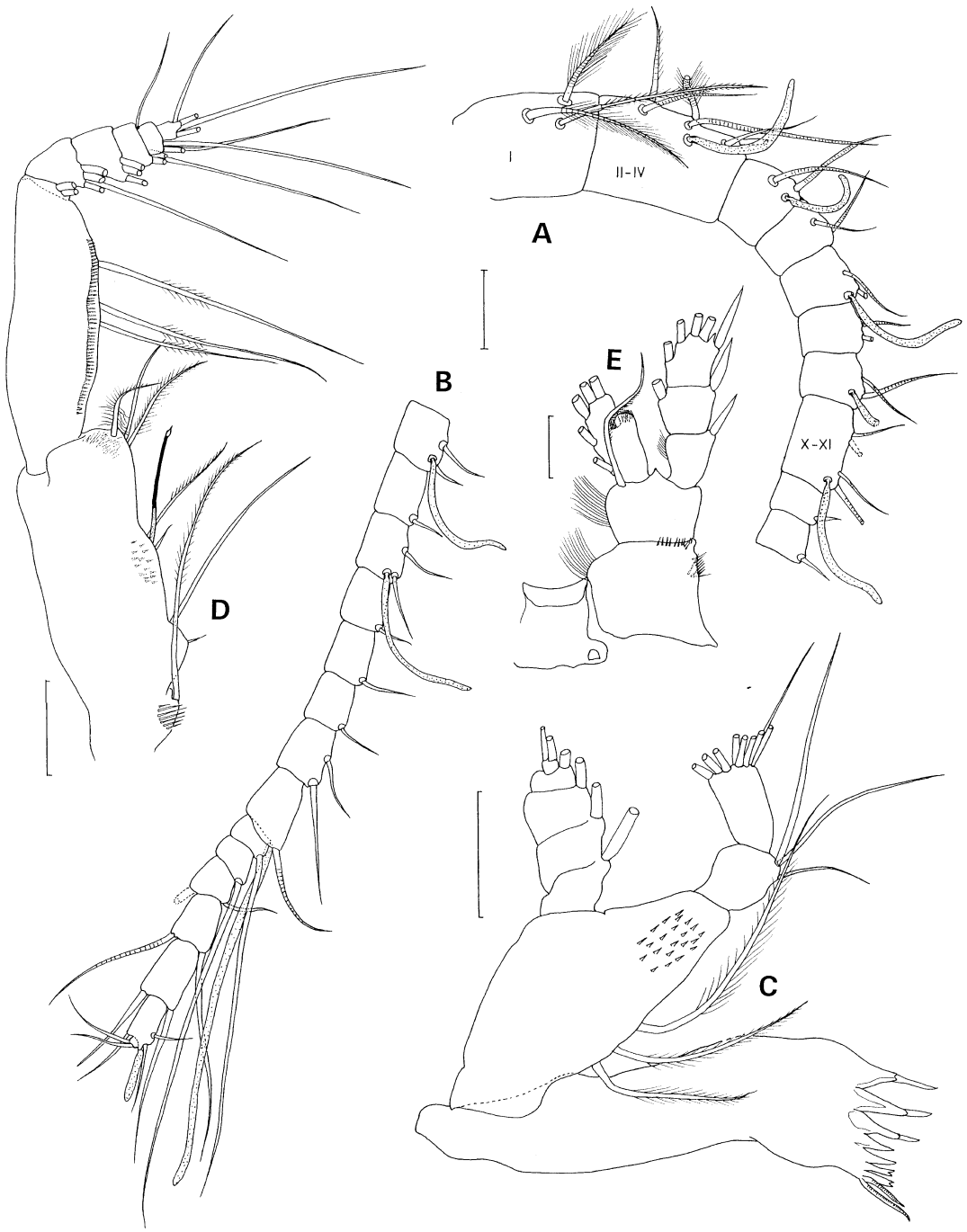


Fig. 7. *Xantharus siedleckii* sp. nov.; female. A. Antennule, segments I–XIII. B. Antennule, segments XIV–XXVIII. C. Mandible. D. Maxilliped. E. leg 1. Scale lines 0.05 mm.

ornamentation consisting of two patches of spinules, located slightly proximal to proximal-most seta and at midlength, close to third setal group; basis about as long as syncoxa, armed with three long setae along medial margin and submarginal row of spinules along three quarters of medial margin; first endopod segment

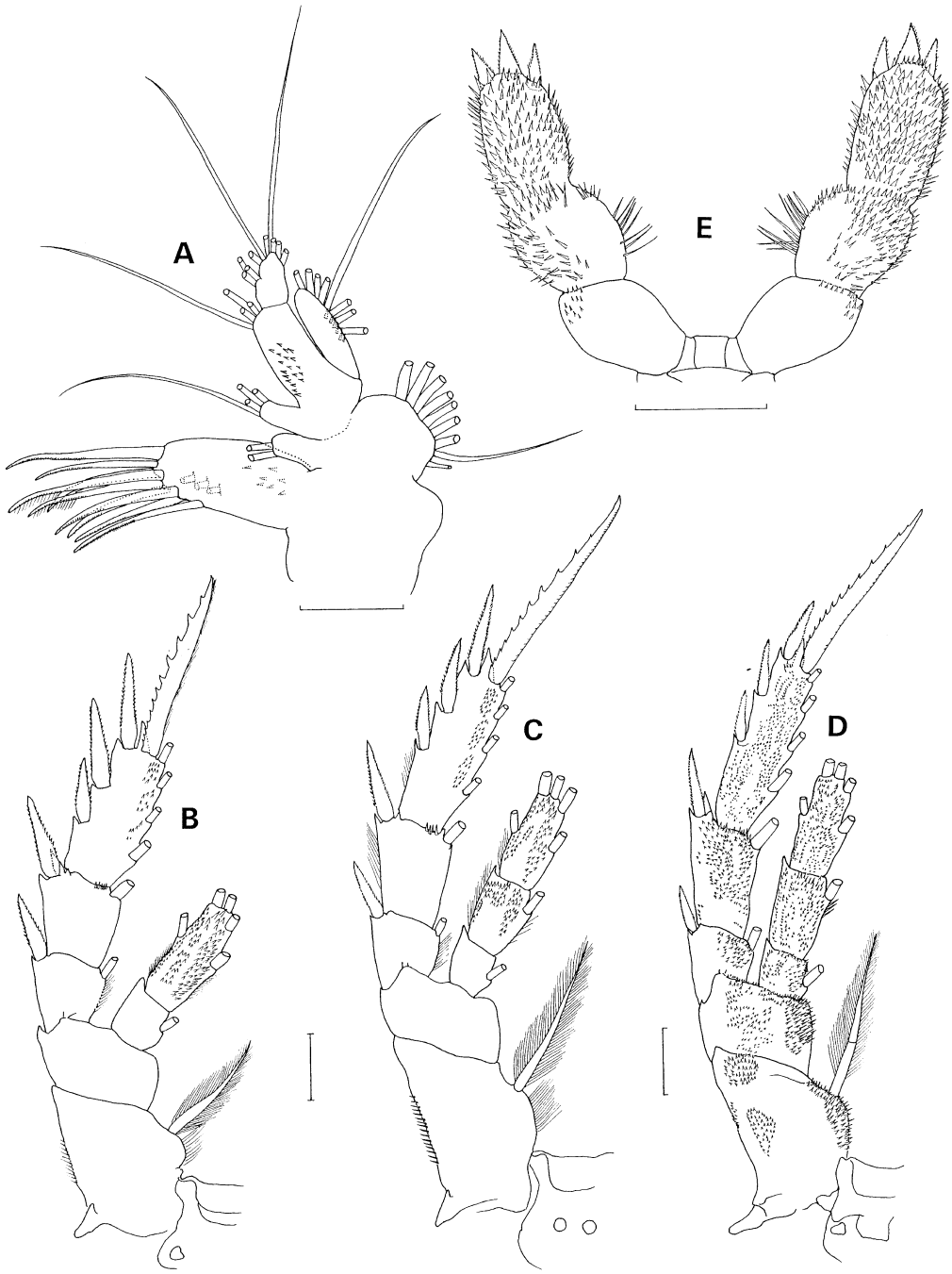


Fig. 8. *Xantharus siedleckii* sp. nov.; female. A. Maxillule. B. Leg 2. C. Leg 3. D. Leg 4. E. Legs 5. Scale lines 0.05 mm.

almost completely incorporated into basis, bearing two setae; second to sixth endopodal segments having four, three, three, three+one, and four setae.

Swimming legs (Figs 7E, 8B–D) increasing in size from 1 to 4, each with three-segmented exopod; endopod of leg 1 one-segmented, that of leg 2 two-segmented, endopods of legs 3 and 4 three-segmented. Leg 1 (Fig. 7E): coxa ornamented with

row of spinules subdistally along outer margin and along outer distal margin on anterior surface; basis bearing one curved seta on distal medial edge; endopod with large outer lobe ornamented with spinules distally; exopodal segments 1–3 with large, compact outer spines. Leg 2 (Fig. 8B): basis with outer corner produced into pointed process; second endopod segment with strong ornamentation of denticles on posterior surface; exopod with large, compact outer spines ornamented with denticles; distal spine of third segment with inner margin plumose, outer margin coarsely serrate with about 12 teeth, widely spaced distally. Leg 3 (Fig. 8C): coxa with row of spinules along outer margin; first and second endopod segments each with pointed process on outer corner; second and third segments ornamented with denticles on posterior surface; outer spines on first to third exopodal segments slightly smaller than counterparts on leg 2; third exopod segment with distal spine longer than leg 2 counterpart, with about 11 teeth. Leg 4 (Fig. 8D) similar to leg 3 but posterior surface of entire leg densely covered with spinules as figured; outer spines of exopodal segments comparatively smaller and more slender than those of legs 2 and 3; distal exopodal spine of third segment shorter than that of leg 3.

Fifth legs (Fig. 8E) uniramous, symmetrical, three-segmented, with proximal segment separate from intercoxal sclerite; distal segment mostly fused to second, bearing two short spine-like projections distally and one stout inner spine subdistally, all covered with denticles; length of segments increasing from first to third, and ornamented with denticles; inner margin of second segment bearing long spinules.

Adult male. Body length 1.02–1.14 mm (mean ± standard deviation = 1.07 ± 0.03 mm, n = 17); habitus (Fig. 9A, B) similar to female except for five-segmented condition of urosome. Genital somite asymmetrical, slightly produced posteriorly on left side; gonopore opening posterolaterally on left side; anal somite extremely short; caudal rami as in female. Appendages similar to female except for antennule and fifth legs. Antennules (Fig. 9C–F) slightly asymmetrical, relatively longer compared with those of female, extending to end of second pedigerous somite. Segmentation pattern as in female except for right antennule, 23-segmented due to fusion of ancestral segments XXII–XXIII; armature differing from female especially in the presence of a higher number of aesthetascs, with double aesthetascs located on segments III, V, VII, IX, and XI. Armature pattern of left antennule as follows: segment 1 (ancestral segment I) one seta + aesthetasc; segment 2 (II–IV) six setae + four aesthetascs; segment 3 (V) two setae + two aesthetascs; segment 4 (VI) two setae + aesthetasc; segment 5 (VII) two setae + two aesthetascs; segment 6 (VIII) two setae + aesthetasc; segment 7 (IX) two setae + two aesthetascs; segment 8 (X–XI) four setae + three aesthetascs; segments 9–10 (XII–XIII) one seta + one aesthetasc each; segment 11 (XIV) two setae + aesthetasc; segment 12 (XV) one seta + aesthetasc; segment 13 (XVI) two setae + aesthetasc; segments 14–18 (XVII–XXI) one seta + one aesthetasc each; segment 19 (XXII) naked; segment 20 (XXIII) one seta; segment 21 (XXIV) one + one seta; segment 22 (XXV) one + one seta + aesthetasc; segment 23 (XXVI) one + one seta; segment 24 (XXVII–XXVIII) seven setae + aesthetasc.

Fifth legs (Fig. 9G) asymmetrical, uniramous; left longer than right. Coxa of right leg fused with intercoxal sclerite; left ramus indistinctly five-segmented; coxa distinctly larger than right counterpart, with sparsely set long spinules distally; basis with lobe-like protrusion distally on inner margin, interpreted as remnant of endopod; exopod slender, first segment armed with small inner and slightly larger spine distolaterally; second segment having short inner row of spinules distally; third segment tapering distally, about half length of preceding segment and incompletely separated from it, with a row of spinules on inner margin. Right ramus five-segmented, coxa and basis of about equal size, coxa ornamented with distolateral spinules; basis unarmed, with distomedial outgrowth (probably remnant of endopod); exopod shorter than left counterpart, first segment with small spine on distolateral edge and spinules as figured; second segment having a row of spinules on inner face; terminal segment more slender, spine-like, tapering distally and armed with small, spine-like projection on outer half.

### *Etymology*

The specific name is given in honour of Professor Dr Stanislaw Siedlecki, Polish geologist, pioneer of Polish contemporary research activity in the Arctic, initiator of establishing the Polish Polar Station in Spitsbergen fjord Hornsund, and Arctic explorer.

### *Remarks*

The genus *Xantharus* comprises to date two species which have been collected in near-bottom and shallow slope waters (220–235 m) of the northwestern Atlantic off the USA (*X. formosus* Andronov, 1981) and *X. renatehaassae* Schulz, 1998 in Antarctic waters of the eastern Weddell Sea, the latter described only from a single female which was probably captured, close to

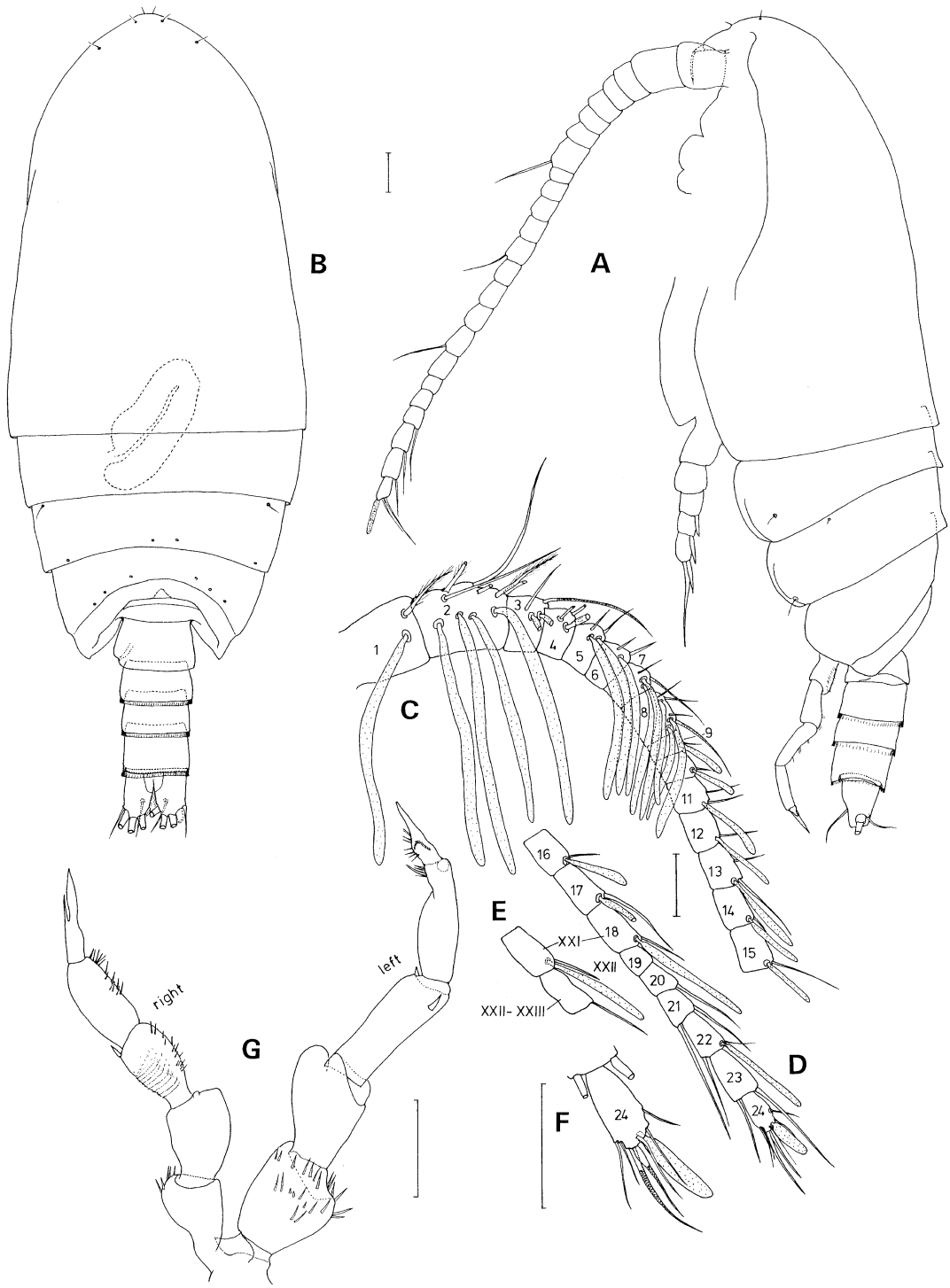


Fig. 9. *Xantharus siedleckii* sp. nov.; male. A. Habitus, lateral. B. Same, dorsal. C. Antennule, segments I–XVIII. D. Left antennule, segments XIX–XXVIII. E. Right antennule, segments XXI, XXII–XXIII. F. Distal segment (XXVII–XXVIII) of left antennule. G. Legs 5, posterior. Scale lines 0.05 mm.

the deep-sea bottom (single haul: 1040–500 m, water depth 1050 m). The female of *X. siedleckii* may be distinguished from both congeners most notably by its larger size and an indistinctly three-segmented fifth pair of legs armed with three subequal spine-like projections distally, whereas both remaining species have clearly three-segmented fifth legs with the third segment carrying two (*X. renatehaassae*) or three (*X. formosus*) subequal spine-like projections. The presence of a modified seta, like the maxillipedal sensory seta with a small brush-like tip, reported from *X. renatehaassae* by Schulz (1998), could be confirmed on the third syncoxal endite in the present species. With regard to this feature there is no information available from the type species *X. formosus*, as the maxilliped has not been illustrated. The male of *X. siedleckii* differs from *X. formosus* most notably in the larger body size and by lacking a one-segmented endopod on both rami of leg 5.

The male antennule of *X. siedleckii* is noteworthy in that it displays double aesthetascs on proximal odd-numbered ancestral segments III–XI, as demonstrated in a number of Clausocalanoidean taxa and, usually, in pelagic species of more plesiomorphic superfamilies, thus probably enhancing the male chemosensory capacity to locate receptive females (Boxshall & Huys 1998). Only recently, evidence of doubling of aesthetascs on proximal antennulary segments was presented for the first time for a member of the pelagic copepod family Discoidae (Schulz, in press), contrary to the statement of Bradford-Grieve (2002a) that this family lacks any double aesthetascs. All but one female of *X. siedleckii* and most of the males were collected by MPS from the water column within the depth range 377–170 m. A single female was found in the WP-2 sample from 355–0 m. Remaining males were caught by C-B sampler in proximity to the bottom at depths of 350–273 m. It is assumed here that the individuals were captured within a close distance of the seafloor in the outer part of Kongsfjorden.

The systematic position of the genus *Xantharus* is still a matter of debate on account of a number of characteristics atypical of any of the five "Bradfordian" copepod families Diaixidae, Parkiidae, Phaennidae, Scolecitrichidae and Tharybidae (Ferrari & Markhaseva 1996), all having sensory setae instead of normally sclerotized setae on the maxillary endopod. These autapomorphies include the short antennule with exceptional strongly divergent sizes of ancestral segments XXI and XXII, particularly in the female, the coarsely serrate distal spine of the third exopod segment of legs 2–4, male mouthparts showing no setal reductions, and only slightly asymmetrical legs 5 in the male having strongly reduced or entirely lacking endopods. Originally, Andronov (1981) assigned the genus to the family Phaennidae, Vyshkvartzeva (1989), as well as Schulz (1998), later proposed to place it in Scolecitrichidae; recently, Bradford-Grieve (2002b) included this species-poor genus in the family Tharybidae, stating, however, that the genus does not fit easily within its ranks. However, until new characters are introduced that may help to discriminate between taxa of tharybid and scolecitrichid affiliation, *Xantharus* can conveniently remain within Scolecitrichidae.

## NOTE ADDED IN PROOF

Recently, another new species of *Mesaiokeras*, *M. hurei* KRSINIC, 2003, has been described from the Adriatic Sea, as the first representative of this genus in the Mediterranean. (Krsinic, F. 2003. *Mesaiokeras hurei* n. sp. (Copepoda, Calanoida, Mesaiokeratidea) from the Adriatic Sea, *Journal of Plankton Research* 25:939–948).

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