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Pseudotachidiidae) from the upper sublittoral zone off Hyeopjae beach,
Jeju Island, Korea, and a key to genera of the subfamily Danielsseniinae**

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A new species of *Sentiropsis* (Copepoda: Harpacticoida: Pseudotachidiidae) from the upper sublittoral zone off Hyeopjae beach, Jeju Island, Korea, and a key to genera of the subfamily Danielsseniinae

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Abstract.—Both sexes of a new species of *Sentiropsis* Huys & Gee, 1996 (Copepoda, Harpacticoida, Pseudotachidiidae) are described from the upper sublittoral zone off Hyeopjae, Jeju Island, Korea. *Sentiropsis coreana*, new species is very similar to its zoogeographically closest congener, *S. vietnamensis* Gómez & Chertoprud, 2009 from Nha Trang Bay (Vietnam) in the South China Sea. Females of both species differ primarily in morphometric characters. The presence of a well-developed apophysis on the male P2 endopod of *S. coreana* serves to distinguish it from the Caribbean type species, *S. minuta* (Coull, 1973) and calls into question the previously suggested sister-group relationship between *Sentiropsis* and the *Paradanielssenia*-lineage characterized by the presence of claviform aesthetascs on the mouthparts. An updated key to the 19 valid genera of the subfamily Danielsseniinae is provided. The genus *Carolinicola* Huys & Thistle, 1989 is removed from the Pseudotachidiidae and transferred to the subfamily Hemimesochrinae in the Canthocamptidae.

Keywords: abyssal copepods, historical review, zoogeography

The family Pseudotachidiidae (Copepoda: Harpacticoida) currently comprises 30 genera and 127 valid species (Willen 2006, 2008, 2009; Wells 2007, Willen & Schulz 2007, Kornev & Chertoprud 2008, Vasconcelos et al. 2008, Gómez & Chertoprud 2009, Willen & Dittmar 2009) accommodated in four subfamilies: Pseudotachidiinae, Pseudomesochrinae, Donsiellinae and Danielsseniinae. The latter was proposed by Huys & Gee (in Huys et al. 1996) as a replacement name for the unavailable subfamily name Paranannopodinae Por, 1986 [see Huys (2009) for argumentation and correct spelling]. Al-

though recent studies of the harpacticoid fauna from the Angola Basin and Antarctic deep sea (Rose et al. 2005, Willen 2008) revealed the Danielsseniinae as one of the most diverse and numerically important groups of abyssal copepods, some genera have also radiated in shallower habitats such as the upper sublittoral zone (e.g., *Danielssenia* Boeck, 1873; *Jonesiella* Brady, 1880; *Peltisenia* Huys & Gee, 1996; *Sentiropsis* Huys & Gee, 1996) or even sandy beaches (*Micropsammis* Gee & Huys, 1991; *Telopsammis* Gee & Huys, 1991; *Afrosenia* Huys & Gee, 1996) and mangrove forests (*Prionos* Huys & Gee, 1996). The subfamily assumes a virtually cosmopolitan distribution, par-

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ticularly in deeper waters; however, remarkably few records are known from East Asia. Shen & Bai (1956) recorded *Danielssenia typica* Boeck, 1873 off Yantai (formerly known to the West as "Chefoo") on the southern coast of the Bohai Sea from muddy substrates at 30–50 m depth. An unidentified species of *Danielssenia* was reported by Zhang et al. (2004, 2005a,b) from two stations in the southern part of the Yellow Sea between Qingdao and Jeju Island at depths of 73 and 80 m, respectively. The only other record of a danielsseniinid from East Asia is that by Gómez & Chertoprud (2009) who described a new species, *Sentropsis vietnamensis*, from Nha Trang Bay (Vietnam) in the South China Sea. This species, known only from two females collected from a coral sandy substrate in the upper sublittoral zone of Mot Island, was originally recorded as *Sentropsis* sp. nov. by Chertoprud et al. (2009). During a survey of the harpacticoid community along the coast of Jeju island of Korea, a new species of *Sentropsis* was collected off Hyeopjae. In this paper we provide an illustrated description of both sexes of the new species and discuss its relationships with other members of the genus.

Materials and Methods

Samples were collected by snorkeling in the littoral zone off the sandy beach at Hyeopjae, Jeju Island, Korea on 10 Apr 2004. Specimens were fixed and preserved with 70% ethanol. Before dissection, the habitus was drawn and the body length was measured from whole specimens temporarily mounted in lactophenol. Specimens were dissected in lactic acid, and the dissected parts were mounted on slides using lactophenol mounting medium. The coverslips were sealed with transparent nail varnish. All drawings were prepared using a drawing tube on an Olympus BX51 differential interfer-

ence contrast microscope. Some specimens were examined with a Philips XL30 scanning electron microscope (SEM). Specimens were prepared for SEM by dehydration through graded ethanol, critical point dried, mounted on stubs, and sputter-coated with gold. Scale bars in all illustrations and SEM micrographs are in μm .

The descriptive terminology follows Huys et al. (1996). Abbreviations used in the text are: A1, antennule; A2, antenna; ae, aesthetasc; enp, endopod; exp, exopod; P1–P6, first to sixth thoracopod; exp(enp)-1(2,3) to denote the proximal (middle, distal) segment of a ramus. The type series is deposited in the collections of the National Institute of Biological Resources (NIBR) in Korea. Specimens prepared for SEM were deposited in one of the author's (WL) collections in the Laboratory of Biodiversity, Department of Life Science, Hanyang University, Seoul.

Systematics

Family Pseudotachidiidae Lang, 1936
Subfamily Danielsseniinae Huys & Gee in
Huys et al. (1996)

Genus *Sentropsis* Huys & Gee, 1996
Sentropsis coreana, new species

Figs. 1–9

Type locality.—South Korea, northwestern coast of Jeju Island, off Hyeopjae beach (33°23'40"N, 126°14'23"E), depth 2–3 m, sand.

Material examined.—Holotype ♀ (NIBRIV 0000241452) in 70% ethanol. Paratypes: 1 ♀ and 3 ♂♂ (NIBRIV 0000241453) in 70% ethanol, 2 ♀♀ (NIBRIV 0000241457) dissected on 7 and 10 slides, respectively, and 2 ♂♂ (NIBRIV 0000241458) dissected on 4 and 8 slides, respectively. An additional 3 ♀♀ and 2 ♂♂ were examined under the SEM, and among them 1 ♀ and 1 ♂ were deposited in the author (WL)'s collection. All type specimens collected from the type locality

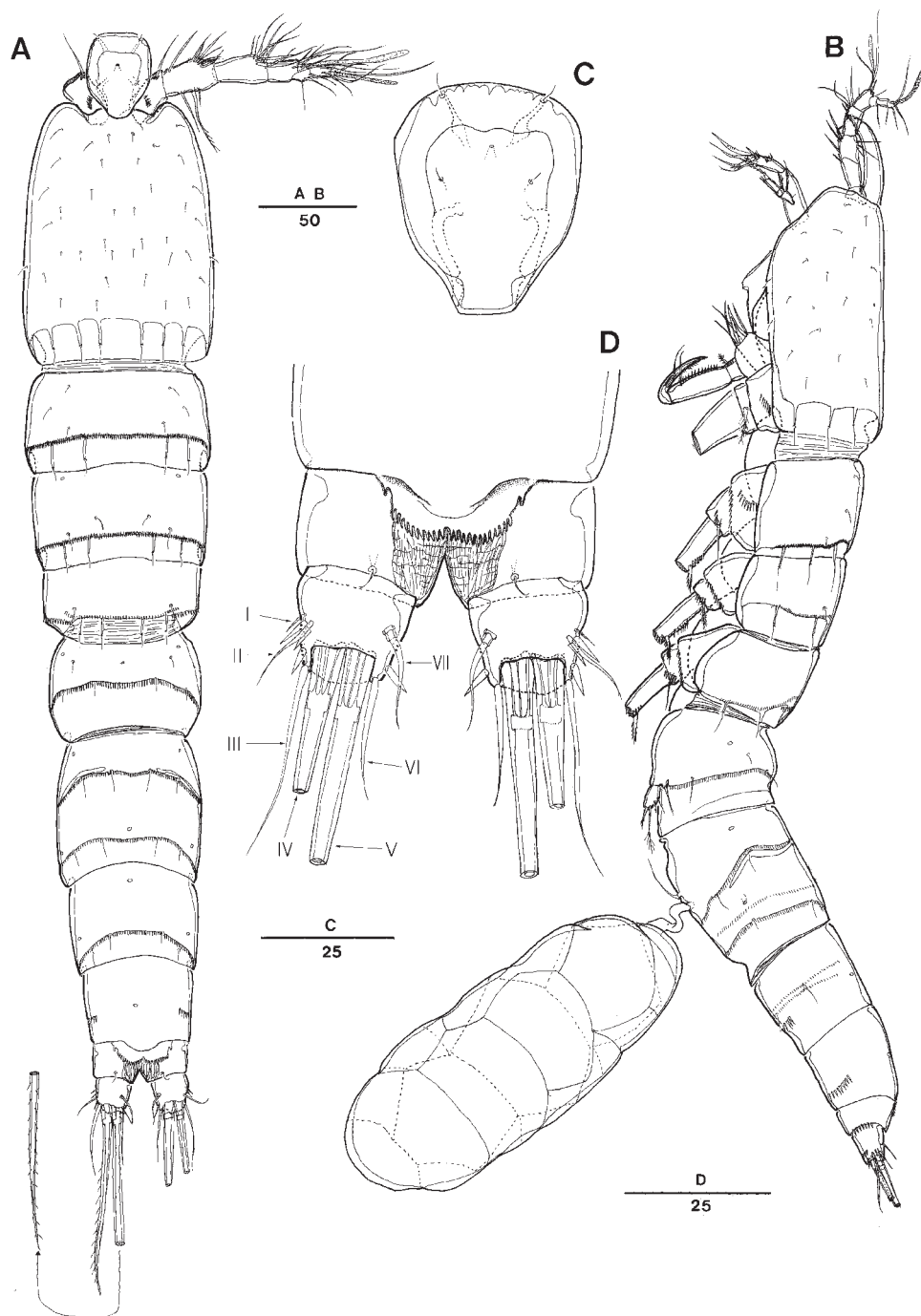


Fig. 1. *Sentiopsis coreana* (♀). A. Habitus, dorsal. B. Habitus of ovigerous individual, lateral. C. Rostrum, dorsal. D. Pseudoperculum, anal somite and caudal rami, dorsal.

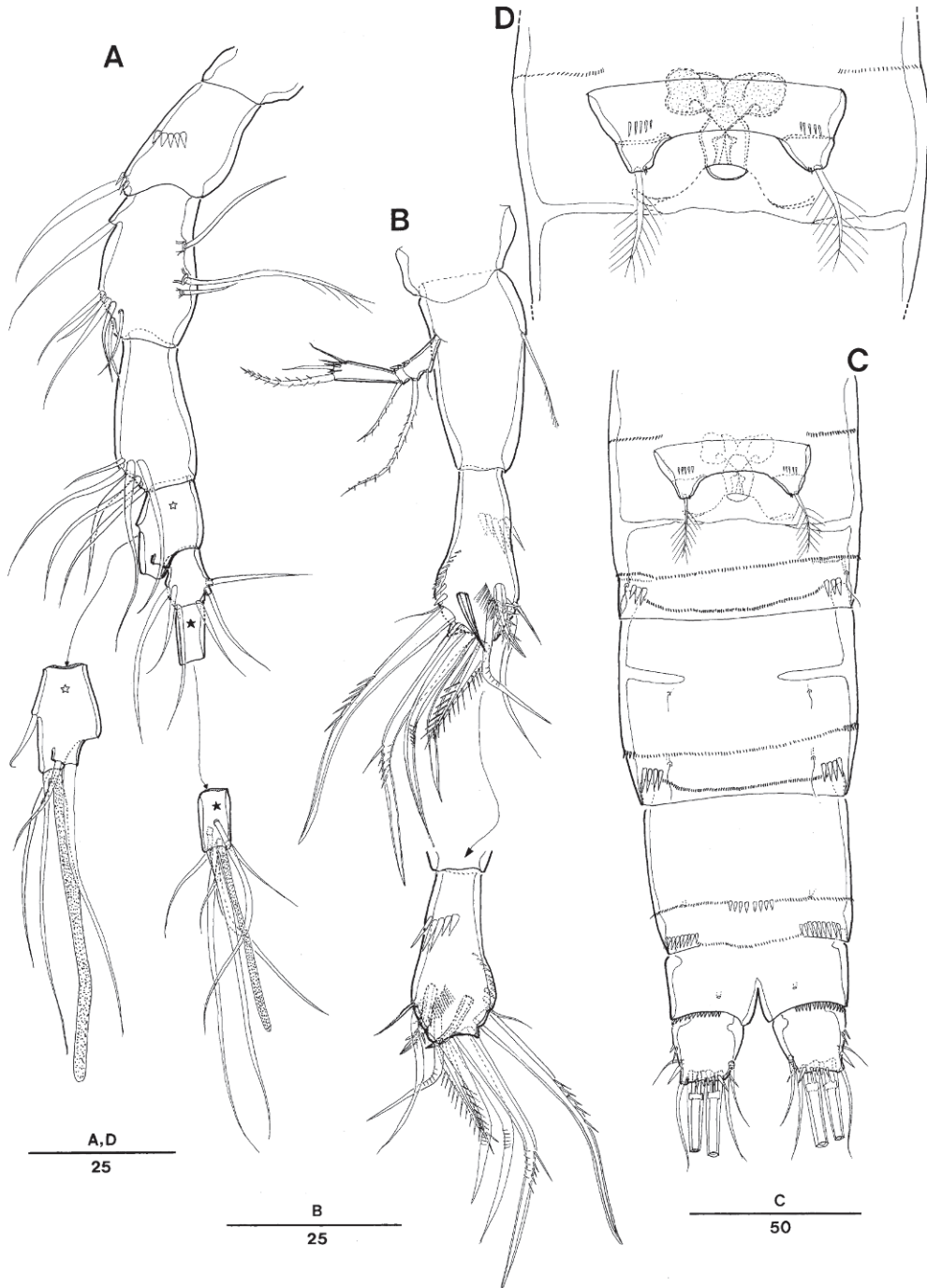


Fig. 2. *Sentiopsis coreana* (♀). A. Antennule, ventral [inserts showing armature on segments 4 and 6]. B. Antenna, outer lateral [insert showing medial view of distal endopod segment]. C. Urosome (excluding P5-bearing somite), ventral. D. Genital field, ventral.

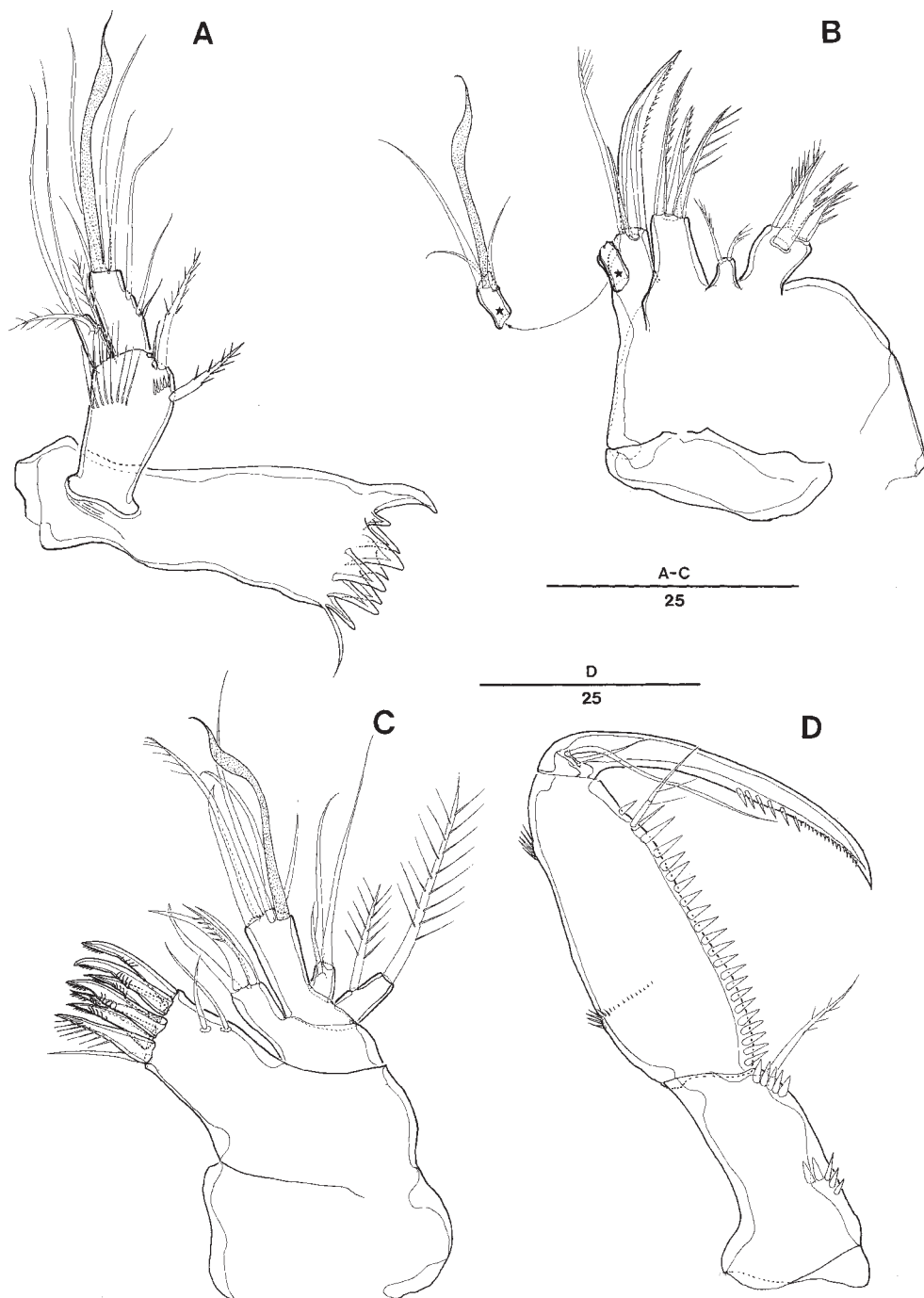


Fig. 3. *Sentiropsis coreana* (♀). A. Mandible. B. Maxilla [insert showing armature on endopod]. C. Maxillule, anterior. D. Maxilliped.

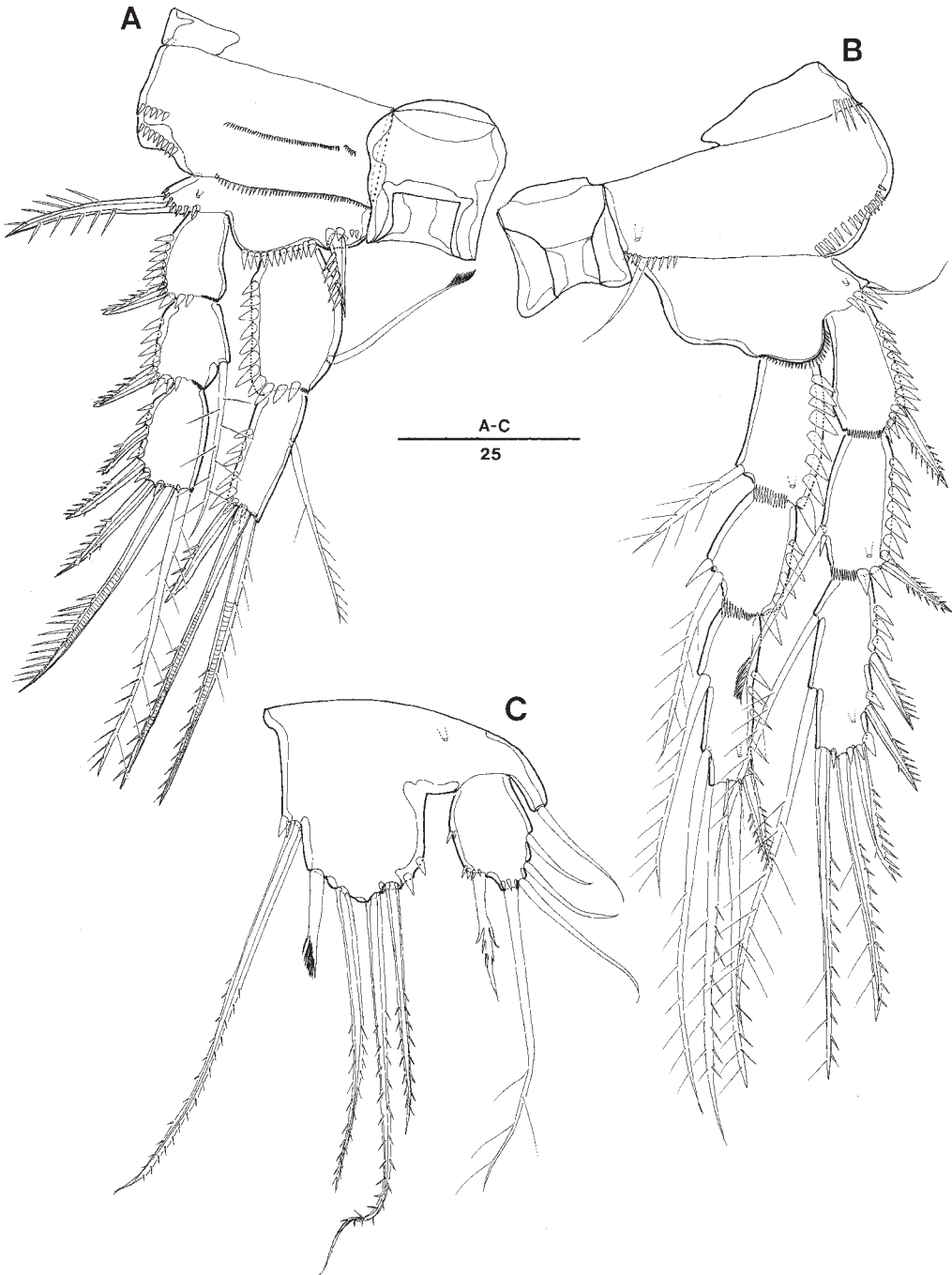


Fig. 4. *Sentiopsis coreana* (♀). A. P1, anterior. B. P2, anterior. C. P5, anterior.

on 10 Apr 2004 by E. J. Nam and Y. H. Song.

Description of female.—Total body length 550 μm (measured from anterior

margin of cephalic shield to posterior margin of caudal rami). Body (Fig. 1A, B) semi-cylindrical, slender, with prosome slightly wider than urosome. Largest

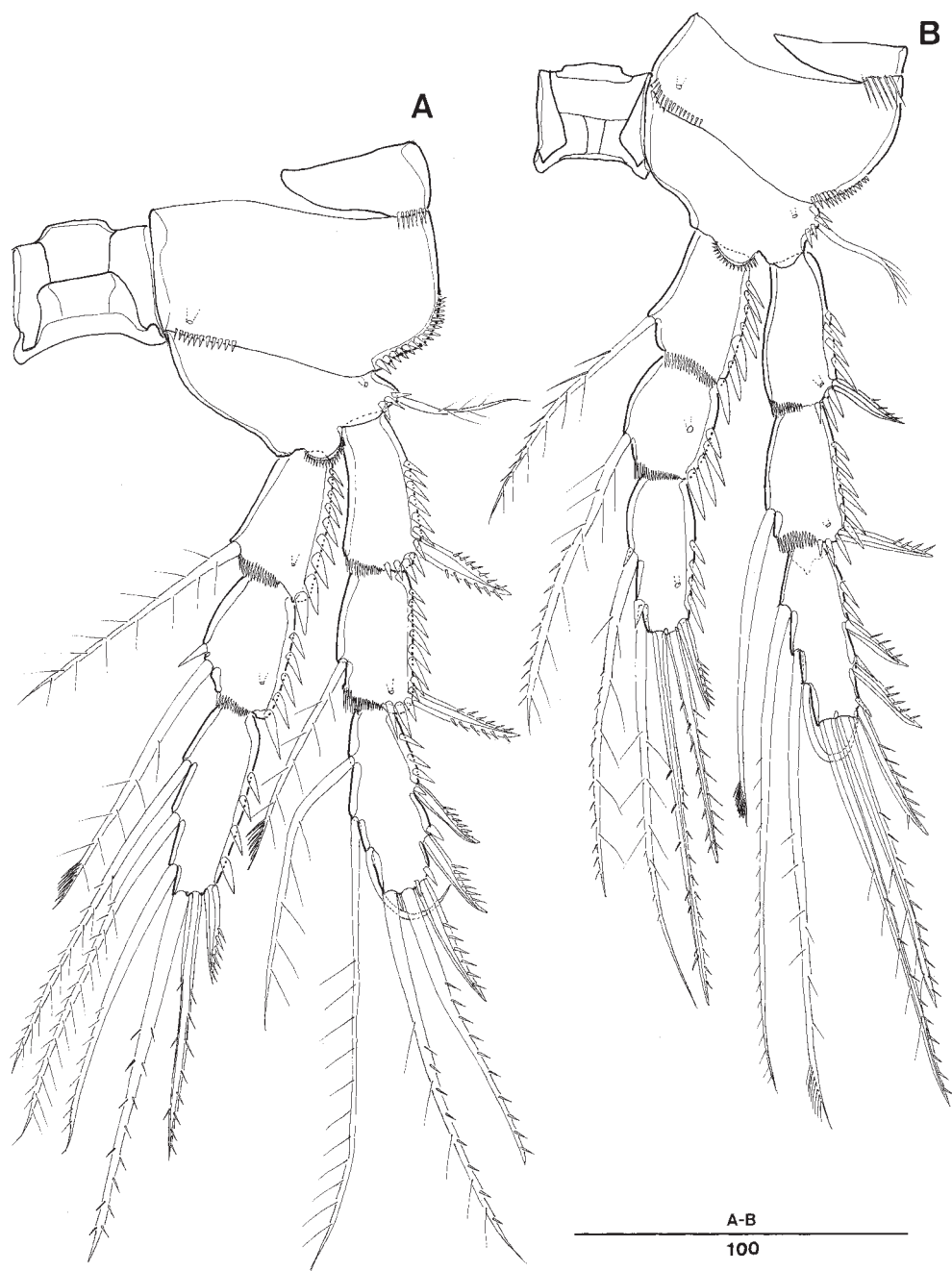


Fig. 5. *Sentiopsis coreana* (♀). A. P3, anterior. B. P4, anterior.

width measured at posterior margin of cephalic shield: 136 μm . All somites with pores and/or sensilla as illustrated in Figs. 1A, B, D, and 2C.

Rostrum (Fig. 1C) large, ventrally deflected (Fig. 1B), hyaline, rounded anteriorly, tapering at base; with 2 pairs of minute sensilla and 1 median pore dorsally.

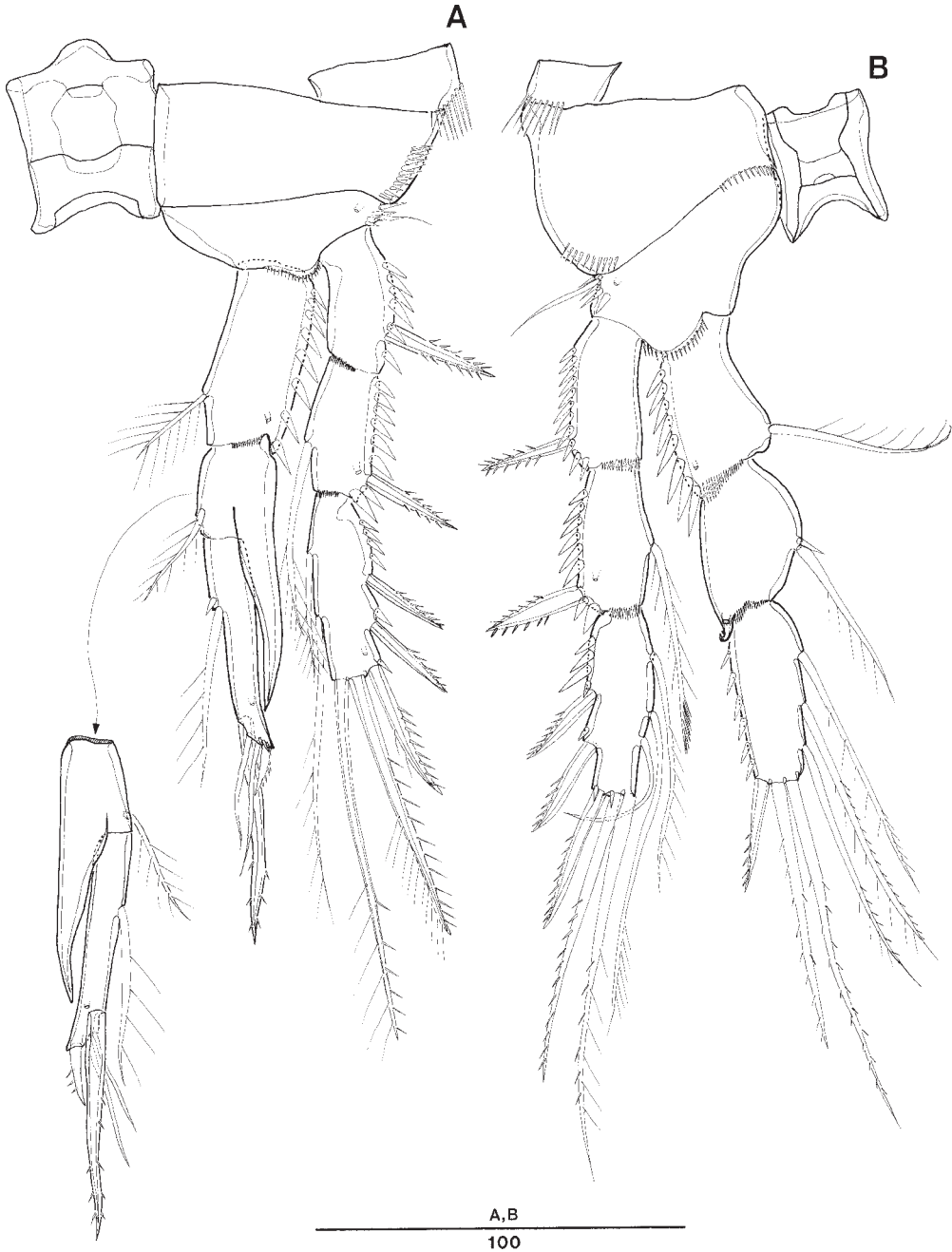


Fig. 6. *Sentiopsis coreana* (♂). A. P2, anterior [insert showing middle and distal endopod segments in posterior view]. B. P3, anterior.

Prosoma (Fig. 1A, B) 4-segmented, comprising cephalothorax and 3 free pedigerous somites. Cephalothorax with smooth posterior margin. Free pediger-

ous somites without distinct hyaline frills; with transverse row of minute spinules subdistally; posterior margin smooth.

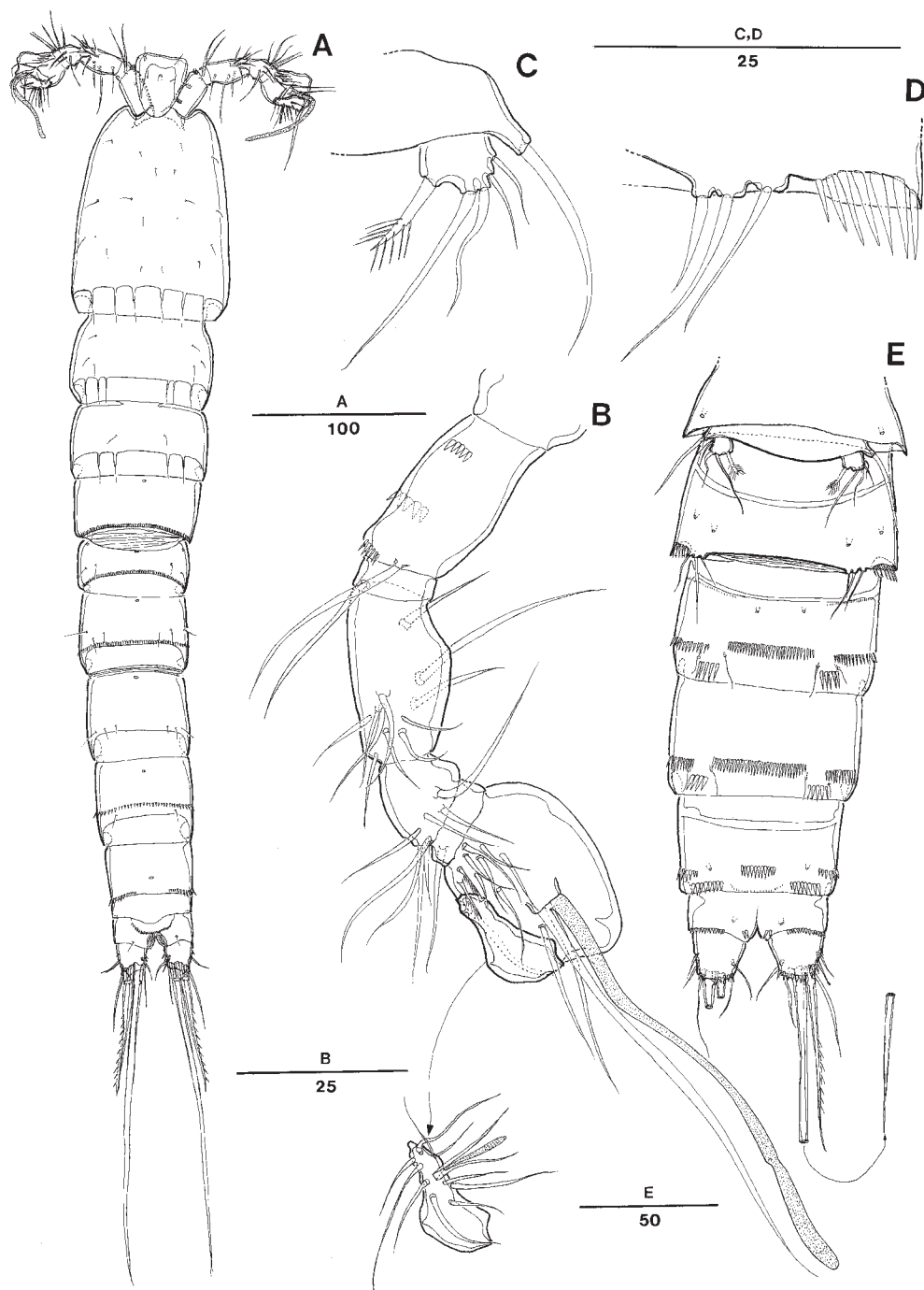


Fig. 7. *Sentiropsis coreana* (♂). A. Habitus, dorsal. B. Antennule, ventral [insert showing armature on segment 7]. C. Left P5, anterior. D. Left P6, anterior. E. Urosome, ventral.

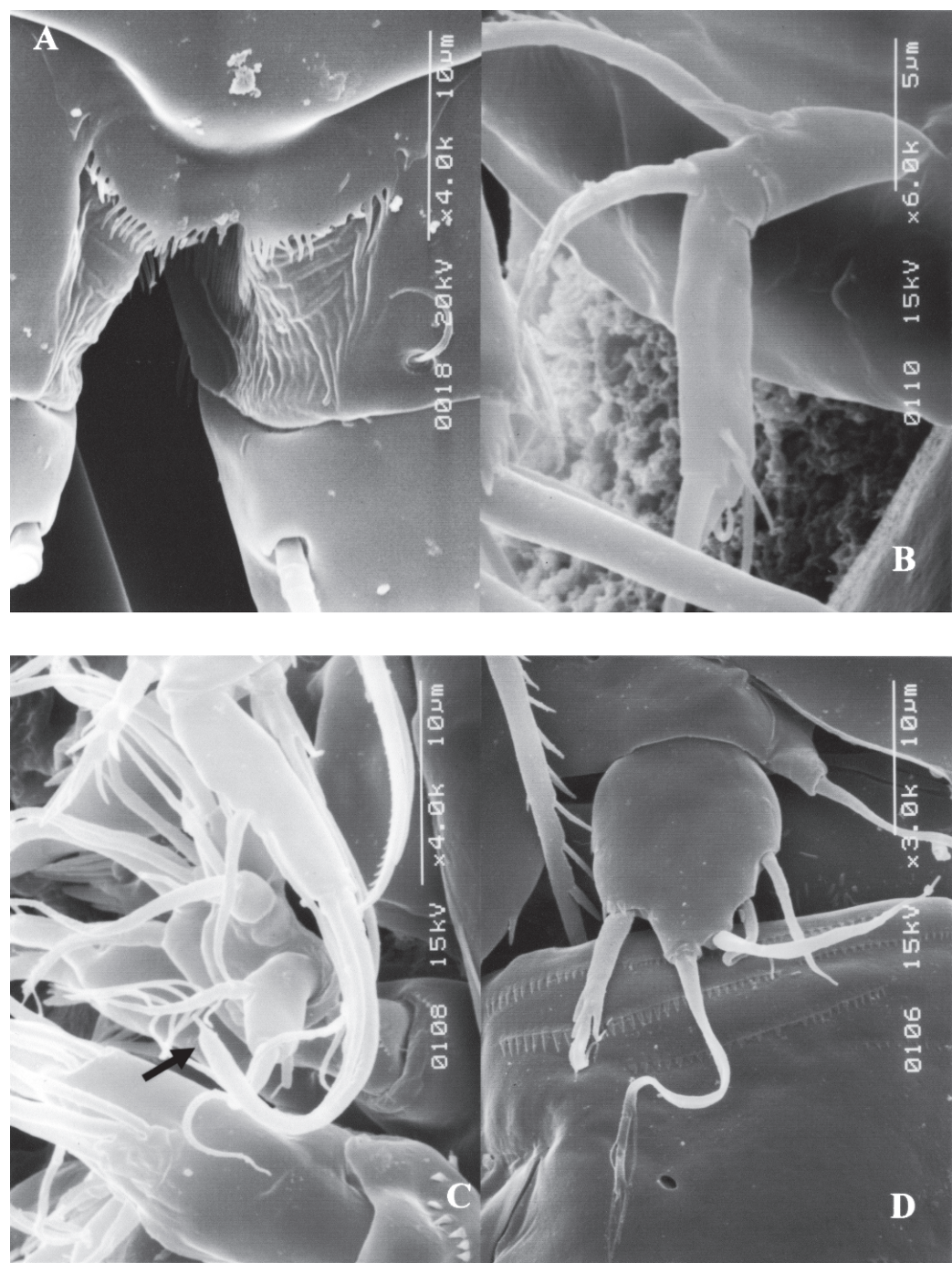


Fig. 8. SEM micrographs of *Sentiopsis coreana* (♀). A. Anal somite and pseudopericulum, dorsal. B. Antennary exopod. C. Mouthparts, lateral [arrow indicates aesthetasc-like element on mandibular endopod]. D. P5 exopod, ventral.

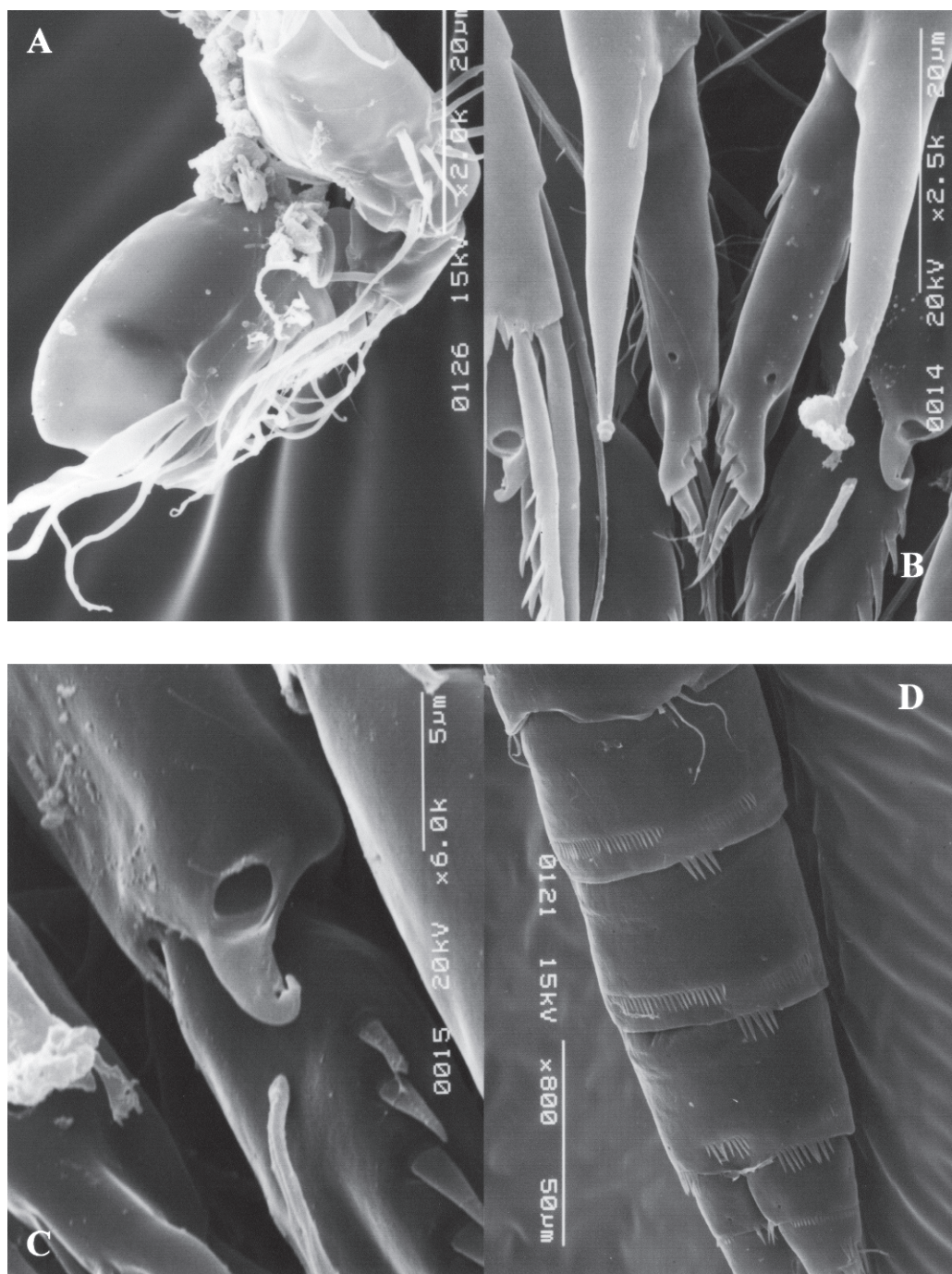


Fig. 9. SEM micrographs of *Sentiopsis coreana* (♂). A. Antennule, ventral. B. P2 endopod, anterior. C. Apophysis and pore on P3 enp-2, anterior. D. Urosome, lateroventral.

Urosome (Figs. 1A, B, 2C) 5-segmented, comprised of P5-bearing somite, genital double-somite, and 3 free abdominal somites. All urosomites with smooth posterior margins. P5-bearing somite with continuous row of minute spinules dorsally and laterally.

Genital double-somite longer than wide; original segmentation marked by internal chitinous ribs dorsolaterally, laterally and ventrally (Figs. 1A, B, 2C, D); anterior half with paired rows of tiny spinules lateroventrally (Figs. 2D, 8D); posterior half with row of minute spinules around entire somite, and second row of minute spinules ventrally flanked by ventrolateral patches of larger spinules. Genital apertures (Fig. 2D) fused medially, forming common transverse genital slit; closed off by paired opercula derived from vestigial P6, each bearing one pinnate seta; midventral copulatory pore located at about mid-length of double-somite; moderately large; leading via short copulatory duct to median seminal receptacle with paired chambers located anterior to genital slit.

Second and third postgenital somites (Figs. 1A, B, 2C) with rows of minute spinules as illustrated; with paired patches of coarse spinules ventrolaterally. Anal somite deeply cleft medially (Figs. 1D, 2C, 8A); anal operculum absent but functionally replaced by membranous, bilobate, serrate pseudoperculum derived from dorsal posterior margin of penultimate somite (Figs. 1D, 8A); ventral posterior margin with spinules.

Caudal rami (Fig. 1D) slightly divergent, trapezoid, slightly wider than long; with ventral extension overlying bases of setae IV and V; with 7 setae; outer and inner margins with few spinules. Seta I minute; setae II and III slender and bare; setae IV and V well developed, pinnate in posterior half (Fig. 1A), not fused basally, with predesigned fracture planes; seta VII bi-articulate at base; setae I–III and VI–VII bare.

Antennule (Fig. 2A) of moderate length, 6-segmented; without pinnate or plumose setae/spines except for single plumose seta on segment 2. Segment 1 with 2 spinular rows; segment 4 with aesthetasc (55 μ m) fused basally to seta; segment 6 with apical acrothek consisting of 2 setae and slender aesthetasc (33 μ m). Armature formula: 1-[1], 2-[10 + 1 plumose], 3-[7], 4-[4 + (1 + ae)], 5-[6], 6-[5 + acrothek].

Antenna (Fig. 2B). Coxa represented by small sclerite without ornamentation. Basis and proximal endopod segment completely fused, forming allobasis; abexopodal margin with unipinnate seta. Exopod (Fig. 8B) 3-segmented, exp-2 minute; armature formula [2, 1, 2]; proximal seta of exp-1 and outer apical seta of exp-3 small; exp-3 with tuft of spinules at outer distal corner. Free endopod with 2 spinular rows and surface hyaline frill; lateral armature consisting of 1 bipinnate spine, 1 geniculate seta and 2 naked setae (one of which very small); distal armature represented by 4 geniculate setae (longest of which fused at base to minute seta), 1 bipinnate spine and 1 naked seta.

Mandible (Fig. 3A). Coxal gnathobase with numerous pointed teeth as illustrated, and 1 naked seta at dorsal corner. Palp biramous, consisting of basis and 1-segmented rami. Basis with 2 rows of setules, 1 row of spinules, 1 minute naked seta and 2 bipinnate setae. Exopod distinctly smaller than endopod; with 2 short bipinnate setae laterally and 2 long naked setae apically. Endopod not elongate; lateral armature consisting of 3 naked setae (1 vestigial); distal armature consisting of 2 naked setae and setal complex consisting of 3 basally fused elements: 2 naked setae and 1 aesthetasc-like seta (Fig. 8C, arrow) provided with flagellate tip.

Maxillule (Fig. 3C). Praecoxal arthrite represented by rectangular lobe with 8 marginal elements (7 spines, 1 naked seta)

and 2 naked setae arising from anterior surface. Coxa with cylindrical endite bearing 1 pinnate and 3 naked elements distally. Basis with 3 naked setae, 1 pinnate seta and 1 aesthetasc-like element provided with flagellate tip. Exopod larger than endopod; with short lateral and long apical pinnate seta. Endopod with 1 short seta laterally and 2 long setae distally; all elements naked.

Maxilla (Fig. 3B) with syncoxa largely fused to allobasis along anterior surface. Syncoxa with 3 endites; proximal endite with 1 short subdistal and 2 larger distal spines (all elements spinulose); middle endite reduced, with 2 short pinnate setae apically; distal endite cylindrical, with 3 pinnate elements. Allobasis drawn out into strong unipinnate claw; accessory armature consisting of 1 posterior and 2 anterior setae. Endopod 1-segmented, well defined at base; with 1 long and 2 short naked setae in addition to one aesthetasc-like element with flagellate tip.

Maxilliped (Fig. 3D). Syncoxa with 2 spinular rows and 1 bipinnate seta. Palmar margin of basis with spinular row and with short naked seta near articulation with endopod; outer margin with two groups of spinules. Endopod drawn out into strong, slightly curved unipinnate claw; accessory armature consisting of 1 long and 1 short naked seta.

P1 (Fig. 4A). Intercoxal sclerite without ornamentation. Praecoxa well developed. Coxa wider than long. Basis with 1 outer and 1 inner strong pinnate spine; with secretory pore on anterior surface. Outer margins of all segments with coarse spinules. Endopod 2-segmented, as long as exopod; enp-1 wider than enp-2, with spinulose distal and outer margins and with distally serrate seta along inner margin; enp-1 longer than enp-2, with inner plumose seta and distal armature consisting of short unipinnate outer spine and 2 long weakly geniculate setae. Exopod 3-segmented, segments subequal in length; exp-2 with inner plumose seta;

exp-3 with 3 pinnate spines, 1 weakly geniculate spine and 1 plumose seta.

P2 (Fig. 4B) with subquadrate, smooth intercoxal sclerite; ventral margin distinctly concave. Praecoxa with spinule row. Coxa with one long spinule and row of short spinules along inner distal margin, and spinule row near outer distal margin; with secretory pore on anterior surface. Basis with spinules around base of short naked outer seta and near articulation with endopod; with secretory pore on anterior surface. Endopod 3-segmented; enp-2 with large spinule near base of inner seta. Exopod 3-segmented; each exopodal segment with coarse spinules along outer margin; inner seta of exp-2 serrate distally; exp-3 with 2 plumose inner setae, 3 unipinnate outer spines and 2 bipinnate elements distally.

P3–P4 (Fig. 5A, B) with subquadrate, smooth intercoxal sclerites; ventral margin weakly concave. Praecoxa with spinule (P3) or setule row (P4). Coxa with rows of short spinules along outer and distal margin; with secretory pore on anterior surface. Basis with spinules around base of plumose outer seta and near articulation with exopod; with secretory pore on anterior surface. Rami 3-segmented; outer margins of segments with coarse spinules. Inner seta of P3–P4 exp-2 and P3 enp-2, and middle seta of P4 exp-3 serrate distally. Distal inner seta of P3–P4 exp-3 reduced and bare. P3 enp-2 with large spinule near base of inner seta.

Armature of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.023	1.121
P2	0.1.223	1.1.221
P3	0.1.323	1.1.321
P4	0.1.323	1.1.221

P5 (Figs. 4C, 8D) biramous, comprising small semi-circular exopod and large baseoendopod. Exopod not extending beyond endopodal lobe; inner margin

with serrate spine; outer margin with 2 short naked setae; apex with 1 long plumose and 1 shorter naked setae; with sparse spinules around inner and distal margins. Baseoendopod with secretory pore on anterior surface; outer basal seta slender and naked. Endopodal lobe broad; inner margin lobe with long bipinnate seta and short apically serrate spine; distal margin with 3 bipinnate setae; with few coarse spinules at outer distal corner and around base of inner seta.

Egg-sac (Fig. 1B) large, multiseriate, containing 10–12 eggs.

Description of male.—Male (Fig. 7A) smaller and more slender than female. Body length 530 μm (measured from anterior margin of cephalic shield to posterior margin of caudal rami). Greatest width measured at posterior margin of cephalic shield: 89 μm . Postgenital somites (Figs. 7E, 9D) with double spinule rows ventrolaterally and single spinule row midventrally.

Antennule (Figs. 7B, 9A) 7-segmented, short, chirocer; geniculation between segments 6 and 7 with segment 6 distinctly swollen. Segment 1 surrounded by small sclerite at base and with 3 spinular rows and 1 slender naked seta along anterior margin. Segment 2 with 1 naked seta. Segment 3 with 1 long and 10 short naked setae. Segment 4 with 4 long and 4 short setae. Segment 5 minute, represented by incomplete ring with 1 naked seta. Segment 6 with 2 pinnate and 10 naked setae (1 fused basally to aesthetasc: 68 μm). Segment 7 with 10 naked setae and acrothek consisting of 2 naked setae fused basally to short aesthetasc (13 μm) (Fig. 9A).

P2 (Figs. 6A, 9B). Protopod and exopod as in female. Endopod 3-segmented. Inner setae of enp-1 and enp-2 distinctly shorter than in female. Outer distal corner of enp-2 forming large spinous process; outer margin without spinules. Enp-3 longer and more slender than in female;

distal inner seta replaced by bipinnate spine; apical elements represented by 2 short bare setae; outer spine more slender than in female and slightly displaced to apical position.

P3 (Figs. 6B, 9C). Protopod and exopod as in female. Endopod 3-segmented; outer margin of enp-2 without spinules and distal corner produced into small recurved process bearing large secretory pore (Fig. 9C); inner seta of enp-2 distinctly shorter than in female and not apically serrate.

P5 (Fig. 7C, E). Fifth pair of legs fused medially. Baseoendopod represented by short setophore bearing outer basal seta; endopodal lobe and corresponding armature completely absent. Exopod very small and discrete; with short bipinnate inner seta, and 2 long apical setae and 2 short naked setae around outer margin.

P6 (Figs. 7D, E, 9D) symmetrical; each represented by small plate with 3 naked setae; innermost seta shortest. Lateroventral margin of genital somite with long spinules adjacent to P6.

Etymology.—The specific name refers to the country of the type locality, off Hyeopjae beach, on Jeju Island.

Discussion

The genus *Sentiropsis* is one of the eight danielsseniniid genera that exhibit sensory aesthetascs on the mandibular endopod, maxillary basis and maxillary endopod (Gee & Huys 1991, Huys & Gee 1992, 1996a; Willen 2009) and currently includes the type species *S. minuta* (Coull, 1969) and the recently described *S. vietnamensis* Gómez & Chertoprud, 2009. *Sentiropsis coreana* is most similar to its geographically closest congener, *S. vietnamensis*, and females of both Asian species can readily be differentiated from *S. minuta* by the presence of five elements on the P5 exopod (instead of four). The same character can be used to distinguish male *S. minuta* and *S. coreana* (the male

of *S. vietnamensis* is as yet unknown). An additional discriminant is the size of the apophysis on the middle endopod segment of P2, which is minute in the Caribbean species, but extends to almost the distal margin of enp-3 in *S. coreana*. The two Asian species are morphologically very close and most differences between them are morphometric in nature. The condition in *S. vietnamensis* is given in brackets: 1) body size ♀ 550 µm [410 µm]; 2) cephalothorax subrectangular in dorsal aspect [distinctly tapering towards rostrum]; 3) pseudoperculum bilobate with distinct serrations [unilobate with minute serrations]; 4) caudal ramus as long as basal width (measured in ventral aspect) [0.75 times as long as basal width]; 5) mandibular endopod with 3 lateral setae [2 lateral setae]; 6) P1 enp-1 slightly longer than enp-2 (enp-1:enp-2 = 1.11) [enp-1 distinctly shorter than enp-2 (enp-1:enp-2 = 0.77)]; 7) P1 exp-2 inner seta reaching well beyond distal margin of exp-3 [not reaching to distal margin of exp-3]; 8) P2 exp-3 proximal inner and distal inner seta 0.83 and 1.1 times the length of inner apical spine, respectively [0.50 and 0.83 times, respectively]; 9) P4 exp-2 outer spine 1.25 times the length of exp-1 outer spine [enlarged, 2.33 times the length of exp-1 outer spine]; and 10) P5 exopod proximal and middle outer setae naked [pinnate].

Huys & Gee (1996a) suggested that *Danielssenia minuta* should be placed near the basal node of the *Paradanielssenia*-lineage, either as a member of *Jonesiella*, or as the sister-group of the latter, or as a distinct genus intermediate between *Jonesiella* and the genera exhibiting claviform mouthpart aesthetascs (including *Micropsammis*, *Nyxis*, *Paradanielssenia*, and *Telopsammis*). They ruled out the first scenario on the basis of differences in the male P2 endopod, which in *Jonesiella* has a robust spinous apophysis on enp-2 reaching to the distal margin of enp-3 (Huys & Gee 1992: Fig. 6B), whereas in

D. minuta the apophysis is reduced to a minute spinous outgrowth. The discovery of the male of *S. coreana* shows that the groundpattern of the male P2 endopod is essentially identical in both *Jonesiella* and *Sentiropsis* and, hence, the reduced apophysis in *S. minuta* is to be considered as secondarily derived within the latter genus, raising the possibility that the two are synonyms. However, none of the three species of *Sentiropsis* displays the apomorphies of *Jonesiella* (maxillary exopod folded under the basis, maxillary syncoxa with modified spine on distal endite), showing instead a combination of apomorphic character states preventing their allocation to *Jonesiella*: 1) antennule with virtually all setae slender and naked [with numerous pinnate setae and spines, and large spinulose spines on segment 5 in *Jonesiella*]; 2) antennary exopod with 2 apical setae on exp-3 [with 1 lateral and 2 apical]; 3) maxillule with 2 setae on exopod [trisetose]; 4) maxillary syncoxa with reduced middle endite bearing 2 setae [normally developed with 3 elements]; 5) maxillipedal syncoxa with 1 seta [with 2 pinnate spines]; 6) male P5 baseoendopod completely absorbed into somite, endopodal setae lost [baseoendopod defined at base with 2 spines on endopodal lobe]. Gómez & Chertoprud (2009) discussed two hypotheses with regard to a relationship between *Sentiropsis* and *Afrosenia* but neither appears plausible, as the authors admitted themselves. Willen's (2009) claim that in *Sentiropsis* and *Jonesiella* one of the basal setae on the mandibular palp is small is contradicted by Huys & Gee's (1992) illustrations (their Figs. 3C, 11C, 13C). As pointed out by Huys & Gee (1996a) the only synapomorphy shared by *Sentiropsis* and *Jonesiella* appears to be the armature of the mandibular basis, consisting of two pinnate setae proximally and one naked seta distally; however, whether this is sufficient evidence to hypothesize a shared common ancestry

is questionable. With the removal of the reduction of the apophysis on the male P2 enp-2 as a possible synapomorphy linking *Sentiropsis* to the *Paradanielssenia*-lineage, the relationships of the former have become more elusive than ever.

The few known records suggest that the genus *Sentiropsis* is distributed in all oceanic basins and appears to have an ecological preference for shallow fine to medium sandy substrates. The type species, *S. minuta*, was originally collected from Trunk Island (5 m depth), Castle Harbor (3–13 m), and Baileys Bay (2–3 m) in Bermuda (Coull 1969, 1970a; Coull & Herman 1970) and subsequently recorded off the Bellairs Research Institute beach (2–7 m) in Barbados (Coull 1970b). Hartzband & Hummon (1974) reported it from 10–15 m depth in Coki Bay, St. Thomas (U.S. Virgin Islands). The only record from outside the West Indies is that by Sevastou (2005) who reported it from a sheltered beach on Elafonisi Island, located close to the southwestern corner of Crete. Given the subtle differences required to discriminate species in the genus, it is conceivable that this Mediterranean record of *S. minuta* in reality refers to a morphologically close, as yet undescribed, species. *Sentiropsis vietnamensis* is thus far known only from the upper sublittoral zone (5 m depth) of Mot Island in Nha Trang Bay, southern Vietnam (Chertoprud et al. 2009, Gómez & Chertoprud 2009) and *S. coreana* is similarly restricted to its type locality off Hyeopjae beach on Jeju Island. Gheerardyn et al. (2008) cited an as yet undescribed species of *Sentiropsis*, collected in the lagoon of the fringing reef, between the reef crest and the sand beach, along the eastern coast of Zanzibar Island.

Key to genera of subfamily Danielsseniinae

The formal description of the genera *Sentiropsis*, *Peltisenia*, and *Afrosenia* by

Huys & Gee (1996a), the proposal of four new genera, *Mucrosenia*, *Prionos*, *Anapophysia* and *Nyxis* (Gee & Huys 1994, Huys & Gee 1996b, Willen 2009), and new information on *Bathypsammis* (cf. Willen & Schulz 2007) and *Telopsammis* (cf. Mielke 1997) have outdated Huys & Gee's (1993) key to genera. The genus *Carolinicola* Huys & Thistle, 1989 was established to accommodate *Hemimesochra trisetosa* Coull, 1973. In the absence of the male, Huys & Thistle (1989) considered this species an advanced member of the "Paranannopidae", but the description of the male of *C. galapagoensis* Mielke, 1997 suggests that *Carolinicola* has canthocamptid affinities (e.g., sexual dimorphism in the P3 endopod) and should be removed from the Danielsseniinae. We concur with Mielke (1997) that the genus shows similarities with *Poria* Lang, 1965 and *Boreolimella* Huys & Thistle, 1989 and, consequently, transfer it to the subfamily Hemimesochrinae in the Canthocamptidae. A new key to the 19 currently valid genera of the subfamily Danielsseniinae is proposed below.

1. P4 endopod 2-segmented, 1-segmented or absent 2
- P4 endopod 3-segmented 3
2. Body short, robust; caudal rami setae IV–V long and spinulose; P5 well developed, covering entire width of pedigerous somite
..... *Paranannopus* Huys, 2009
- Body slender, cylindrical to vermiform; caudal rami setae IV–V short and plumose; P5 a minute plate, located midventrally
..... *Cylindronannopus* Coull, 1973
3. P2–P4 exp-1 without inner seta 4
- P2–P4 exp-1 with inner seta 7
4. P2–P4 enp-1 without inner seta ..
..... *Nyxis* Willen, 2009
[one species *N. rostricularis* Willen, 2009]
- P2–P4 enp-1 with inner seta 5
5. Caudal ramus with distinct cluster of long setules near inner distal corner; P2 enp-2 ♀ without inner seta but

- with large mucroniform process, reaching almost to end of enp-3; P2 endopod shorter than exopod *Mucrosenia* Gee & Huys, 1994
- Caudal ramus without such setular cluster; P2 enp-2 ♀ with inner seta but without large mucroniform process; P2 endopod at least as long as exopod 6
 - 6. Antennule ♀ 6-segmented, without or with very few pinnate setae (on segments 2 and 6); P3 enp-3 with 3 inner setae, P4 enp-3 with 2 inner setae *Sentiropsis* Huys & Gee, 1996a
 - Antennule ♀ 4-segmented, with numerous pinnate setae and spines; P3 enp-3 with 1–2 inner setae, P4 enp-3 with 0–1 inner setae *Danielssenia* Boeck, 1873
 - 7. P4 exp-3 with 8 setae/spines 8
 - P4 exp-3 with at most 7 setae/spines 15
 - 8. P2 enp-2 with 2 inner setae 9
 - P2 enp-2 with 1 inner seta 12
 - 9. Caudal rami at least 5 times as long as maximum width; P3 enp-3 with 1–2 inner setae *Bathypsammis* Huys & Gee, 1993
 - Caudal rami at most twice as long as maximum width; P3 enp-3 with 3 inner setae 10
 - 10. Cephalothorax and somites bearing P2–P3 with deeply serrate hyaline frills *Prionos* Huys & Gee, 1996b [one species *P. ornata* Huys & Gee, 1996b]
 - Cephalothorax and somites bearing P2–P3 with smooth or minutely dentate hyaline frills 11
 - 11. Antennule ♀ 4-segmented; P2 enp-2 without apophysis in ♂; P5 of both sexes with fused exopod and baseoendopod *Anapophysia* Huys & Gee, 1996b
 - Antennule ♀ 5- or 6-segmented; P2 enp-2 with long apophysis in ♂; P5 of both sexes with discrete exopod and baseoendopod *Jonesiella* Brady, 1880
 - 12. Body dorsoventrally flattened; caudal rami setae IV–V stubby and spiniform; P1 enp-1 1.5 times as long as enp-2 *Peltisenia* Huys & Gee, 1996a [one species *P. aberrans* (Por, 1964)]
 - Body not dorsoventrally flattened; caudal rami setae IV–V long and setiform; P1 enp-1 at most as long as enp-2 13
 - 13. Antennule ♀ 4-segmented; claviform aesthetascs present on mandible (endopod), maxillule (basis) and maxilla (endopod); P2 enp-2 ♂ without distinct outer apophysis *Paradanielssenia* Soyer, 1970¹
 - Antennule ♀ 6-segmented; mouthparts without claviform aesthetascs; P2 enp-2 ♂ with long outer apophysis 14
 - 14. Antennary exopod with 1 seta on proximal segment; P3 exp-3 with 7 setae/spines; P2 enp-3 ♂ with inner distal seta transformed into large pinnate spine reaching beyond apophysis of enp-2 *Afrosenia* Huys & Gee, 1996a [one species *A. sibirica* (Sars, 1898)]
 - Antennary exopod with 2 setae on proximal segment; P3 exp-3 with 8 setae/spines; P2 enp-3 ♂ with inner distal seta not transformed and shorter than apophysis of enp-2 *Archisenia* Huys & Gee, 1993 [one species *A. spinipes* (Wells, 1967)]
 - 15. P2 enp-2 with 2 inner setae *Psammis* Sars, 1910
 - P2 enp-2 with 0–1 inner setae 16
 - 16. Claviform aesthetascs present on mandible (endopod), maxillule (basis) and maxilla (endopod); P2 exp-3 with at most 6 setae/spines 17
 - No claviform aesthetascs present on these appendages; P2 exp-3 with 7 setae/spines *Fladenia* Gee & Huys, 1990 [one species *F. robusta* (Sars, 1921)]
 - 17. P1 enp-2 with 2 geniculate apical setae; P2 enp-2 ♂ without apophysis; P6 ♂ with 2 setae/spines; penultimate urosomite with a minutely dentate hyaline frill and pseudopericulum 18

¹ Note that all species of *Paradanielssenia* have 3 inner setae on P3 exp-3. Gee (1988) showed the correct armature for *P. biclavata* Gee, 1988 in his Fig. 7 but incorrectly stated that there are only 2 inner setae in his setal formula (1:1:223). This error was perpetuated in Willen's (2008) key to species and her Table 2; Wells (2007:683) used the correct number in his tabular keys.

- P1 enp-2 with 1 geniculate apical seta; P2 enp-2 ♂ with small apophysis; P6 ♂ with 3 setae/spines; penultimate urosomite with a deeply divided hyaline frill and pseudoperculum; *Micropsammis* Gee & Huys, 1991
- 18. Antennule in both sexes with densely opaque, bulbous appendage on distal segment; P2–P3 exp-2 without inner seta . . . *Leptotachidia* Becker, 1974 [one species *L. iberica* Bechker, 1974]
- Antennule in both sexes without densely opaque, bulbous appendage on distal segment; P2–P3 exp-2 with inner seta *Telopsammis* Gee & Huys, 1991

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