Zoological Journal of the Linnean Society, 2005, **143**, 133–159. With 16 figures

Description of two new species of *Neotachidius* Shen & Tai, 1963 (Copepoda, Harpacticoida, Tachidiidae) from Korean brackish waters and proposal of a new genus for *Tachidius* (*Tachidius*) *vicinospinalis* Shen & Tai, 1964

RONY HUYS FLS[1]*, SUSUMU OHTSUKA[2], SOPHIE CONROY-DALTON[1] and YOSHIAKI KIKUCHI[3]

[1]*Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK*
[2]*Fisheries Laboratory, Hiroshima University, 5-8-1 Minato-machi, Takehara,Hiroshima 725–0024, Japan*
[3]*Center for Water Environment Studies, Ibaraki University, 1375 Ohu Itako, Ibaraki 311–2402, Japan*

Received March 2004; accepted for publication July 2004

Two new sympatric species of *Neotachidius* Shen & Tai, 1963, ***N. coreanus* sp. nov.** and ***N. parvus* sp. nov.**, are described from plankton samples collected from brackish waters in Kwangyang Bay, South Korea. Morphological differences with the type species *N. triangularis* (Shen & Tai, 1963) **comb. nov.** are discussed in detail. Korean material from Chindo Island, previously identified as *N. triangularis* by Song and Chang in 1995 is at least partly based on ***N. parvus* sp. nov.** The occurrence of *N. triangularis* in estuaries in British Columbia and Washington is attributed to transoceanic transport by ballast water from cargo ships entering the Columbia River or neighbouring estuaries. The subgeneric division of the genus *Tachidius* proposed by Shen and Tai in 1963 is rejected and instead full generic rank is assigned to both *Tachidius* and *Neotachidius*. The taxonomic position and original description of *Tachidius* (*Tachidius*) *vicinospinalis* Shen & Tai, 1964 are reviewed and the species is designated as the type species of a new genus ***Sinotachidius* gen. nov.** The latter and *Neotachidius* form a clade which stands in apposition to *Tachidius*. *Tachidius discipes* Giesbrecht, 1881 *sensu* Song & Chang is considered *species inquirenda* in ***Sinotachidius* gen. nov.** © 2005 The Linnean Society of London, *Zoological Journal of the Linnean Society*, 2005, **143**, 133–159.

ADDITIONAL KEYWORDS: Korea – scanning electron microscopy – *Sinotachidius* – sympatry – taxonomy.

INTRODUCTION

The family Tachidiidae was one of the first to be recognized in the Harpacticoida. Boeck (1865) introduced the higher taxon name Tachidina but it is conceivable that he meant to attribute full family status to this taxon. Data from the literature suggest that the family is confined to the northern hemisphere; however, unpublished records from Brazil (T. Kihara, pers. comm.) and New Zealand (G. R. F. Hicks, pers. comm.) indicate a worldwide distribution ranging from high latitudes (e.g. Olofsson, 1917; Mielke, 1974) to tropical waters. Huys *et al*. (1996) recognized four genera in the family: *Tachidius* Lilljeborg, 1853, *Microarthridion* Lang, 1944, *Cithadius* Bowman, 1972 and *Geeopsis* Huys, 1996.

Shen & Tai (1963) subdivided the genus *Tachidius* into two subgenera, *Tachidius* and *Neotachidius*, based on differences in the P1 endopod and the P5 armature in both sexes. The latter subgenus was established to accommodate a new freshwater species, *T. (N.) triangularis*, originally described from the Pearl River estuary in southern China (Shen & Tai, 1963), and subsequently recorded from south-western British Columbia by Kask, Sibert & Windecker (1982) and Korea by Song & Chang (1995). According to the latter authors the species is commonly found in brackish estuarine waters and littoral localities all around the Korean peninsula.

Some Tachidiidae, such as *Microarthridion littorale* (Poppe, 1881) and *Tachidius discipes* Giesbrecht, 1881, have occasionally been recorded from coastal plankton (El-Maghraby & Perkins, 1956; Hauspie & Polk, 1973; J. R. Cordell, pers. comm.), as they can get

*Corresponding author. E-mail: rjh@nhm.ac.uk

entrained in the water column. However, the great majority of the species are benthic, occurring over a wide spectrum of salinity regimes and sediment grain sizes.

In this paper we have set out to: (1) provide descriptions of two new species of *Neotachidius*, which were encountered in brackish water plankton samples collected in South Korea; (2) review the taxonomic rank of the subgenus *Neotachidius* and the status of its type species *N. triangularis*, and (3) re-evaluate the generic assignment of *Tachidius* (*Tachidius*) *vicinospinalis* Shen & Tai (1964). This paper forms the third contribution in a series on the taxonomy of brackish copepods in Korean waters (Ohtsuka, Yoon & Endo, 1992; Soh *et al*., 2001).

MATERIAL AND METHODS

Samples were collected from six stations in brackish waters in South Korea on 18 December 1991 (see Ohtsuka *et al.* 1992). Conical nets (diameter 30 cm; mesh size 0.09 mm) were towed from the near-bottom to the surface. Both new *Neotachidius* species occurred at all stations but were most abundant at stations 5 and 6. The descriptions of these species were based on material collected at these two localities, where sediments were mainly muddy and reeds were highly abundant along the riverbanks.

Before dissection the habitus was drawn from whole specimens temporarily mounted in lactophenol. Specimens were dissected in lactic acid and the parts individually mounted in lactophenol under coverslips that were subsequently sealed with transparent nail varnish. All drawings were prepared using a camera lucida on a Leica Diaplan or Leica DMR differential interference contrast microscope. The terminology for body and appendage morphology follows that of Huys & Boxshall (1991) and Huys *et al*. (1996). Abbreviations: P1–P6 for swimming legs 1–6; exp(enp)-1(-2-3) to denote the proximal (middle, distal) segment of a ramus; and ae for aesthetasc. Body length was measured along the dorsal curvature in lateral aspect, from the anterior margin of the rostrum to the posterior margin of the caudal rami.

Specimens of *N. coreanus* sp. nov. and *N. parvus* sp. nov. were examined with a Philips XL30 scanning electron microscope. Specimens were prepared by dehydration through graded acetone, critical point dried, mounted on stubs and sputter-coated with gold/palladium. Scale bars in all illustrations and micrographs are in μm.

Type material was deposited in the National Museum of Natural History, Washington (NMNH) and the Natural History Museum, London (NHM). Additional material of *N. parvus* sp. nov. was also deposited in NHM.

RESULTS

FAMILY TACHIDIIDAE BOECK, 1865
GENUS *NEOTACHIDIUS* SHEN & TAI, 1963 **GRAD. NOV.**

Diagnosis: Tachidiidae. Rostrum elongate, delimited at base. Paired lateral integumental windows on P5-bearing somite present. Genital and first abdominal somites fused in ♀ original segmentation marked by transverse surface ridge dorsally and laterally; mid-ventral copulatory pore not isolated from gonopores. Anal operculum spinulose. Caudal ramus setae IV–V well developed and pinnate. Sexual dimorphism in antennule, P2 endopod, P3 exopod, P5, P6, urosomal ornamentation and segmentation.

Antennule with numerous pinnate setae/spines; 7-segmented in both sexes; chirocer in ♂, with aesthetascs on segments 4, 6 and 7; segment 5 in ♂ with spinous outgrowth. Antenna with (indistinctly) 2-segmented exopod; exp-1 with one seta, exp-2 with one lateral and two apical setae; lateral endopodal spine proximally displaced. Mandible with two setae on basis, five setae on exopod and three lateral and nine apical setae on endopod. Maxillule with four setae and one geniculate spine on coxa, and six elements on basis; exopod represented by one seta, endopod 1-segmented with three setae. Maxillary syncoxa with enditic formula [4,3,3]; allobasis with three accessory setae; endopod indistinctly 2-segmented with one geniculate spine and five setae. Maxilliped with two accessory setae on endopod; claw minutely pinnate.

P1–P4 with 3-segmented rami; enp-1 of normal size and with inner seta. P1 exp-3 with two outer spines, enp-3 with one inner seta. P3 enp-3 with five setae/spines. P4 enp-2 with one inner seta. Armature formula as follows:

	Exopod	Endopod
P1	0.1.122	1.1.121
P2	1.1.222	1.2.221
P3	1.1.222	1.2.221
P4	1.1.122	1.1.221

P2 ♂ enp-2 with outwardly directed spinous apophysis; enp-3 small, anterior surface with transverse spinular comb concealing tip of enp-2 apophysis, outer spine reduced in size, outer distal seta rudimentary and fused to segment, inner setae well developed. P3 exopod ♂ longer than in ♀ with exp-3 often bent inwards; inner setae of exp-1 and -2 smaller than in ♀ inner distal seta of exp-3 vestigial.

P5 ♀ with outer concavity, separating outer lobe from distal portion; outer lobe with basal plumose seta and pinnate spine; distal portion with plumose seta flanked by strong pinnate spines around apex, and two (endopodal) pinnate spines along inner margin. P5 ♂ medially fused; each with three pinnate spines and two setae.

P6 ♀ represented by opercula closing off common genital slit, each with one seta. P6 ♂ symmetrical; each member with two pinnate spines and naked outer basal seta.

Free-living. Freshwater or brackish habitats.

Type species: Tachidius (*Neotachidius*) *triangularis* Shen & Tai, 1963 = *Neotachidius triangularis* (Shen & Tai, 1963) comb. nov. [by monotypy]

Other species: N. coreanus sp. nov.; *N. parvus* sp. nov.

NEOTACHIDIUS COREANUS SP. NOV.

Type material: Holotype ♀ (NMNH reg. no. 251948) dissected and mounted on slides. Paratypes are 1 ♀ (NMNH reg. no. 251949) and 4 ♂♂ (NMNH reg. nos. 251950–53) dissected and mounted on slides; 20 ♀♀ and 20 ♂♂ in alcohol (NMNH reg. no. 251954); 11 ♀♀ and 5 ♂♂ in alcohol (NHM reg. nos. 2003.755–770).

Type locality: Station 5 in a small river discharging into Kwangyang Bay, South Korea (34°57.1′N, 127°36.4′E), salinity 11.10‰ (see Ohtsuka *et al.* 1992).

Body length: ♀: 690 ± 40 μm ($N = 53$); ♂: 600 ± 40 μm ($N = 51$).

Description

Based on NMNH paratypes (reg. nos. 251949–53) and NHM paratypes (reg. nos. 2003.755–770).

Female: Body robust (Fig. 1A), cyclopiform, with distinct separation between prosome and urosome.

Rostrum (Figs 4B, 5A) weakly defined at base, ventrally directed, not discernible in dorsal aspect (Fig. 1A); elongate-ovoid with slightly constricted tip; dorsal surface with two pairs of sensillae and three median pores.

Cephalosome (Figs 1A, 2A, 3A) with spinules along posterior margin and setules around lateroventral margins; with median dorsal and paired lateral integumental windows; sensillar and pore patterns as figured in Figure 1A. Tergite of first pedigerous somite rudimentary, represented by a transverse sclerite (Figs 1A, 2B; arrowed in Figs 2A, 3A, B) which is partly fused along its lateral sides to that of the second pedigerous somite.

Somites bearing P2–P5 (Fig. 3A) with paired lateral integumental windows; free margins of tergites with long spinules all around except for denticulate dorsal margin of P4-bearing somite (Fig. 1A); dorsal surfaces with minute spinule rows, pores and sensillae as figured. P5-bearing somite with serrate posterior margin, with serrations being larger laterally than dorsally (Fig. 9C); lateral integumental windows largely concealed beneath tergite of preceding somite (Fig. 3A) and surrounded by spinule rows (Fig. 9C).

Original segmentation of genital double-somite marked by bilateral constriction and dorsal serrate surface ridge. Genital field positioned ventrally on raised anterior half of double-somite (see lateral aspect; Fig. 9C). Genital apertures fused medially forming common genital slit (Figs 1B, 2C), closed off on either side by unisetose operculum derived from P6 (Figs 1B, 9C). Isolated copulatory pore not discernible, probably located medially within genital slit (Figs 1B, 2C). Single median seminal receptacle present (Fig. 9C). Raised ventral surface posterior to genital field with three spinule rows (anteriormost paired) (Figs 1B, 2C). Median integumental pore present anterior to genital slit (arrowed in Fig. 2C). Remaining urosomites with spinules around posterior margin and surface ornamentation as figured (Fig. 1A, B). Anal somite with two spinule rows dorsally and spinulose operculum (Fig. 10D).

Caudal rami (Figs 1B, 10D) slightly convergent and slightly longer than wide, with oblique spinule row on dorsal surface and short row of fine spinules dorsolaterally (arrowed in Fig. 10D). With seven setae: I well developed, bare; II bare, displaced to near seta VII; III bipinnate and spiniform, with subapical flagellate extension; IV and V bipinnate and with fracture planes; VI swollen at base and typically with few spinules at inner proximal margin; VII bi-articulate at base and naked.

Antennule (Fig. 4A) short, 7-segmented. Segment 1 with spinule rows around posterior and anterior margins. Armature formula: 1-[1 pinnate], 2-[1 naked +7 pinnate], 3-[5 naked +3 pinnate], 4-[3 pinnate + (1 naked + ae)], 5-[2 pinnate], 6-[2 naked +6 pinnate], 7-[5 naked +1 pinnate + acrothek]. Apical acrothek consisting of aesthetasc and plumose seta.

Antenna (Fig. 4C, D) with spinule rows on abexopodal margin of basis and proximal endopod segment. Exopod incompletely 2-segmented; exp-1 shortest, with one pinnate spine; exp-2 with short pinnate spine fused to lateral margin and two unequal pinnate spines apically; few coarse spinules present around outer distal corner of exp-2. Distal endopod segment laterally with one naked spine in proximal third and one plumose seta plus one unipinnate spine in middle third (Fig. 4D); both lateral spines with subapical tubular extension. Apical armature of enp-2 consisting of one unipinnate spine and four geniculate setae; longest geniculate seta with long setules and fused at base to short pinnate seta; segment with various spinule rows as figured.

Labrum (Fig. 5C) strongly developed, weakly trilobate; median lobe with short strong spinules along free margin and densely packed spinules plus a large

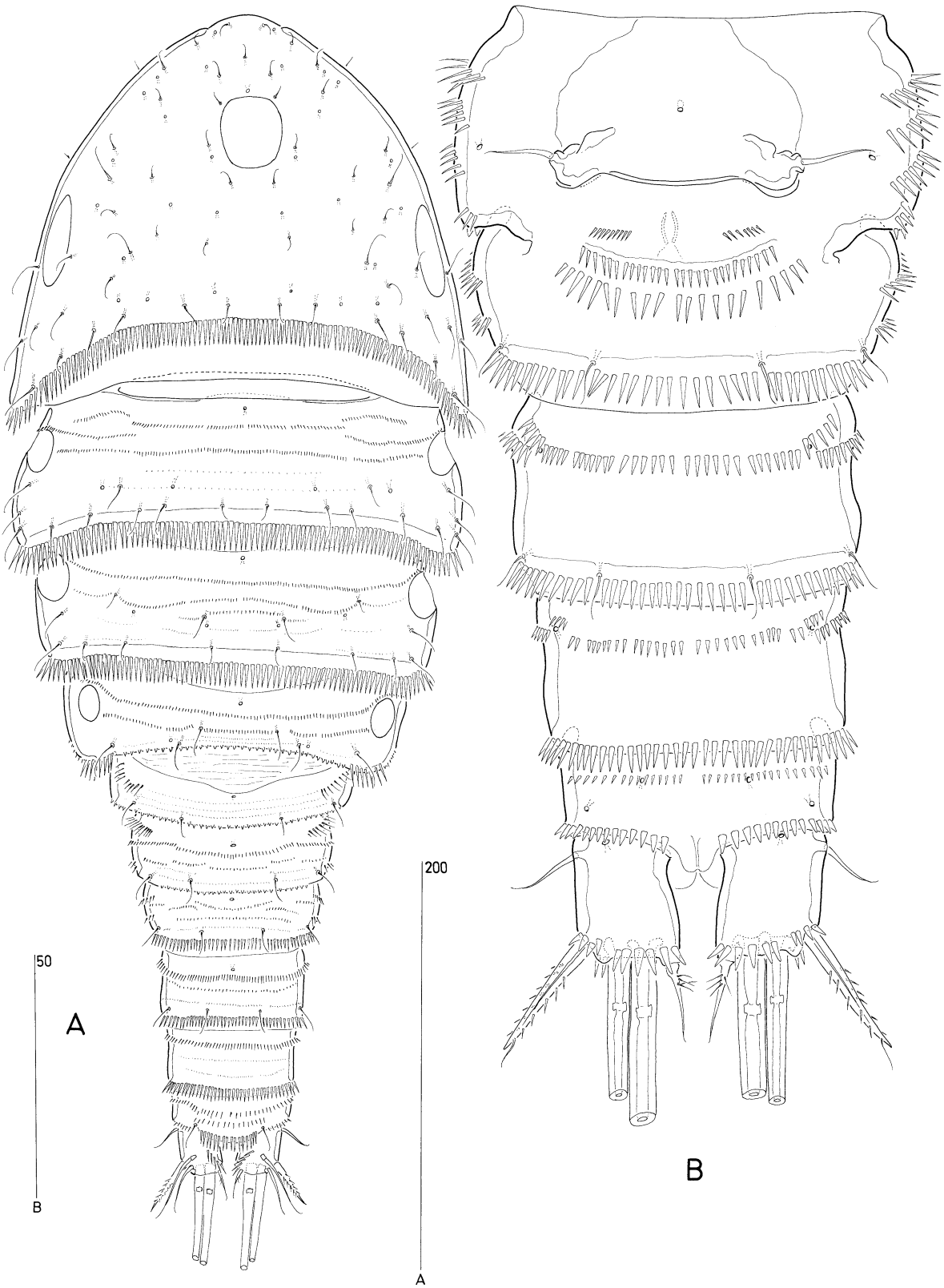

Figure 1. ***Neotachidius coreanus*** **sp. nov.** (♀). A, habitus, dorsal; B, urosome (excluding P5-bearing somite), ventral.

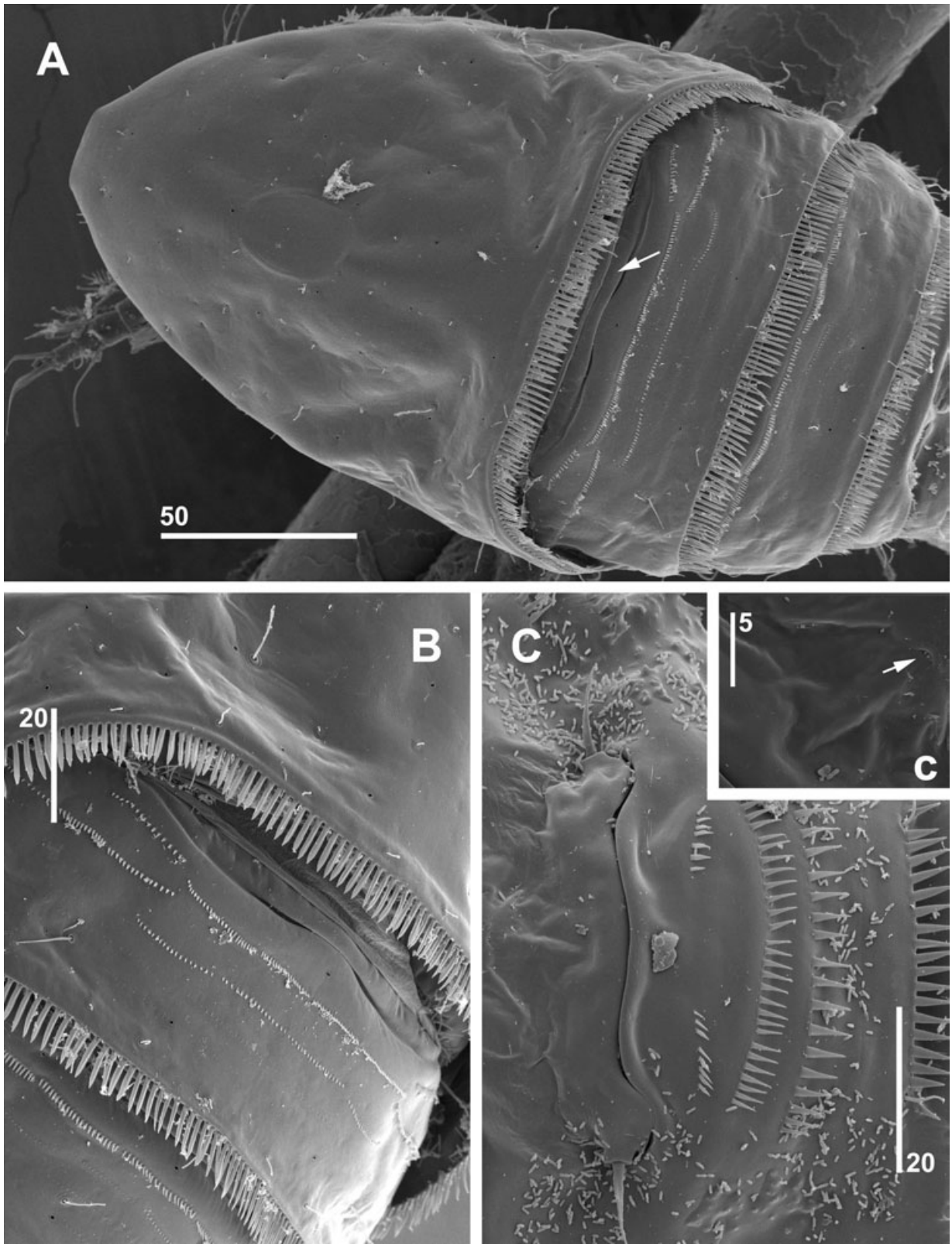

Figure 2. ***Neotachidius coreanus*** **sp. nov.** (♀) SEM micrographs: A, prosome, dorsal (arrow indicating rudimentary tergite of P1-bearing somite); B, area between cephalosome and P2-bearing somite, showing position of intersomitic membrane and rudimentary tergite of P1-bearing somite; C, genital field, ventral (inset c: pore anterior to genital slit, arrowed).

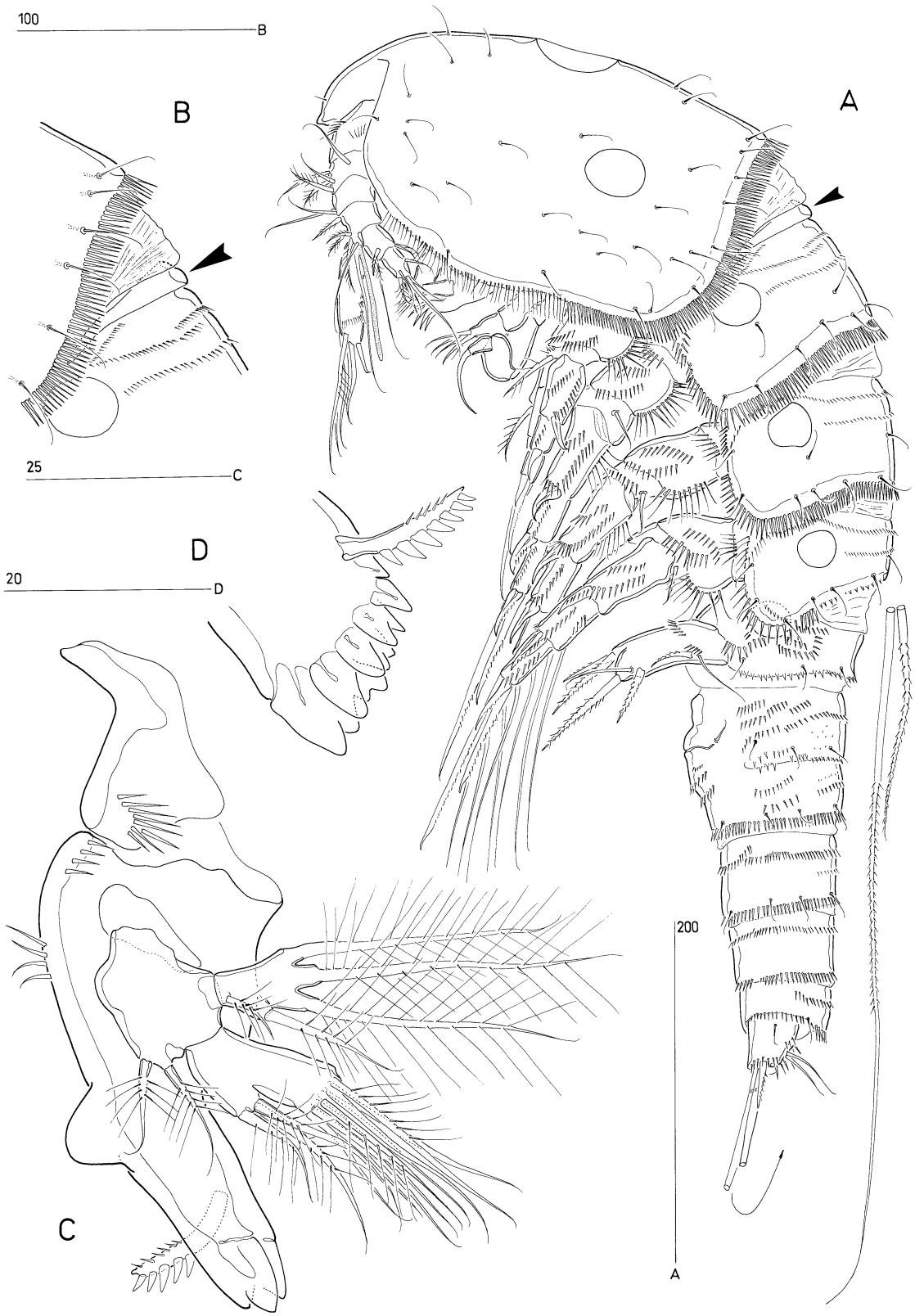

Figure 3. ***Neotachidius coreanus*** **sp. nov.** (♀) A, habitus, lateral (arrow indicating rudimentary tergite of P1-bearing somite); B, detail of area between cephalosome and P2-bearing somite, lateral (tergite of P1-bearing somite arrowed); C, mandible, anterior; D, detail of mandibular gnathobase.

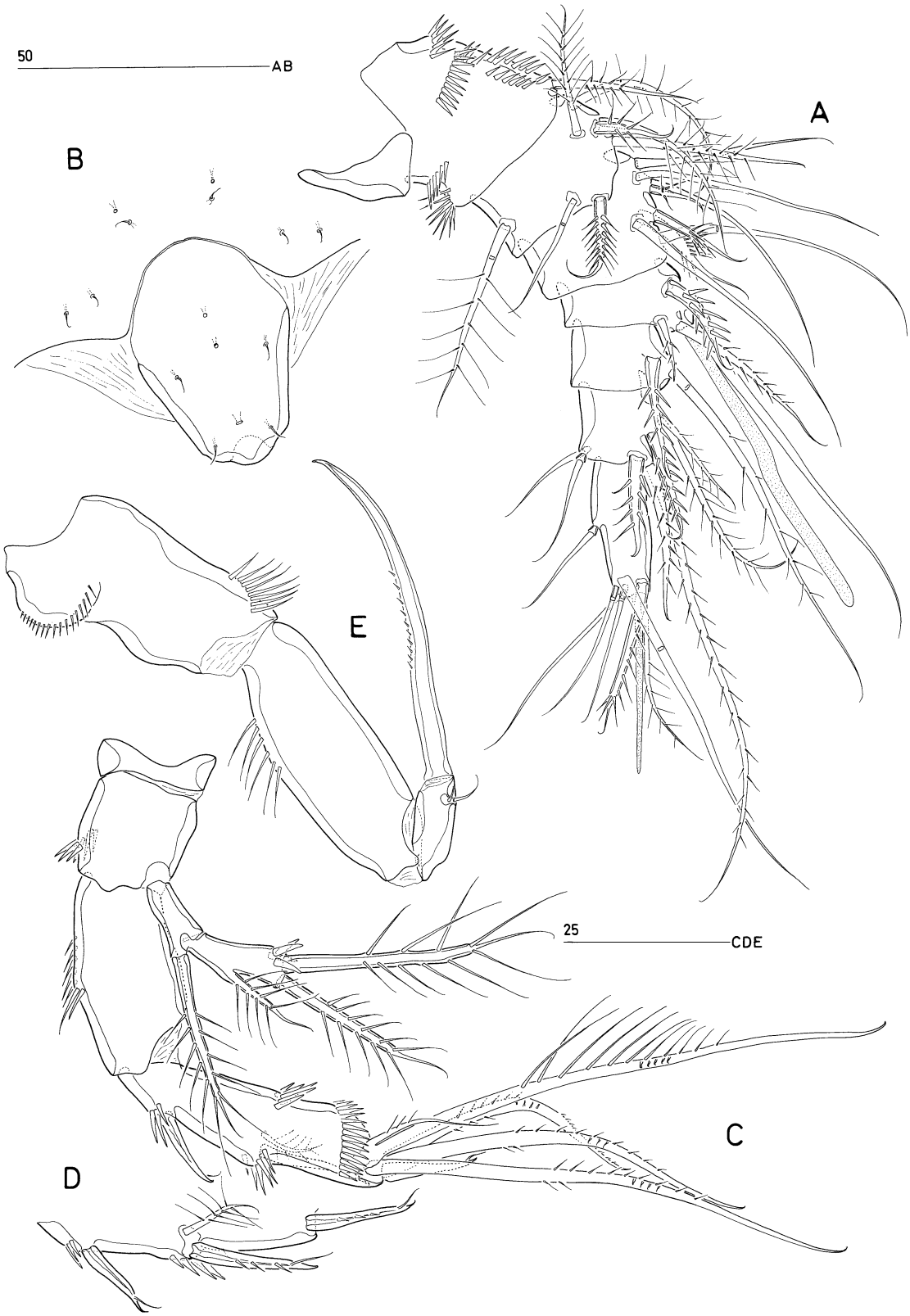

Figure 4. ***Neotachidius coreanus*** **sp. nov.** (♀) A, antennule, dorsal; B, rostrum, dorsal; C, antenna, outer lateral; D, free endopodal margin of antenna, inner lateral; E, maxilliped.

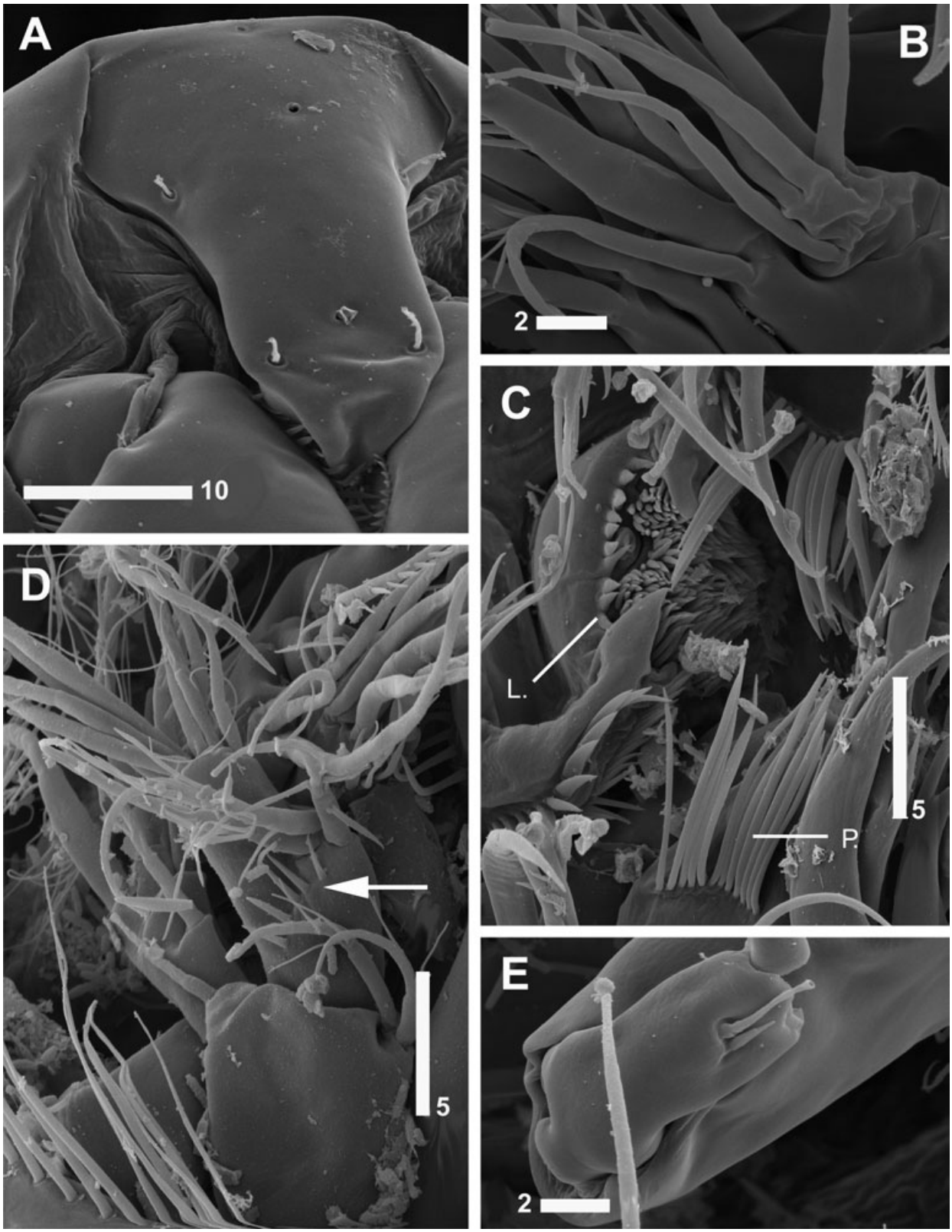

Figure 5. SEM micrographs. ***Neotachidius coreanus* sp. nov.** (♀) A, rostrum, frontal; B, maxillary endopod, posterior; C, oral area (L., labrum; P., paragnath); E, endopod of maxilliped, showing vestigial setation elements. ***N. parvus* sp. nov.** (♀) D, mandibular palp (spinular row on anterior surface of endopod arrowed).

median pore on posterior surface; lateral lobes each with double row of long spinules.

Mandible (Fig. 3C, D). Gnathobase with series of blunt, multicusped teeth; dorsal corner with strong spine bearing minute spinules along dorsal margin and very coarse spinules along ventral margin. Basis relatively small, with two short plumose setae. Endopod longer than exopod, without surface spinules; with three plumose setae laterally (two fused at base) and nine setae apically (seven naked, two pinnate), several of which fused to segment. Exopod 1-segmented, with one short seta near proximal margin and four plumose setae along lateral margin and apex; distalmost three setae fused to segment.

Paragnaths (Fig. 5C) strongly developed lobes with medially directed long spinules.

Maxillule (Fig. 6B, C). Praecoxal arthrite with six spines, one pinnate seta and one minute tube-seta around distal margin; anterior surface with two juxtaposed setae; posterior surface with two pinnate setae, innermost very large and typically curved (Fig. 6C). Coxal endite with long spinules on anterior surface; with two smooth and three pinnate (of which one geniculate) setae. Basis with long setules on anterior surface; armature consisting of four naked and two pinnate (of which one geniculate) setae. Endopod a small segment with one plumose and two naked setae. Exopod represented by a single plumose seta.

Maxilla (Fig. 9A). Syncoxa with three endites and long spinules along outer margin; proximal endite expanded distally, with one large and three shorter pinnate setae; middle and distal endites cylindrical, each with one naked and two pinnate setae. Allobasis with long setules along outer margin; drawn out into pinnate claw; accessory armature consisting of one naked and two pinnate setae. Endopod (Fig. 5B) indistinctly 2-segmented with one geniculate spine, two pinnate and three naked setae.

Maxilliped (Figs 4E, 5E). Syncoxa with spinular row near medial distal corner and smaller spinules around proximal outer margin. Basis outer margin with slender spinules in proximal half. Endopod with curved claw and two minute accessory setae, one of which is tubular (Fig. 5E).

P1 (Fig. 6A). Intercoxal sclerite bilobate, with strong spinules on anterior surface. Praecoxa well developed, with long spinules on anterior surface. Coxa with various anterior spinule rows as figured. Basis with produced lobate inner process bearing spinules anteriorly and setules posteriorly; outer and inner basal setae bipinnate. Rami 3-segmented. Exopod shorter than endopod; inner margin of segments with setules, outer margin with spinules; outer spines with subapical flagellate extension. Endopod with small enp-3; distal and outer margins of all segments with spinules; few spinules also present on proximal inner margin of enp-2 and -3; outer distal element of enp-3 spiniform and bipinnate. Posterior surface of endopod segments and exp-1 and -2 typically with spinule patches.

P2–P4 (Figs 7A, 8A, 9B). Intercoxal sclerites with spinules anteriorly (P2–P4) and posteriorly (P2–P3). Praecoxa a small sclerite with anterior spinules. Coxa typically with very long spinules anteriorly and various spinule rows arranged around outer margin. Inner margin of basis forming lobate setulose expansion; with spinules around distal and outer margin as figured; outer basal seta bare (P2) or sparsely plumose (P3–P4). Endopods shorter than exopods; rami 3-segmented. Exp-1 and -2 (and -3 in P4), and enp-2 and -3 typically with posterior spinule patches. Inner margin of exp-1 and -2 (and -3 in P4) with few long setules; spinular ornamentation around distal and outer segment margins as figured. Exp-3 of P2–P3 forming spinous extension between bases of distal outer spine and outer apical spine. Armature formula of P1–P4 as for genus.

P5 (Fig. 7D) about 1.05 times as long as maximum width; typically with distinct outer concavity, separating outer lobe from distal portion; with numerous spinular rows on both posterior and anterior surfaces as figured; outer lobe with basal plumose seta and pinnate spine; distal portion with plumose seta flanked by strong pinnate spines around apex, and two pinnate spines along inner margin; anterior surface with three secretory pores (one marginal).

Male: Sexually dimorphic in size, urosome ornamentation and segmentation, antennule, P2 endopod, P3 exopod, P5 and P6.

Antennule (Fig. 10B) 7-segmented, with one segment distal to geniculation (chirocer condition). Segment 1 with sclerite around base; posterior margin forming lobate extension bearing long spinules; with numerous spinule rows around anterior margin as figured (Fig. 10B, C). Segment 3 with bulbous process on proximal posterior margin bearing plumose seta. Segment 4 largely membranous around posterior margin; anterior margin with dorsal spinous process. Segment 5 minute, represented by a small sclerite on anterior margin (Fig. 14D; arrowed in Fig. 15B for *N. parvus*). Segment 6 (Fig. 14D) very large and swollen; with incomplete transverse surface suture ventrally and posteriorly; anterior margin forming multicuspidate structure (typically with eight cusps) in proximal half; with modified longitudinally striated element often closely adpressed to anterior surface (Fig. 14D; cf. Fig. 15D for *N. parvus*). Segment 7 (Figs 10B, 14E) hook-shaped, without surface sutures marking original segmentation; apex weakly chitinized, recurved; anterior surface forming longitudinal furrow containing two basally fused elements (arrowed in Fig. 14C)

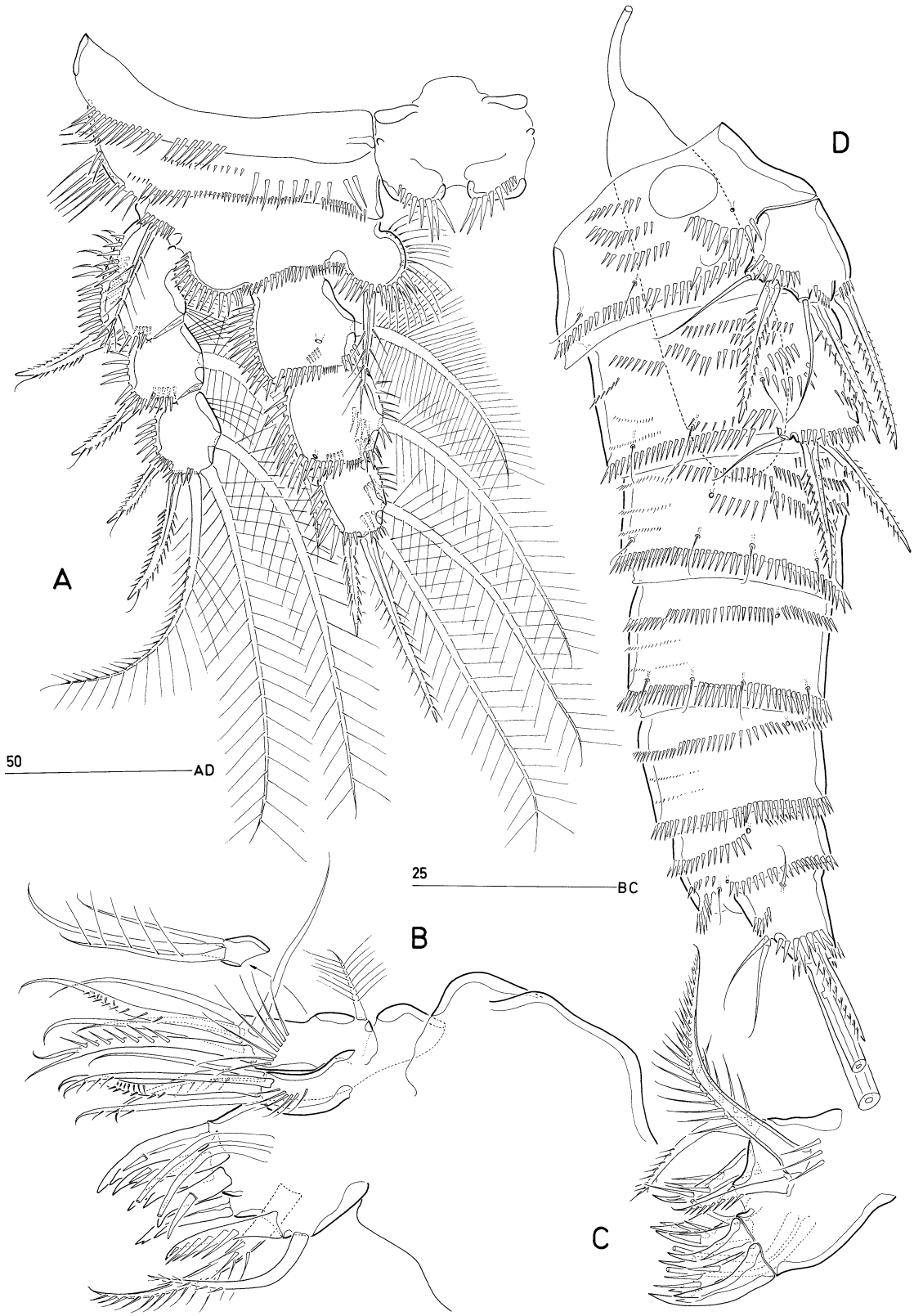

Figure 6. ***Neotachidius coreanus*** **sp. nov.** A, P1 ♀, anterior; B, maxillule ♀, anterior (endopod disarticulated); C, praecoxal arthrite of maxillule ♀, posterior; D, urosome ♂, lateral.

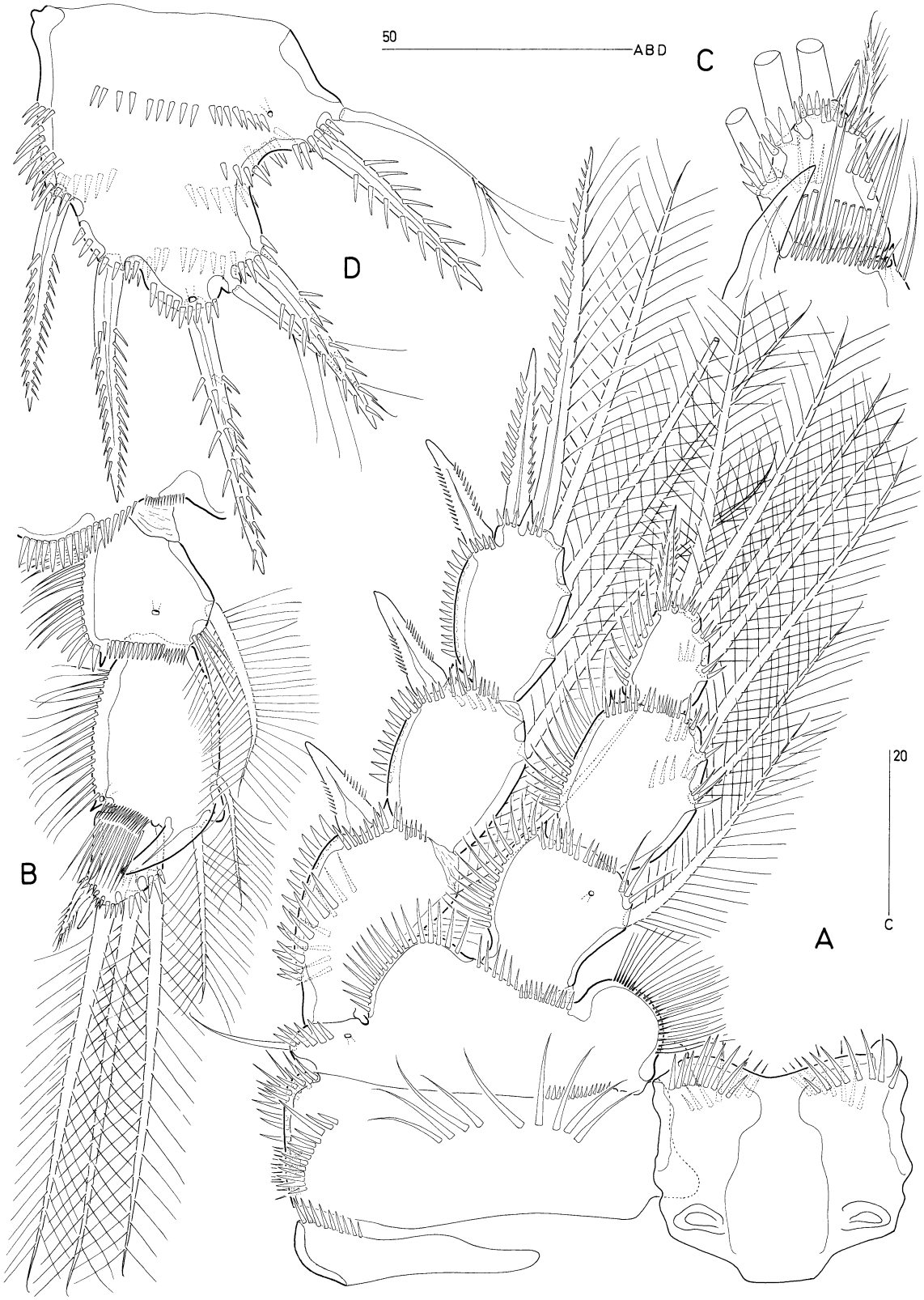

Figure 7. ***Neotachidius coreanus*** **sp. nov.** A, P2 ♀, anterior; B, P2 endopod ♂, anterior; C, detail of P2 enp-3 ♂, anterior; D, P5 ♀, anterior.

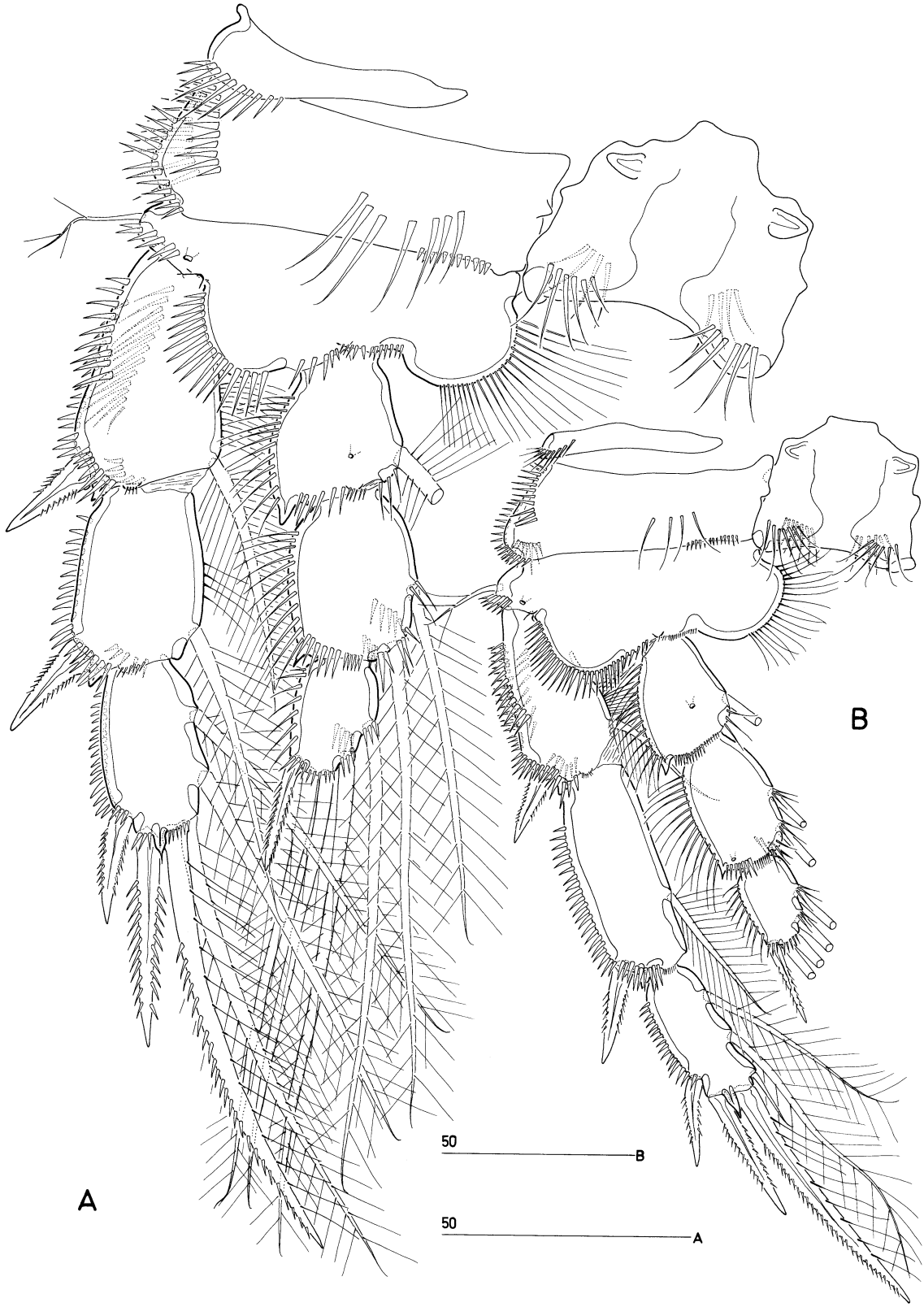

Figure 8. ***Neotachidius coreanus*** **sp. nov.** A, P3 ♀, anterior; B, P3 ♂, anterior.

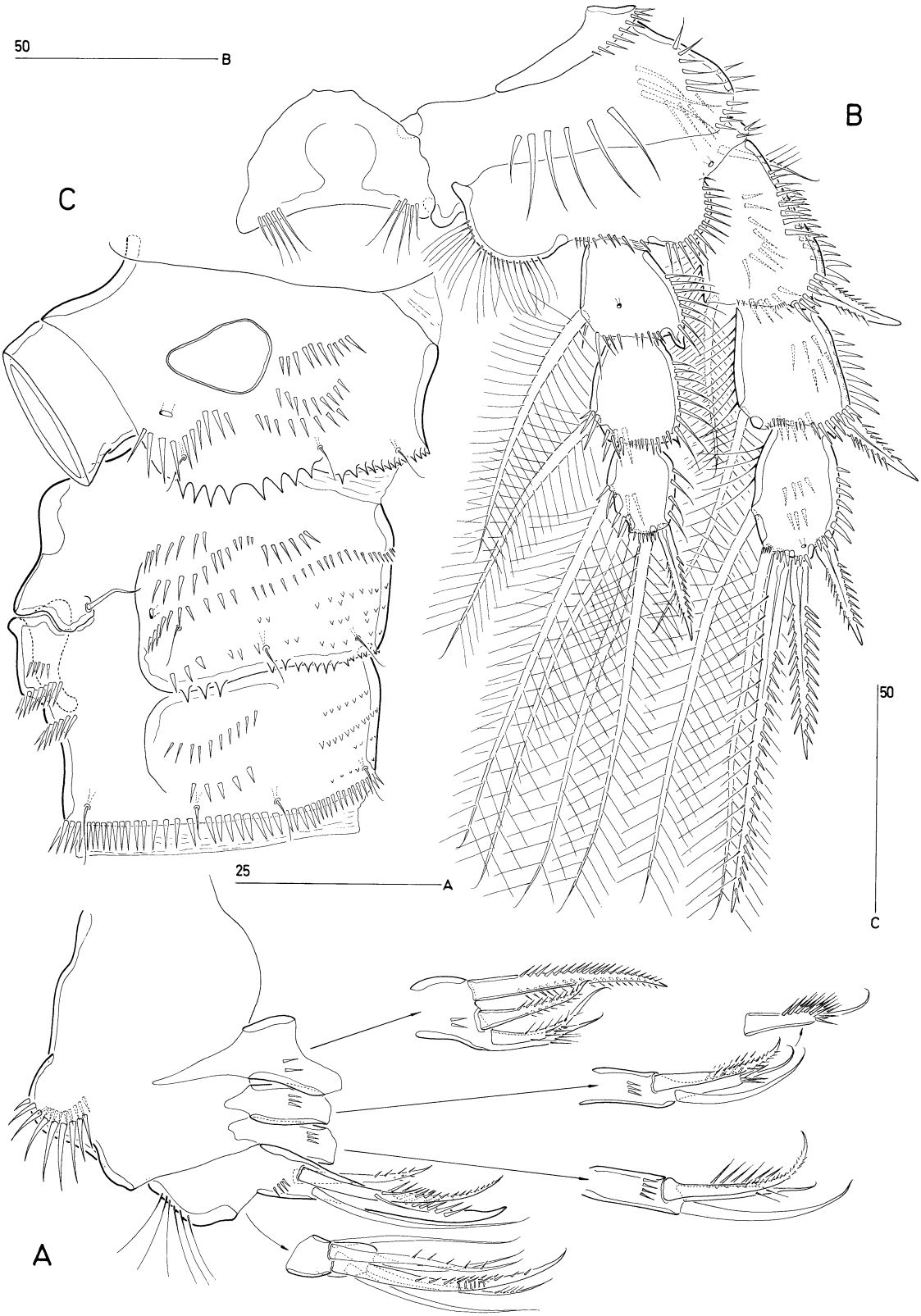

Figure 9. ***Neotachidius coreanus*** **sp. nov.** (♀) A, maxilla (insets showing armature of syncoxal endites; endopod disarticulated); B, P4, anterior; C, P5-bearing and genital double-somite, lateral (P5 omitted).

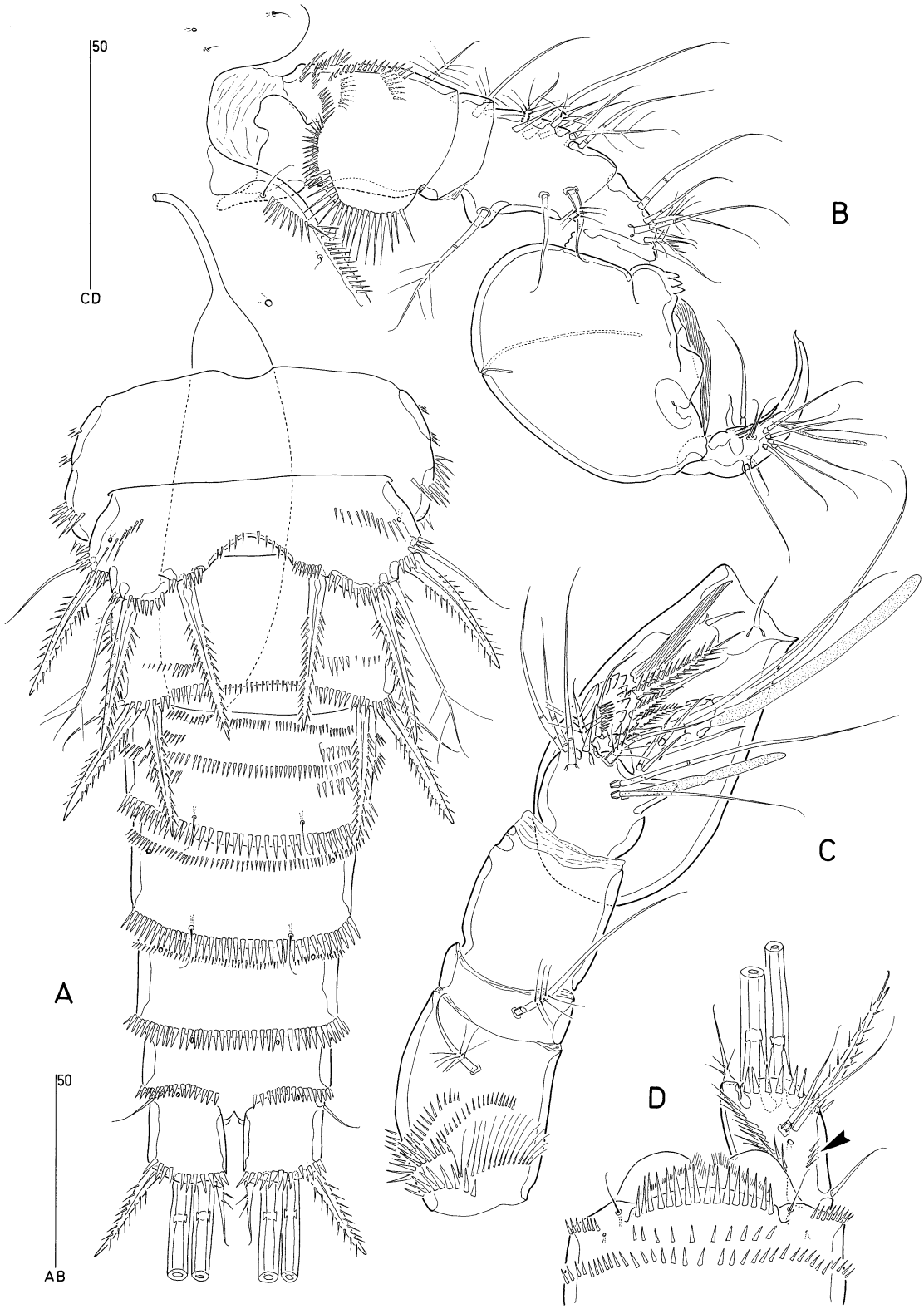

Figure 10. ***Neotachidius coreanus*** **sp. nov.** A, urosome ♂, ventral; B, antennule ♂ and free margin of cephalosome, dorsal (armature of segments 1–3 and seven complete; for complete armature of other segments see C, Fig. 14D); C, antennulary segments 1–6 ♂, anterior (armature of segment three omitted). D, anal somite and left caudal ramus ♀, dorsal (accessory dorsal spinular row on caudal ramus arrowed).

as in *N. parvus* (Fig. 15C). Armature formula: 1-[1 pinnate], 2-[1 pinnate], 3-[6 bare +5 pinnate], 4-[6 bare +2 pinnate + ae], 5-[2 pinnate], 6-[9 bare +3 pinnate +1 striated element + (1 + ae)], 7-[12 +2 modified + acrothek]. Apical acrothek consisting of short aesthetasc and small naked seta. Many setae on segments 3–4 with proximal flexure zone.

P2 endopod (Figs 7B, 16A, C). Middle segment enlarged on inner margin, forming outwardly directed spinous apophysis partly overlying enp-3 anteriorly; inner setae markedly shorter than in ♀. Enp-3 small (Figs 7C, 16A), with row of long setules on anterior surface, typically overlying apex of spinous apophysis; outer distal seta strongly reduced, represented by minute, basally fused spine with recurved tip; outer spine reduced.

P3 exopod (Fig. 8B) distinctly longer and more slender than in ♀. Inner setae of exp-1 and -2 smaller than in ♀. Exp-2 elongate; posterior spinules absent. Exp-3 longer than in ♀ inner distal seta vestigial.

P5 (Figs 6D, 10A) medially fused, each with three pinnate spines and two setae; outermost seta naked, representing outer basal seta, other seta sparsely plumose. Anterior surface with fine spinule rows and pore.

P6 (Figs 6D, 10A) symmetrical; each member with two pinnate spines and naked outer basal seta; posterior margin with coarse spinules bi-laterally and fine spinules medially. Spermatophore large, about 100 μm in length.

Ornamentation of urosome essentially as in ♀ except for more elaborate spinular patterns on first abdominal somite (Figs 6D, 10A).

Etymology: The specific name refers to Korea, the country where the type locality of the new species is situated.

NEOTACHIDIUS PARVUS SP. NOV.

Synonym: Tachidius (Neotachidius) triangularis Shen & Tai, 1963 *sensu* Song & Chang (1995) [partim].

Type material: Holotype ♀ (NMNH reg. no. 251942) dissected and mounted on slides. Paratypes deposited in NMNH are 2 ♀♀ (reg. no. 251943–944) and 3 ♂ (reg. nos. 251945–947) dissected and mounted on slides; 20 ♀♀ and 20 ♂♂ in alcohol (reg. no. 251973). Paratypes deposited in NHM are 1 ♀ dissected on ten slides (reg. no. 2003.808), 1 ♂ dissected on seven slides (reg. no. 2003.809); 24 ♀♀ and 13 ♂♂ in alcohol (reg nos. 2003.771–807)

Type locality: Stn five in a small river discharging into Kwangyang Bay, South Korea (34°57.1′N, 127°36.4′E), salinity 11.10‰ (see Ohtsuka *et al.,* 1992).

Additional material: (1) Taehwa River estuary, Ulsan, South Korea; leg. C.Y. Chang, 31 January 1987; 1 ♀ and 1 ♂ in alcohol (NHM reg. nos. 2003.812–813). (2) Jochean, Cheju Island, South Korea; leg. C.Y. Chang and S. J. Song, 27 October 1993; 2 ♀♀ in alcohol (NHM reg. nos. 2003.810–811).

Body length: ♀: 500 ± 30 μm (N = 53); ♂: 450 ± 30 μm (N = 53; based on paratypes).

Neotachidius parvus is closely related to *N. coreanus* and the description below is consequently restricted to differences only.

Description

Based on NHM paratypes (reg. nos. 2003.771–809).

Female: Spinules around posterior margin of cephalosome and somites bearing P2–P3 shorter than in *N. coreanus* (Fig. 11A). Slight differences in fine surface spinulation of pedigerous somites as illustrated in Figure 11A. Rudimentary tergite of P1-bearing somite less well defined. Posterior margin of P4-bearing somite denticulate laterodorsally but smooth dorsally; dorsolateral spinules shorter than in *N. coreanus*. P5-bearing somite with spinules around lateroventral corner of pleurotergite; lateral surface spinules distinctly shorter and more blunt than in *N. coreanus* (Fig. 11C).

Dorsal posterior margins of genital double-somite and free abdominal somites 2–3 denticulate instead of with long spinules (Fig. 11A, C); spinules along ventral posterior margin of these somites shorter than in *N. coreanus* (Fig. 11B). Paired spinule rows posterior to genital slit absent (compare with *N. coreanus*: Figs 1B, 2C); remaining two rows consisting of smaller spinules (Fig. 11B, C). Genital field area less raised in lateral aspect (Fig. 11C). Lateral surface ornamentation of genital double-somite less elaborate than in *N. coreanus* (Fig. 11C). Anal somite with paired laterodorsal spinule rows but without spinules dorsally (Fig. 13D). Anal operculum spinulose but spinules markedly shorter than in *N. coreanus.*

Caudal rami (Figs 11B, 13D) slightly longer than wide but shorter than in *N. coreanus*; armature and ornamentation essentially as in *N. coreanus*, except dorsolateral spinule row (arrowed in Fig. 10D) absent.

Antennule (Fig. 12A) with short apical segment, only slightly longer than segment 6. Armature as in *N. coreanus*.

Antenna (Fig. 12B) with spinule rows on abexopodal margin of basis and proximal endopod segment. Exopod distinctly 2-segmented; exp-1 shortest, with one long slender plumose seta; exp-2 with short smooth seta fused to lateral margin and two unequal plumose setae apically; spinular ornamentation around outer distal corner of exp-2 more elaborate than in

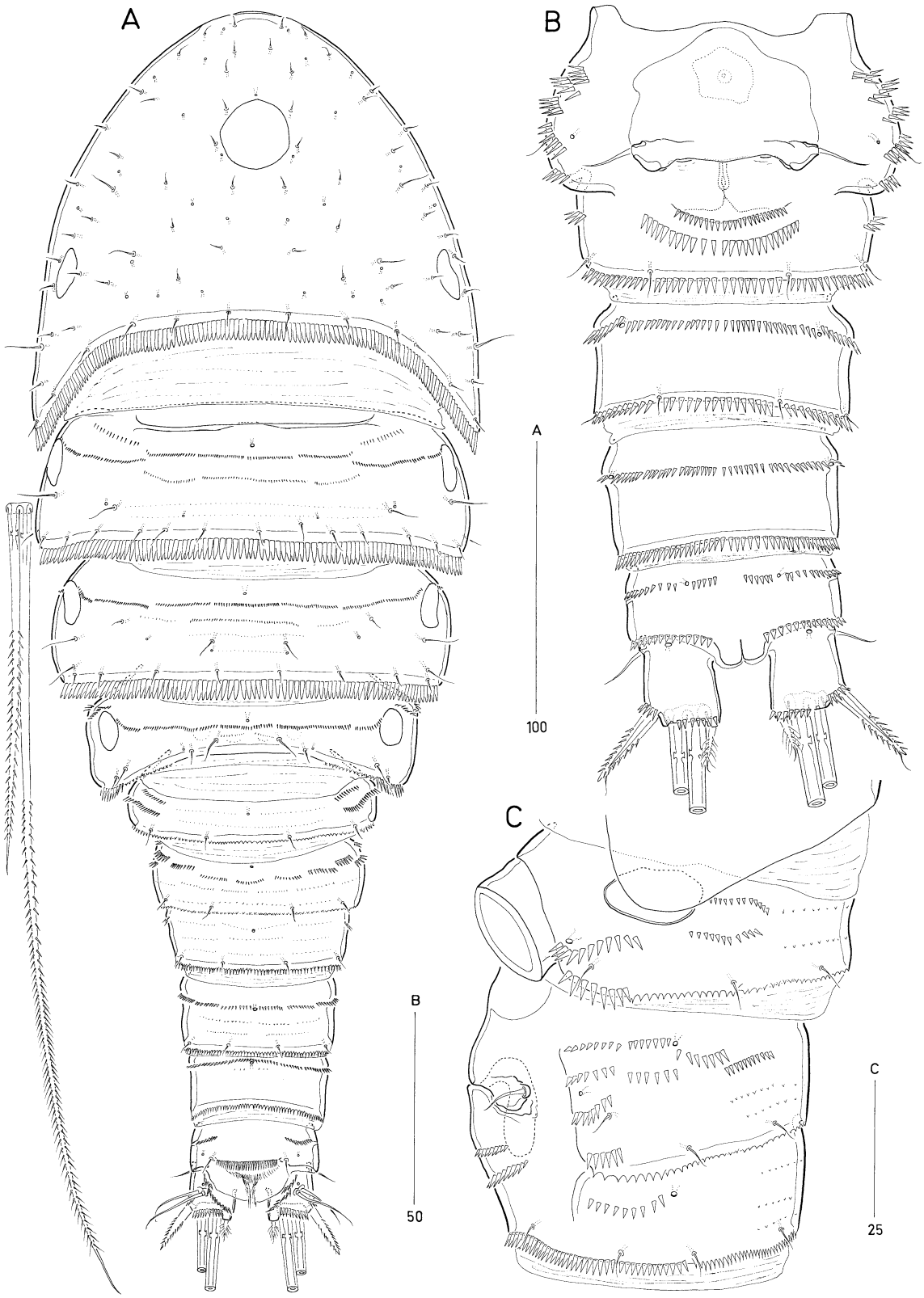

Figure 11. ***Neotachidius parvus*** **sp. nov.** (♀) A, habitus, dorsal; B, urosome (excluding P5-bearing somite), ventral; C, P5-bearing and genital double-somite, lateral (P5 omitted).

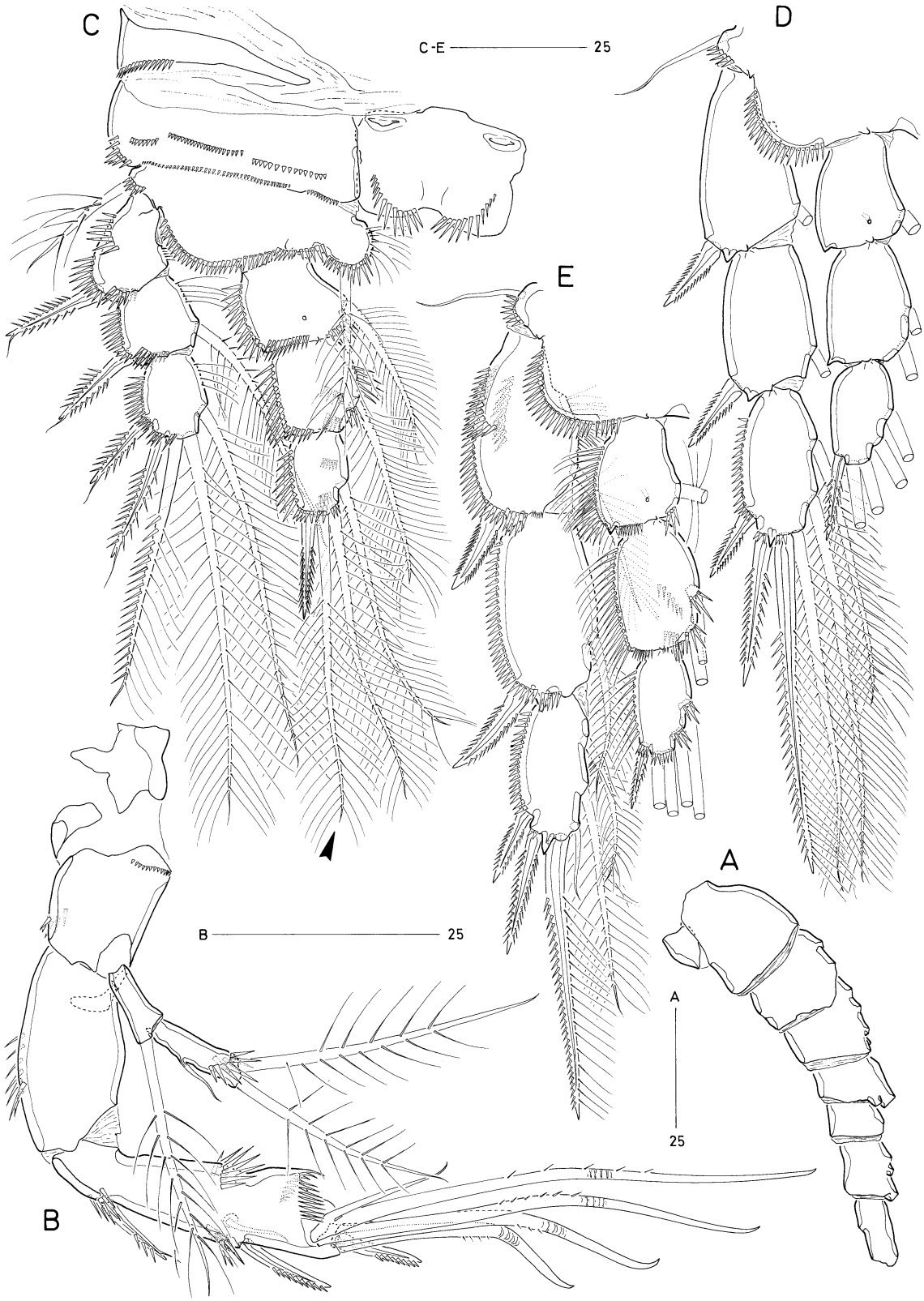

Figure 12. ***Neotachidius parvus*** **sp. nov.** A, segment contours of ♀ antennule; B, antenna ♀; C, P1 ♀, anterior (outer distal seta of enp-3 arrowed); D, P3 ♀, anterior (proximal part of protopod and most ornamentation omitted); E, P3 ♂, anterior (proximal part of protopod omitted).

N. coreanus. Distal endopod segment laterally with one unipinnate spine in proximal third and one smooth seta plus one unipinnate spine in middle third. Apical armature of enp-2 consisting of one unipinnate spine and four geniculate setae; longest geniculate seta with few spinules and fused at base to short naked seta; segment with various spinule rows and surface frills as figured.

Mandible. Palp with similar armature as in *N. coreanus*. Endopod with spinule row on anterior surface (arrowed in Fig. 5D).

Maxillule, maxilla and maxilliped as in *N. coreanus*.

P1 (Fig. 12C). Most spinules on anterior surface of praecoxa and coxa and around distal margin of basis distinctly shorter than in *N. coreanus*. Inner basal seta more slender and longer, reaching beyond distal margin of enp-2. Rami as in *N. coreanus* except for inner distal element of enp-3 (arrowed in Fig. 12C) being long, plumose and setiform instead of pinnate and spiniform.

P2–P4 (Figs 12D, 13A) as in *N. coreanus* except for (a) intercoxal sclerites with spinules anteriorly but not posteriorly; (b) long spinules on anterior surface of coxa absent; (c) spinules around distal margin of basis uniform in size; (d) posterior spinules on P4 coxa absent, and (e) P4 exp-3 with only one spinule row on posterior surface.

P5 (Fig. 13C) longer and with outer concavity less pronounced than in *N. coreanus*; about 1.40 times as long as maximum width; spinule pattern on anterior surface and along inner margin different (as illustrated in Fig. 13C); apical seta smooth instead of plumose; spines more slender than in *N. coreanus*.

Male. Sexually dimorphic in size, urosome ornamentation, antennule, P2 endopod, P3 exopod, P5 and P6.

Antennule (Figs 14A, 15A–D) as in *N. coreanus* except for two differences on segment 6: (a) multicuspidate process (Figs 14A, 15B; b in Fig. 15D) less pronounced and typically with five cusps, and (b) cylindrical process adjacent to longitudinally ribbed element (a in Fig. 15D) with two spinulose elements (ventralmost smooth in *N. coreanus*; arrowed in Fig. 14D). Armature formula: 1-[1 pinnate], 2-[1 pinnate], 3-[6 bare +5 pinnate], 4-[6 bare +2 pinnate + ae], 5-[2 pinnate], 6-[8 bare +4 pinnate +1 striated element + (1 + ae)], 7-[12 +2 modified + acrothek].

P2 endopod (Figs 13B, 16B). Enp-1 comparatively longer than in *N. coreanus* with outer distal corner not spinous; spinules along outer margin longer, those of inner distal corner shorter than in *N. coreanus*. Middle segment transversally enlarged but markedly shorter than in *N. coreanus*; outer margin distinctly convex; both inner setae markedly shorter than in *N. coreanus*. Enp-3 small (Fig. 16B), with row of long setules on anterior surface covering spinous apophysis of enp-2; outer distal seta strongly reduced, represented by a short and blunt, basally fused element (arrowed in Fig. 13B).

P3 exopod (Fig. 12E) more robust than in *N. coreanus*, with exp-2 being distinctly shorter; inner setae of exp-3 shorter. P3 endopod about as long as in *N. coreanus* but enp-3 proportionally longer.

P5 (Fig. 14B, C) medially fused with medial incision more pronounced than in *N. coreanus*; each with three serrate spines and two naked setae; middle and inner spines shorter than in *N. coreanus*; anterior surface spinules absent; spinules around midventral distal margin coarser than in *N. coreanus*.

P6 (Fig. 14B, C) symmetrical; each member with two serrate spines and naked outer basal seta; spinules around medial distal margin uniform in size and coarser than in *N. coreanus*.

Ornamentation of urosome essentially as in *N. coreanus* except for size of spinules (Fig. 14B, C).

Variability: The females from Cheju Island were larger in size (575–579 μm).

Etymology: The specific name is derived from the Latin *parvus*, meaning small, and alludes to the small size of the present species.

DISCUSSION

Species discrimination

Shen & Tai (1963) established the subgenus *Neotachidius* to accommodate a new species *N. triangularis* from the Pearl River (Zhujiang River) delta near Guangzhou, Guangdong Province, southern China. The original description, illustrating both sexes, was reproduced with slight amendments in Shen's (1979) handbook on the freshwater copepods of China (Tai & Song, 1979) which lists additional records from brackish waters in Fujian Province in south-east China and the municipality of Tianjin in the north (Bohai Sea). Unfortunately, Shen & Tai's (1963) type material is no longer extant (F.-H. Mu, pers. comm.), hampering detailed comparison with the two Korean species. Although their drawings are relatively detailed by contemporary standards it is obvious that some structures were overlooked or misinterpreted. The dorsal integumental window on the cephalothorax, which is present in all Tachidiidae (Huys *et al.*, 1996), was neither figured nor mentioned in the text. Similarly, the outer seta of the male P6 was overlooked, an observational error also made by Song & Chang (1995) in their redescription of *N. triangularis* and by Shen & Tai (1964) in their description of *Tachidius* (*Tachidius*) *vicinospinalis*. Comparison with the two Korean species suggests that Shen & Tai's (1963) illustrations of the male P2

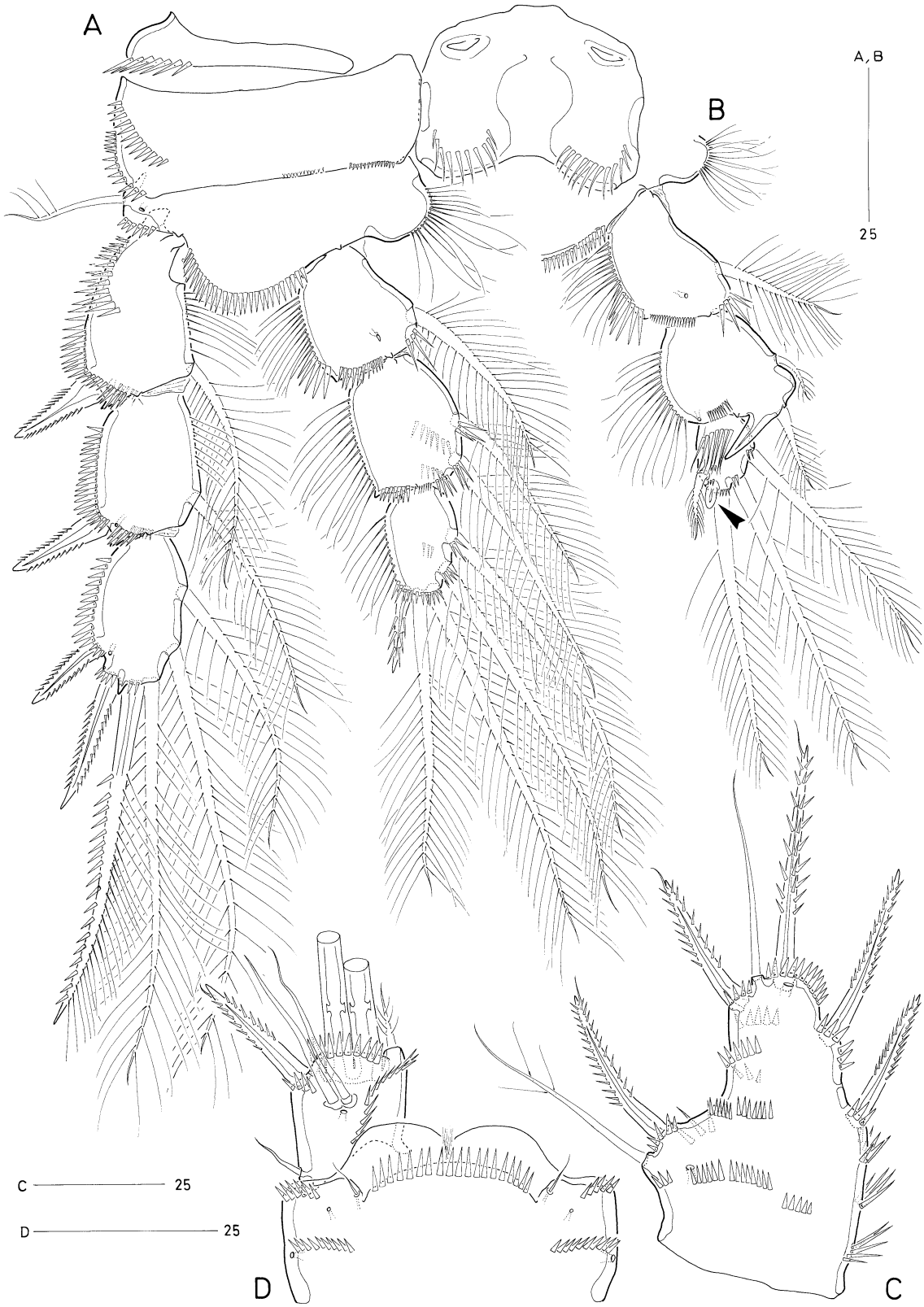

Figure 13. ***Neotachidius parvus*** **sp. nov.** A, P2 ♀, anterior; B, P2 endopod ♂, anterior (distal outer element arrowed); C, P5 ♀, anterior; D, anal somite and right caudal ramus ♀, dorsal.

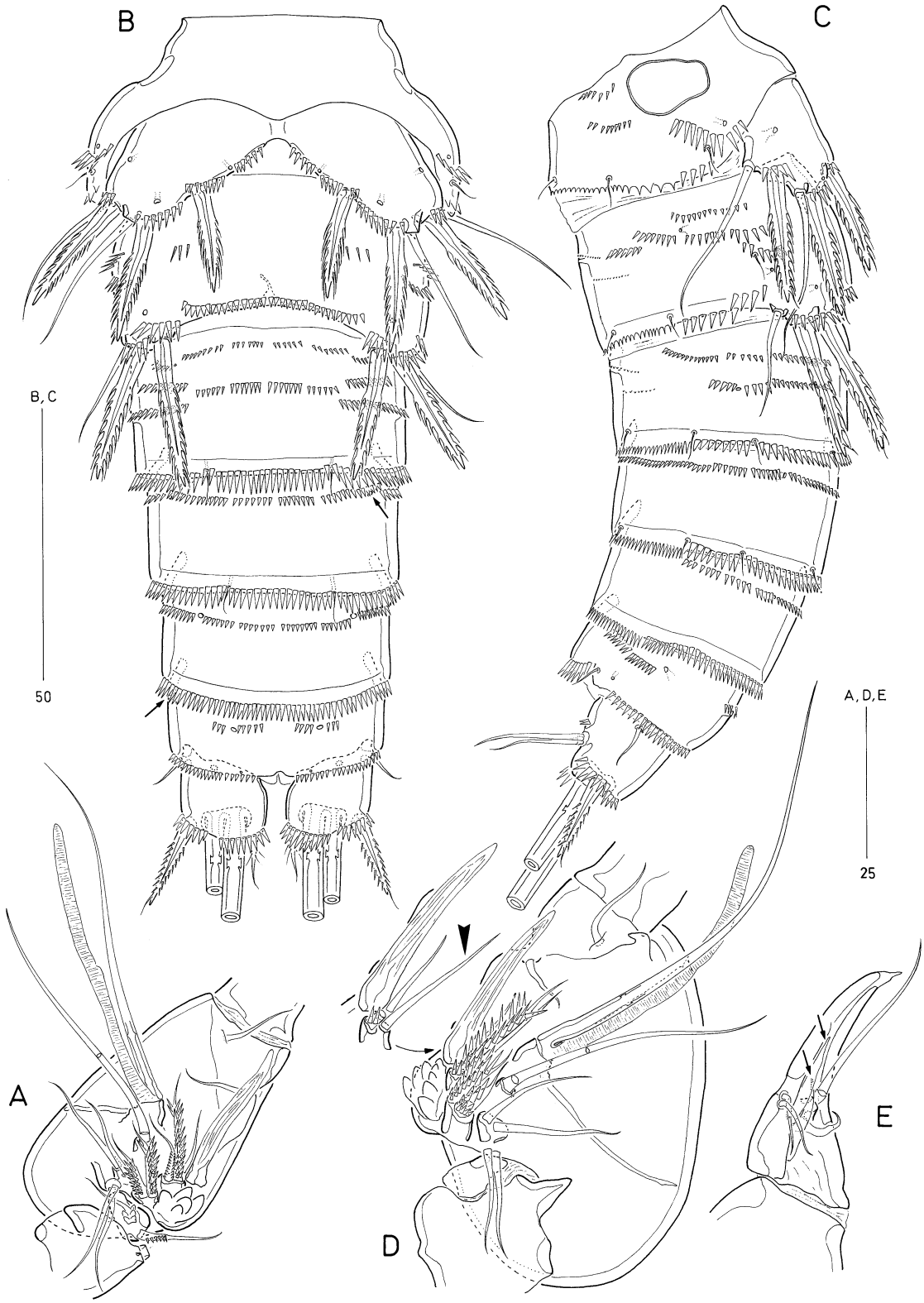

Figure 14. ***Neotachidius parvus*** **sp. nov.** (♂) A, antennulary segments 5–6, anterior; B, urosome, ventral (integumental pores obscured by spinules arrowed); C, urosome, lateral. ***N. coreanus*** **sp. nov.** (♂) D, antennulary segments 5–6, anterior (armature of segment 5 omitted; setation element with ornamentation different from *N. parvus* arrowed in inset); E, antennulary segment 7, anterior (modified elements arrowed; posterior setae and acrothek omitted).

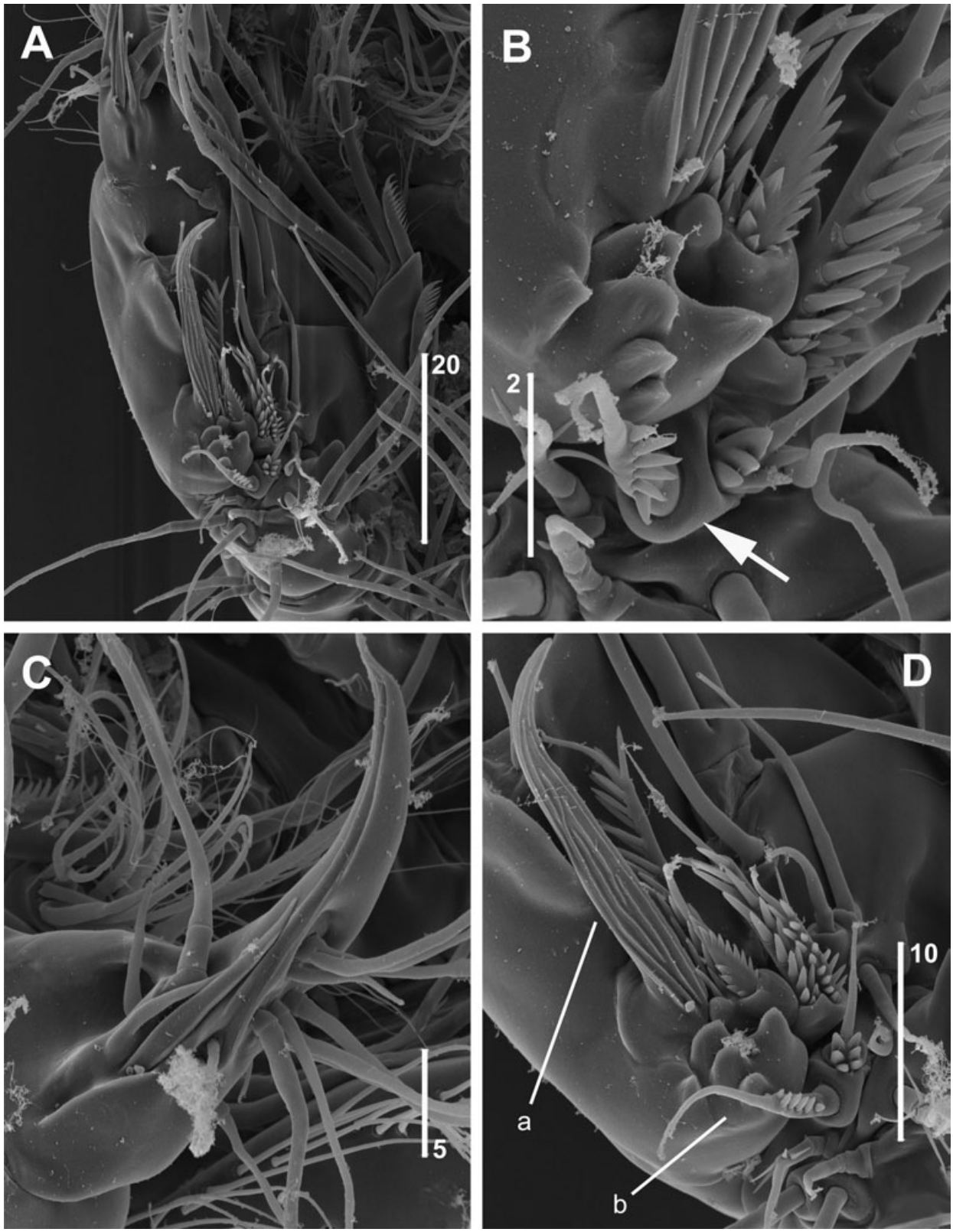

Figure 15. ***Neotachidius parvus*** **sp. nov.** (♂) SEM micrographs of antennule: A, segments around geniculation, anterior; B, vestigial segment 5, anterior (arrowed); C, apical segment, dorsal; D, segment 6, anterior (a = longitudinally ribbed modified element; b = multicuspidate process).

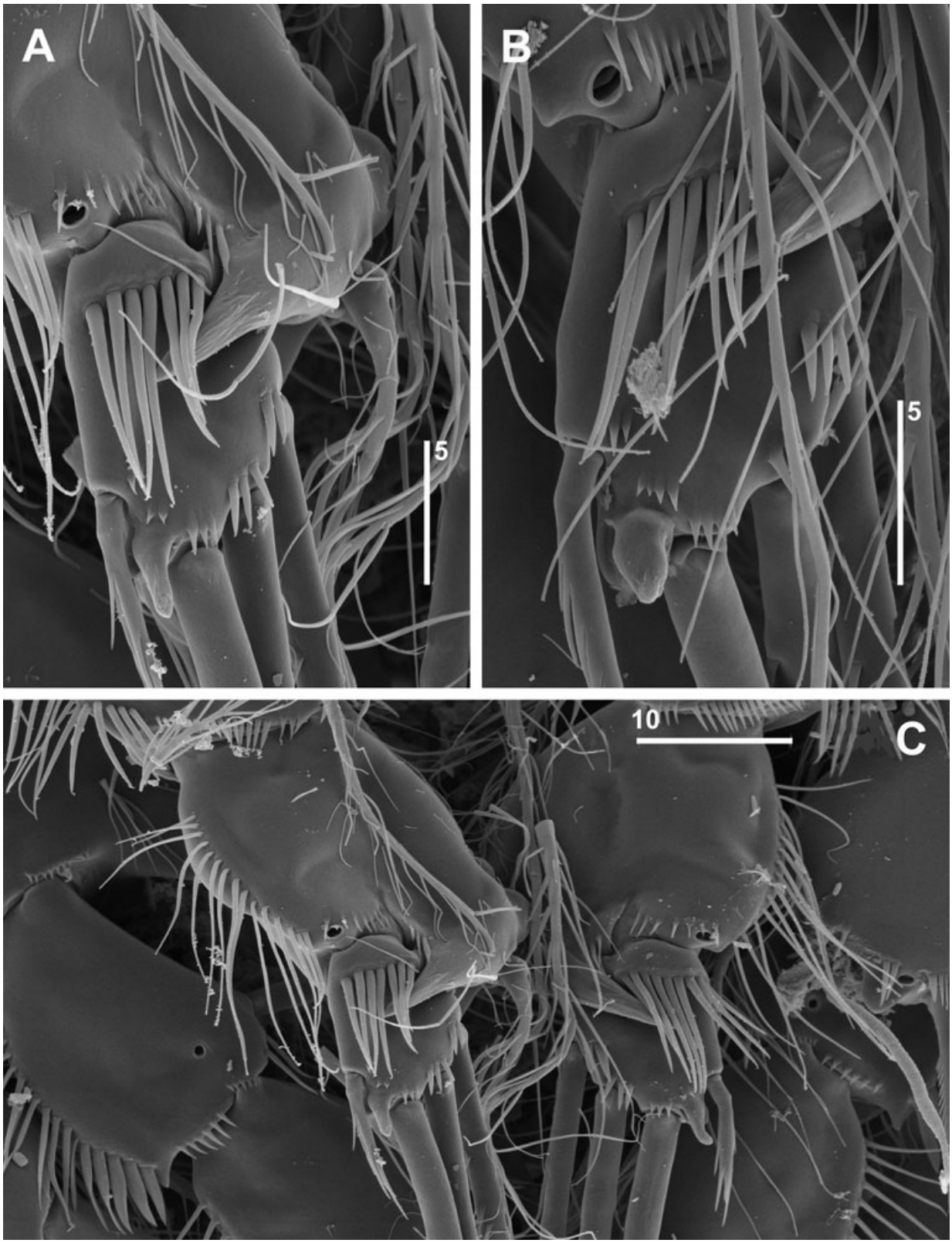

Figure 16. SEM micrographs of P2 endopod ♂. ***Neotachidius coreanus* sp. nov.** (A, C); ***N. parvus* sp. nov.** (B).

endopod and P3 exopod are also incorrect. Both the outer spine and the rudimentary apical element on P2 enp-3 are not illustrated, and the inner distal seta on P3 exp-3 was overlooked. The authors also figured a raised structure on the middle exopod segment of the male P3 which they described as a surface protuberance in the Chinese text (but not in the English summary). Examination of male *N. coreanus* revealed that this structure is an internal reinforcement, serving as an insertion site for a large extrinsic muscle. Several other deficiencies can be found in the setation patterns of the antennule, antennary endopod (and exopod?) and caudal ramus.

Neotachidius parvus can readily be distinguished from its congeners by its smaller size, the slenderness and size of the setae on the antennary exopod, the long inner basal spine on P1, the outer distal element on P1 enp-3 being setiform (instead of spiniform) and the absence of the dorsolateral spinule row on the caudal ramus. These and additional differences found in the morphology of the male P3 and the female P5 are summarized in Table 1. *N. parvus* occurs sympatrically with the larger *N. coreanus* in the Kwangyang estuary. As there is no overlap in the body length range, individuals of both species can easily be separated when co-occurring in samples. *N. parvus* also differs from *N. coreanus* in the distinctly 2-segmented antennary exopod (and the reduced lateral seta on exp-2), the presence of an anterior spinule row on the mandibular endopod, the spinule patterns on P1–P4 and their intercoxal sclerites (see descriptions for more detail), the ornamentation around the posterior margin of the body somites and the spinulation on the dorsal surface of the anal somite and the ventral surface of the gen-

Table 1. Salient features discriminating *Neotachidius* species. Data for *N. triangularis* based on Shen & Tai (1963). For additional characters separating *N. coreanus* and *N. parvus* see respective text descriptions

	triangularis	*coreanus*	*parvus*
Size (μm) ♀	600–630	690	500
♂	500	600	450
Antennule ♀ length segment 7 : segment 6	1.3	2.0	1.2
Antennary exopod: segmentation	distinctly 2-segmented	indistinctly 2-segmented	distinctly 2-segmented
lateral seta exp-2	absent	pinnate, well developed	smooth, reduced
Antennary endopod longest geniculate seta	sparsely pinnate or smooth (?)	with long setules	sparsely pinnate
Mandibular endopod	?	without spinules	with anterior spinule row
P1 outer margin coxa	with long spinules	with long spinules	with short spinules
P1 inner basal spine	not reaching to distal margin of enp-2	not reaching to distal margin of enp-2	reaching to distal margin of enp-2
P1 enp-3 outer distal element	spiniform, much shorter than adjacent seta	spiniform, much shorter than adjacent seta	setiform, as long as adjacent seta
P2–P3 intercoxal sclerite posterior surface	?	with spinules	without spinules
P2–P4 coxa anterior surface	?	with very long spinules	without very long spinules
P2 ♂ enp-2 inner margin	distinctly produced	not produced	distinctly produced
P3 ♂ length exp-2:exp-3	1.7	1.5	1.2
P3 exp ♂ length outer apical spine:distal outer spine	3.7	2.0	2.2
P3 ♂ length enp-2:enp-3	1.8	1.5	1.2
P5 ♀ length:maximum width	1.25	1.05	1.40
Dorsal posterior margin P4-bearing somite	?	denticulate	smooth
Lateroventral corner P5-bearing somite	?	serrate	with spinules
Dorsal posterior margins abdominal somites	?	with long spinules	denticulate
Area posterior to genital slit ♀	?	with three spinule rows (anteriormost paired)	with two spinule rows
Anal somite dorsal surface	?	2 continuous spinule rows	1 medially interrupted spinule row
Caudal ramus dorsolateral spinule row	present	present	absent

ital double-somite (Table 1). Unfortunately, Shen & Tai (1963) did not pay attention to ornamentation so most characters listed above remain unconfirmed for *N. triangularis*.

N. coreanus is clearly more closely related to *N. triangularis*, with which it shares the ornamentation of the antennary exopodal setae, the long spinules on the outer margin of the P1 coxa, the short inner basal spine of the P1, the spiniform outer distal element on P1 enp-3 and the dorsolateral spinule row on the caudal ramus. Conspecificity can be ruled out on the basis of several morphometric characters related to the antennule, male P3 (both rami) and female P5 (Table 1). In addition, males of both species can be differentiated on the basis of the P2 endopod which has a distinctly produced middle segment with angular inner margin in *N. triangularis* (resembling the condition in *N. parvus*). The alleged absence of the lateral seta on the distal exopod segment of the antennary exopod in *N. triangularis* requires confirmation.

Song & Chang (1995) reported *N. triangularis* from brackish estuarine waters and littoral zones all around Korea and provided a brief redescription based on material collected from crab burrows in three mudflats on Chindo Island. Although they acknowledged discrepancies with the original description, in the presence of an additional seta on the antennary exopod and in the more elaborate surface ornamentation of the female P5, the Chindo Island material was identified as *N. triangularis*. Song & Chang's (1995) illustrations provide strong indications that at least part of their redescription was based on *N. parvus*:

1. body length (450 μm; based on their fig. 2a);
2. short apical antennulary segment;
3. antennary exopod distinctly 2-segmented, with reduced lateral seta on exp-2 and remaining elements plumose and setiform;
4. antennary endopod without setules on longest geniculate seta;
5. P1 enp-3 outer distal element very long and setiform, and
6. caudal ramus without dorsolateral spinule row.

However, the Chindo Island material differs from *N. parvus* in three aspects:

1. the lateral seta on the distal segment of the antennary exopod is pinnate instead of smooth;
2. the inner basal spine of P1 is not reaching to the distal margin of enp-2 and appears more spiniform than in *N. parvus*, and
3. female P5 only 1.2 times as long as maximum width, and apical spine distinctly shorter.

These characters did not display any variability in the Kwangyang Bay material of *N. parvus*, suggesting that Song & Chang (1995) were probably dealing with another, as yet unnamed, species or with an amalgamate of the latter and genuine *N. parvus*. It is conceivable that increasing sampling effort in brackish water habitats along the coasts of Korea and China will reveal several other undescribed species. A single damaged female that could not be attributed to any of the three known species was discovered among specimens of *N. parvus* specimens from collections made by Dr C. Y. Chang at Cheju Island. This further substantiates the existence of a *Neotachidius* species complex and reflects its rapid speciation and radiation in low salinity habitats along the Chinese–Korean coastline.

Kask *et al.* (1982) reported *N. triangularis* from an intertidal gravel-sandy beach in the Cowichan estuary and from intertidal eelgrass and sandy mud in the Nanaimo estuary. These records from south-western British Columbia appear to be genuine since the species has been recorded since from similar habitats in the Columbia River estuary. In fact it is often the most abundant epibenthic harpacticoid in the mesohaline regions of Pacific north-west estuaries (J. R. Cordell, pers. comm.). The Columbia River is a major entry point for ships bound for several major ports in Oregon and Washington. According to Cordell, Morgan & Simenstad (1992) the net tonnage of ballasted ships from Japan, Taiwan, Korea and China entering the river has almost doubled between 1976 and 1990 and was proportionally greater for the latter two countries. Cordell *et al.* (1992) suggested that ballast water discharge accounted for the transoceanic transport and subsequent introduction in the Columbia River of the Asian calanoid *Pseudodiaptomus inopinus* (Burckhardt, 1913). This species was previously found only along the coasts of China, Japan and Siberia but became established and abundant in the Columbia River between 1980 and 1990. In a later study, Cordell & Morrison (1996) showed *P. inopinus* had already invaded at least seven other estuaries in the region and was sometimes the dominant zooplankter in these systems. Kask *et al.* (1982) stated *N. triangularis* was common to abundant from March to August, indicating the species had successfully established itself in the Nanaimo and Cowichan estuaries. It is more than likely that the Canadian *N. triangularis* is yet another invasive Asian copepod recently introduced to the north-western Pacific coast of North America. Unfortunately, we were unable to obtain material from the Columbia River and consequently cannot confirm whether the Canadian records are based on genuine *N. triangularis*, a Korean congener or an as yet undescribed species.

Shen (1979) reported that ovigerous females of *N. triangularis* were only found during winter. The presence of many ovigerous females in the December material of *N. coreanus* and *N. parvus* may indi-

cate a similar reproductive period for the Korean species.

SUBGENERIC DIVISION OF *TACHIDIUS*

At the time of Shen & Tai's (1963) description only two genera had been proposed in the Tachidiidae (= subfamily Microarthrioninae *sensu* Lang, 1948): *Tachidius* and *Microarthridion*. The authors created the subgenus *Neotachidius* within *Tachidius* to reflect its transitionary position between both genera. This subgeneric distinction was based on two characters: (1) the armature of P1 enp-3, being [221] in *Tachidius* (*Tachidius*) and [121] in *Tachidius* (*Neotachidius*), and (2) the morphology of the female P5 being a subcircular (sometimes bilobate) plate in *T.* (*T.*) and a simple triangular lobe in *T.* (*N.*). Our observations on *Neotachidius* spp. have revealed additional differences with the nominotypical subgenus *Tachidius*.

The genital field of *Neotachidius* is unique within the Tachidiidae by the absence of an isolated midventral copulatory pore (Fig. 2C). A minute pore is present anterior to the level of the genital slit and positioned on the ventral midline (arrowed in Fig. 2C); however, this structure represents a mere integumental invagination lacking any connection with the reproductive system or other underlying tissues or glands. It is assumed here that the copulatory pore(s) lie within the fused genital apertures and are concealed beneath the operculum derived from the sixth legs. In *Tachidius discipes* a discrete copulatore pore is discernible near the posterior margin of the genital double-somite (Gurney, 1932; Chislenko, 1967; Dussart, 1967).

The sexual dimorphism displayed on the male P2 endopod is also fundamentally different, in particular the morphology of the distal segment and the modification of its elements. In *Neotachidius* the segment is short and possesses an anterior surface comb of long spinules, covering a concavity which receives the outwardly directed spinous process of the middle segment (Fig. 16). In addition, the outer distal seta is strongly reduced to a rudimentary, basally fused element, and the outer spine is shorter than in the female. The two inner setae are well developed and resemble the condition in the female. In *Tachidius* the distal segment is elongate (Huys *et al*., 1996: fig. 88D) and shows a conspicuous concavity along the proximal inner margin, which is largely concealed beneath the straight apophysis arising from the middle segment. There is no anterior spinule comb covering the apophysis. The distal segment has three elements compared to five in the female, where the two inner setae have been expressed. The outer spine is much longer than in the female, being twice the length of the segment. The outer distal element is reduced to a short plumose seta, articulating at the base.

The male antennule in *Neotachidius* has a large spinous process arising from segment 4 which is absent in *Tachidius*. The process originates from the ventral anterior corner and is positioned at the base of the small aesthetasc (Figs 10C, 14D, 15A).

On the basis of their morphological disparity both subgenera are here upgraded to generic rank. The genus *Neotachidius* is defined by the following apomorphies: (1) segment 4 of ♂ antennule with spinous process arising from ventral anterior corner; (2) absence of an isolated midventral copulatory pore; (3) P1 enp-3 with one inner seta (instead of two); (4) P2 enp-3 ♂ with anterior surface spinular comb (concealing outwardly directed apophysis); (5) P5 ♀ with two endopodal spines (instead of four); (6) P5 ♂ with two inner spines (instead of four), and (7) P5 ♂ medially fused forming single plate. The outwardly directed spinous apophysis on the male P2 enp-2 and the rudimentary outer distal seta on enp-3 are synapomorphies shared with *Sinotachidius* gen. nov. (see below). Apomorphies defining the genus *Tachidius* include: (1) P2 enp-3 ♂ elongate, with distinct concavity on proximal inner margin; (2) P2 enp-3 ♂ inner setae lost, and (3) P2 enp-3 ♂ outer spine enlarged.

Tachidius and *Neotachidius* are derived from a common ancestor displaying the following synapomorphies: (1) P1 exp-3 with two outer spines (instead of three); (2) P3 enp-3 with two inner setae (instead of three) (3) P2 enp-2 ♂ forming spinous apophysis. A third genus belonging to this monophyletic group is recognized below.

TAXONOMIC POSITION OF *TACHIDIUS* (*TACHIDIUS*) *VICINOSPINALIS* SHEN & TAI, 1964

Dussart & Defaye (1990) listed, with reservations and without providing any justification, *Tachidius* (*Tachidius*) *vicinospinalis* in *Neotachidius* as *Tachidius* (*Neotachidius*) *vicinospinalis* (?). Shen & Tai (1964) described this species from the Pearl River delta and compared it with *T. incisipes* Klie, 1913 (now *Geeopsis incisipes*) and *T. spitzbergensis* Olofsson (1917), having misquoted Lang (1948) that the latter is a probable synonym of the former. In reality, Lang (1948) considered *T. spitzbergensis* a synonym of *T. discipes*, and *T. longicornis* Olofsson, 1917a a synonym of *T. incisipes*. Shen & Tai (1964) found *T. vicinospinalis* to be most similar to *T. spitzbergensis* but differentiated them by the number of exopodal spines on P1 and the shape and spine formula of the female P5. Lang (1948) pointed out that Olofsson (1917) had overlooked an outer spine on the female P5, the armature formula therefore being identical to that of *T. discipes*.

Surprisingly, Shen & Tai (1964) did not consider the unusual swimming leg formula of *T. vicinospinalis*. The illustration figuring the P4 (their fig. 54) shows two inner setae on the middle endopod segment and two on the distal exopod segment. No other member of the Tachidiidae possesses two inner setae on P4 exp-3 and only the primitive genus *Geeopsis* exhibits two inner setae on P4 enp-2. The alternative possibility, that Shen & Tai (1964) had illustrated either the P2 or the P3 and that the P4 has the common formula [1.1.122] for the exopod and [1.1.221] for the endopod, appears to be confirmed by Tai & Song (1979), who correctly labelled the P2 and provided an illustration of the real P4.

Although *T. vicinospinalis* shows many similarities with *T. discipes* (and therefore its probable synonym *T. spitzbergensis*), the morphology of the male P2 endopod shows it cannot be included in *Tachidius*. The spinous process on enp-2 is outwardly directed, and enp-3 is small, having two well developed inner setae, one long inner distal seta and two minute outer elements (representing the rudimentary outer distal seta and outer spine). This arrangement is reminiscent of the condition found in *Neotachidius*, except the outer spine on enp-3 is not reduced to the same extent as in *T. vicinospinalis* and this segment in the latter apparently lacks the anterior surface spinular comb. However, *T. vicinospinalis* cannot be assigned to *Neotachidius* either (as implied by Dussart & Defaye, 1990) since it has two inner setae on P1 enp-3 (instead of one) and a different P5 morphology (retaining a bilobate facies with four endopodal spines, instead of two, in the female, and possessing an additional inner spine in the male). This mosaic of apomorphic and plesiomorphic character states suggests that *T. vicinospinalis* occupies a transitionary position between *Tachidius* and *Neotachidius* and deserves separate generic rank. Consequently, it is designated here as the type species of a new genus *Sinotachidius*. Unfortunately, Shen & Tai's (1964) description does not enable us to provide a detailed diagnosis since information about the integumental windows, mouthparts and female genital field is lacking and the authors remain silent about the sexual dimorphism of the P3 exopod (which is conceivably present as it is expressed in all other tachidiid genera except for *Microarthridion* and *Cithadius*). The deficiencies contained in Shen & Tai's illustrations also prevent us from solving the true identity of Song & Chang's (1995) material from Chindo Island identified as *T. discipes*. Song & Chang stated that their specimens agreed well with Tai & Song's (1979) description of *T. discipes* but simultaneously pointed out some slight differences in the spinulation of the anal operculum and the bilobate nature of the female P5. Comparison reveals the Chindo Island females have exactly the same P5 as *T. vicinospinalis*, agreeing in overall form and shape, and in the size of individual setation elements. The only marked difference between the Korean material and *T. vicinospinalis* is found in the antennary exopod, having an additional (lateral) seta on the apical segment. In the absence of information on the males, it is at present impossible to decide whether *T. discipes sensu* Song & Chang (1995) is conspecific with *T. vicinospinalis* or represents a distinct species. Pending re-examination of the former it is regarded as *species inquirenda* in *Sinotachidius*.

SINOTACHIDIUS GEN. NOV.

Diagnosis: Tachidiidae. Condition of rostrum, integumental windows and mouthparts unconfirmed. Genital and first abdominal somites fused in ♀ original segmentation marked by transverse surface ridge dorsally and laterally; midventral copulatory pore positioned near posterior margin of genital double-somite (after Song & Chang (1995: fig. 1b)). Anal operculum spinulose. Caudal ramus setae IV–V well developed and pinnate. Sexual dimorphism in antennule, P2 endopod, P3 exopod (?), P5, P6 and urosomal segmentation.

Antennule with numerous pinnate setae/spines; 7-segmented in both sexes; chirocer in ♂, with aesthetascs on segments 4, 6 and 7. Antenna with distinctly 2-segmented exopod; exp-1 with one seta, exp-2 with 0–1 lateral and two apical setae; lateral endopodal spine proximally displaced. Maxilliped with 1(?) accessory seta on endopod; claw minutely pinnate.

P1–P4 enp-1 of normal size and with inner seta. Rami 3-segmented in P1–P4. P1 exp-3 with two outer spines, enp-3 with two inner setae. P3 enp-3 with five setae/spines. P4 enp-2 with one inner seta. Armature formula as follows:

	Exopod	Endopod
P1	0.1.122	1.1.221
P2	1.1.222	1.2.221
P3	1.1.222	1.2.221
P4	1.1.122	1.1.221

P2 ♂ enp-2 with outwardly directed spinous apophysis; enp-3 small, anterior surface without transverse spinular comb, outer spine and outer distal seta rudimentary, inner setae well developed.

P3 exopod ♂ presumably sexually dimorphic as in *Neotachidius* and *Tachidius*.

P5 ♀ slightly bilobate, separating outer lobe from endopodal lobe; outer lobe with basal seta and four exopodal elements (one seta, three spines); endopodal lobe with four pinnate spines. P5 ♂ medially fused (?); each with four spines and two setae.

P6 ♀ represented by opercula closing off common genital slit, each with one seta. P6 ♂ symmetrical;

each member with two pinnate spines and naked outer basal seta.

Free-living. Freshwater or brackish habitats.

Type species: Tachidius (*Tachidius*) *vicinospinalis* Shen & Tai, 1964 = *Sinotachidius vicinospinalis* (Shen & Tai, 1964) comb. nov.

Species inquirenda: Tachidius discipes Giesbrecht, 1881 *sensu* Song & Chang (1995).

Etymology: The genus name is derived from the type genus *Tachidius* and the prefix *sino*, referring to the country of origin of the type species.

According to Shen (1979) *S. vicinospinalis* has been recorded from brackish and freshwater habitats in both Guangdong and Fujian Provinces. Ovigerous females were encountered in April

ACKNOWLEDGEMENTS

We thank Prof. Yang Ho Yoon (Yosu National University, Korea), Dr Hiroaki Hashimoto and Mr Yukihiro Endo (Hiroshima University, Japan) for providing essential assistance in the field and the laboratory. Dr Cheon Young Chang (Taegu University, Korea) kindly provided *Neotachidius* material from his personal collection. Two anonymous referees are thanked for useful suggestions. This research was partly supported by a grant to S.O. from the Japanese Society for the Promotion of Science (No. 14560151).

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