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Four New Species of the Family Tegastidae (Copepoda, Harpacticoida) from Shallow Waters of Korea

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ABSTRACT

In our ongoing efforts to explore the species diversity of the harpacticoid fauna in Korea, we present findings on four newly identified species from family Tegastidae Sars, 1904. Although this family is frequently encountered in phytal communities, the diversity of tegastid copepod species within Korean waters largely remains to be elucidated. Drawing from our collections of tegastid harpacticoids from Chuja-do and Geomun-do Islands, we provide morphological descriptions for *Tegastes lobus* sp. nov., *T. tresetosus* sp. nov., *T. pilosus* sp. nov., and *Syngastes acutus* sp. nov., and propose their taxonomic relationships in relation to other species within the genus. Finally, we update the list of tegastid harpacticoids found in Korea and provide a key for identifying the six confirmed species from this region.

Keywords: copepods, light trap, phytal fauna, SCUBA diving, sublittoral fauna

INTRODUCTION

Tegastidae Sars, 1909 is a family of harpacticoid copepods that are identified by their laterally compressed bodies featuring significant ventral extensions on both the cephalic shield and anterior urosome (Seifried, 2003; Wells, 2007). These copepods primarily inhabit shallow phytal environments and comprise over 70 species across seven genera: *Aglaogastes* Huys, 2016, *Arawella* Cottarelli and Baldari, 1987, *Parategastes* Sars, 1904, *Peregastes* Fiers, 1986, *Smacigastes* Ivanenko and Defaye, 2004, *Syngastes* Monard, 1924, and *Tegastes* Norman, 1903 (Kim and Lee, 2020). Their laterally compressed body structure is a clear adaptation to such environments (Boxshall and Halsey, 2004). Interestingly, species from the genera *Aglaogastes*, *Parategastes*, and *Tegastes* have been recognized as commensals with other invertebrates, including bryozoan, cnidarian, and polychaete hosts (Huys, 2016). Genus *Smacigastes*, which has been identified as the most primitive, has notably colonized deep aquatic environments alongside tubeworm and mussel assemblies, particularly within cold seeps and hydrothermal vents (Ivanenko and Defaye, 2004; Gollner et al., 2008; Plum and Martínez Arbizu, 2009; Kim and Lee, 2020).

However, the taxonomy of Tegastidae remains ambiguous and challenging due to insufficient morphological details for many species and rudimentary generic differentiation. The original descriptions of several tegastid taxa have failed to meet the modern standards of alpha taxonomy, often being either incomplete or imprecise (Wells, 2007; Huys, 2016). Thus, our morphological understanding of many tegastid species is limited to aspects such as body shape, and characteristics of the maxilliped, antennule, and thoracic leg (Lang, 1965). Following early descriptions by Médioni and Soyer (1967), Marcus (1977), Bartsch (1993, 1994, 1995, 1999), and Humes (1981a, 1981b, 1984), dependable descriptions of the family began to emerge. Thus, identifying specific tegastid copepods has remained challenging (Wells, 2007; Huys, 2016). The paucity of available morphological data has also oversimplified generic differentiation, with thoracic leg segmentation acting as a criterion for generic boundaries until the 2000s. Subsequently, tegastid species were clustered based on similar thoracic leg segmentation (Sars, 1904; Marcus, 1977; Humes, 1984). However, Wells (2007) highlighted the phylogenetic significance of the maxilliped, fifth leg, and urosome in both sexes. More recent studies have questioned the monophyly of *Tegastes* and *Syngastes*, identifying unique

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differences in cephalosomal appendages within the same genus (Ivanenko and Defaye, 2004; Kim et al., 2016; Kim and Lee, 2020). Therefore, there is a pressing need for in-depth studies of older specimens, particularly those with outdated morphological information, to clarify taxonomic relationships within Tegastidae (Kim and Lee, 2020).

Although marine harpacticoid copepods have been relatively well studied in Korean waters (Lee et al., 2012), the species diversity of tegastid copepods remains largely underexplored. Kim (2014) pioneered the documentation of this family in Korean waters, offering re-descriptions of *Tegastes nanus* Sars, 1904, *Tegastes minutus* Sewells, 1940 (erroneously reported as *Tegastes minutes*), and *Syngastes dentipes* Bartsch, 1995 (mistakenly presented as *Parategastes dentipes*). Later, Kim et al. (2016), seemingly unaware of the work of Kim (2014), described two new *Syngastes* species: *Syngastes multicavus* Kim, Jung and Yoon, 2016, and *Syngastes pseudofoveatus* Kim, Jung and Yoon, 2016. In this study, we provide detailed descriptions of four new species in family Tegastidae, update the list of tegastid harpacticoids in Korea, and affirm the validity of the three species documented by Kim (2014).

MATERIALS AND METHODS

During the last decade, as part of a taxonomic study exploring marine harpacticoid fauna, field samples were collected from shallow waters in Korea using various methods. Among the Harpacticoida members, species of family Tegastidae were primarily sourced from underwater samples gathered using light traps and from washings of phytal assemblages collected through SCUBA diving at depths of 5−10 m. The sampling method of light traps was described in detail by Lee et al. (2022).

For this taxonomic study, tegastid copepods were isolated from samples that had been preserved with 95% ethanol using a dissecting microscope (M165 C; Leica, Wetzlar, Germany). Selected individuals were subsequently prepared in lactic acid. Species identification and taxonomic illustration of entire specimens and their dissected appendages were performed using a drawing device paired with a DM2500 (Leica) or BX53 (Olympus, Tokyo, Japan) optical microscope that featured differential interference contrast. Dissected portions were set on Higgins-Shirayama slides, permitting observation from both sides (Shirayama et al., 1993). The slides were treated with a lactopenol : glycerol (1 : 5) mixture and the coverslip edges were successively coated with nail varnish and paraffin to seal the samples. High-quality photographs of male and female tegastid copepods were captured by linking a DM6 B optical microscope (Leica) with a DMC5400 microscope camera (Leica). Images obtained at different focal lengths were integrated using the Leica Application Suite X software. The total body length of each specimen was measured from the rostrum tip to the posterior end of the caudal rami along dorsal outline using the drawing device. All scale bars in the illustrations are expressed in micrometers.

We referred to Huys and Boxshall (1991) for general descriptive terminology and Wells (2007) for specific details on maxilliped and urosome characteristics in both genders. For morphological descriptions of the new tegastid taxa, we opted to exclude finer details such as the integumental organs (sensilla and pores) present on body somites and ornamentation elements (setules and spinules) on each appendage. The text uses the following abbreviations for clarity: ae, aesthetasc; ENP, endopod; EXP, exopod; EXP (ENP)-1(-2,-3), proximal (middle, distal) segments of the ramus; P1−P6, first through sixth thoracic legs.

The type of *Syngastes acutus* sp. nov. has been deposited in the Honam National Institute of Biological Resources (HNIBR) in Mokpo, Korea. Type specimens for the other three *Tegastes* species (*Tegastes lobus* sp. nov., *Tegastes tresetosus* sp. nov., and *Tegastes pilosus* sp. nov.) were archived at the Marine Biodiversity Institute of Korea (MABIK) in Seochun, Korea and the Marine Interstitial fauna Resources Bank (MInRB) of KIOST, Busan, Korea.

SYSTEMATIC ACCOUNTS

Order Harpacticoida Sars, 1903
Family Tegastidae Sars, 1904
Genus *Tegastes* Norman, 1903

[1]*_Tegastes lobus_ sp. nov. (Figs. 1−3, 15A)

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Material examined. Holotype, ♀ (MABIK CR00254203) preserved in a vial filled with 95% ethanol, Korea: Jeju-si, Chuja-myeon, Yeongheung-ri, Chuja-do Island, 33°57′38.0″N, 126°17′49.0″E, light trap, 10 Sep 2017, *leg*. JG Kim (HNIBR). Paratypes: 1♀ (MABIK CR00254208) dissected on 12 slides, 1♂ (MABIK CR00254209) dissected on three slides, and 1♂ (MABIK CR00254204) and 4♀♀ (MInRB-Hr93-L001) preserved together in a vial filled with 95% ethanol, respectively; all paratypes same data as in holotype.

Description. Female (holotype MABIK CR00254203, para-

Korean name: [1]*배돌기곱등노벨레 (신칭)

type MABIK CR00254208). Body (Figs. 1A, 15A) laterally compressed, amphipod-like; integument chitinized, covered with numerous sensilla and pores; dorsal outline not gibbous, with a weak depression indicating separation between prosome and urosome. Total length 463 μm measured along dorsal outline and maximum width 204 μm measured at level of postero-ventral corner of ventral extensions. Rostrum weakly prominent, completely fused basally to cephalothorax.

Prosome (Fig. 1A) comprising cephalothorax and 3 free pedigerous prosomites; P1-bearing somite completely incorporated into cephalosome and original division unmarked. Cephalothorax with massive ventral extensions on cephalosomal shield, occupying 44% of body length; postero-ventral corner of ventral extensions weakly pointed and ventral margin somewhat truncated. Length of dorsal outline from P2- to P4-bearing somites (telescoping of somites not considered) 26.2, 45.2, and 64.2 μm, respectively.

Urosome (Figs. 1A, 2E, F) 5-segmented, comprising P5-bearing somite, genital double-somite, and 3 free abdominal somites (visible in lateral view). P5-bearing somite discrete. Genital double-somite about 3 times as long as preceding one (23.8 × 36.9 μm), without ventral extension; ventral surface with a distinct dent anteriorly (Fig. 2F); genital field (Fig. 2F, G) located far anteriorly; vestigial P6 represented by a pair of setules (Fig. 2G); copulatory pore unrecognized. Penultimate somite with ventral protrusion; pseudoperculum prominent, with a deep notch on distal margin (Fig. 2E). Anal somite with a deep cleft dorsally, 1 pair of dorsal sensillar, and 1 pair of lateral pores; anal opening triradiate, furnished with denticulate and diagonal hyaline frills.

Caudal rami (Figs. 1A, 2E) short, slightly longer than wide (11.3 × 9.6 μm in dorsal view), with 1 latero-ventral pore and 7 setae; latero-ventral seta I as long as caudal ramus; latero-dorsal seta II about 3 times as long as seta I; dorsal seta III inserted at distal third of outer margin, as long as seta II; terminal seta IV short, as long as setae I and VI; terminal seta V longest, composed of stout proximal part and slender distal part (damaged); seta VI slender, arising from distal inner corner; dorsal seta VII tri-articulated basally, arising from proximal fifth of ramus length, slightly shorter than setae II and III.

Antennule (Fig. 3A) 8-segmented, 145 μm long, with 1 pore on second segment proximally; fourth and last segment each with aesthetasc fused basally to adjacent seta; length ratio of each segment from first to eighth, 1 : 1.11 : 0.71 : 0.49 : 0.25 : 0.4 : 0.31 : 0.46. Armature formula as follows: 1-[1], 2-[9], 3-[7], 4-[2 + (1 + ae)], 5-[1], 6-[4], 7-[4], 8-[6 + (1 + ae)].

Antenna (Fig. 1B) comprising coxa (missing), basis, exopod, and endopod. Basis elongate, 3 times as long as wide. Exopod small, 10 μm long, 2-segmented, with 1 subdistal seta on first segment, and 1 uni-pinnate and 2 bare distal setae on second segment; first segment about 3 times as long as second one. Endopod 2-segmented: first segment elongate, about 3.7 times as long as wide, without any setae; second segment slightly longer than preceding one, 5.6 times as long as wide, with 1 lateral seta proximally and a set of 3 lateral setae (1 long and 2 short) subdistally; distal armature composed of 2 claw-like spines and 6 slender setae, of which 2 outer setae fused basally; surface frill present subdistally.

Mandible (Fig. 1C). Coxa with well-developed gnathobase bearing 1 dorsal bulge; cutting edge armed with 4 uni- or multi-cuspidate dorsal teeth and 2 long multi-cuspidate ventral teeth, and 1 uni-pinnate dorsal seta. Palp 2-segmented, comprising basis and 1-segmented endopod; basis elongate, about 3.7 times as long as wide, with 2 long plumose setae distally; endopod small, 0.27 times as long as basis, with 1 long and 2 short setae distally; exopod completely incorporated into basis, represented by 1 bare seta.

Maxillule (Fig. 1D). Praecoxal arthrite well-developed; distal margin with 2 ventral setae, 1 stout ventral spine bearing a few spinules, and 6 slender ventral spines. Coxa small, with 2 ventral setae representing epipodite; endite cylindrical, reaching distal end of praecoxal arthrite, with 1 stout plumose seta distally. Basis elongate, twice as long as coxal endite, with 3 plumose setae distally and 1 plumose ventral seta subdistally. Endopod incorporated into basis, represented by 1 plumose seta. Exopod absent.

Maxilla (Fig. 1E). Syncoxa elongate, subrectangular (27.8 × 11.7 μm); distal outer corner distinctly produced; inner margin with 3 endites and 1 plumose seta arising from base of praecoxal endite; praecoxal endite subsquare, with 2 plumose setae distally, of which distal one very long exceeding distal end of syncoxa; proximal coxal endite cylindrical, with 1 plumose seta distally; distal coxal endite large, gradually widening towards distal end, with 1 plumose seta subdistally and 2 uni-spinulose setae distally. Allobasis elongate, exceeding distal end of distal coxal endite, with 1 stout, spinulose seta distally, 1 uni-spinluose seta dorsally, and 1 bare seta ventrally. Endopod probably represented by 1 plumose and 2 bare setae. Exopod absent.

Maxilliped (Fig. 3B) subchelate, arising from small pedestal. Syncoxa elongate, 2.7 times as long as greatest width, tapering towards distal end, without any setae. Basis longer than syncoxa, 3.6 times as long as wide (48.0 × 13.3 μm); palmar margin slightly swollen in proximal two-third part, with 4 stout median spinules gradually decreasing in size from proximal to distal, and 1 row of medial spinules gradually decreasing in size from proximal to distal, 1 row of small medial spinules, 1 row of small lateral spinules, and 1 row of minute lateral denticles (not figured in Fig. 3B); with 1 small bare seta (designated by arrowhead in Fig. 3B) in the middle and 1 mushroom-like process in distal third; mushroom-like process barely discernible, not produced, distally covered with min-

ute spinules. Endopod 1-segmented, represented by claw-like process accompanying 1 very short and 1 short accessory seta on either side; distal tip probably reaching proximal fourth of palmar margin.

P1 (Fig. 2A) 112 μm long. Coxa small, slightly longer than wide, unornamented. Basis elongate, 2.4 times as long as coxa (45.8 × 19.2 μm), with 1 anterior pore subdistally and 1 plumose inner seta; outer seta unrecognized. Exopod distinctly smaller than endopod, about 5.4 times as long as wide, with 1 plumose and 2 bare outer setae, and 1 long spiniform and 1 small bare distal seta; proximal part slightly swollen. Endopod slightly shorter than basis, 4.3 times as long as wide, with 1 bare outer seta, 1 uni-pinnate spiniform distal seta, and 4 plumose inner setae, of which distal one shorter than others.

P2–P4 (Figs. 1F, 2B, C) 165–195 μm long; P2 (Fig. 2B) shortest and P3 (Fig. 2C) longest. Intercoxal sclerites wide, 7.7–10.1 times as long as wide, slightly arched. Coxae asymmetric trapezoidal; outer margin of P4 (Fig. 1F) distinctly produced than others; anterior surfaces cracked in the middle, with 1 anterior pore in P2. Bases transversally elongate, 3.7, 4.3, and 3.7 times as wide as long from P2 to P4, respectively; outer seta arising from posterior surface subdistally in P2–P3, and at two-thirds of basis length in P4. Exopods 3-segmented; EXP-2 shortest in P2–P3, but EXP-1 shortest in P4; length ratio of segments from proximal to distal 1 : 0.56: 1.3 in P2, 1 : 0.55 : 1.28 in P3, and 1 : 1.19 : 1.76 in P4; outer spines weakly pinnate in P2–P3, and seta-like and bare in P4; P2–P3 EXP-1 with 1 plumose inner seta shorter than segment length, but P4 EXP-1 lacking inner seta; outer distal seta on EXP-3 ornamented with outer spinules and inner setules, but inner one plumose; middle inner element of P4 EXP-3 well-developed, spiniform, pinnate in distal half, and serrate subdistally. Endopods longer than exopods, 3-segmented; length ratio of segments from proximal to distal 1 : 0.71 : 1.1 in P2, 1 : 0.68 : 1.29 in P3, and 1 : 0.81 : 1.5 in P4; P4 ENP-1 with 1 very reduced inner seta (designated by arrowhead in Fig. 1F); outer spine on ENP-3 weakly pinnate, and distal spines stout and pinnate.

Armature formula of P2–P4 as follows:

	Exopod	Endopod
P2	1.1.222	1.2.221
P3	1.1.322	1.2.321
P4	0.1.322	1.2.221

P5 (Fig. 2D). Baseoendopod with elongate endopodal lobe, 103 μm long, about 6.1 times as long as wide; uni-plumose seta inserted at proximal fourth of outer margin; endopodal lobe with 1 bare (subdistal) and 3 uni-plumose (proximal) inner setae, and 1 bare distal seta (shortest). Exopod slender, reaching half-length of endopodal lobe, with 1 plumose (proximal) and 1 bare (subdistal) outer seta, 1 long plumose distal seta, and 1 plumose (subdistal) inner seta.

Male (paratypes MABIK CR00254204, MABIK CR00 254209). Total body length smaller than females, 407 μm (Fig. 3C); sexual dimorphism expressed in urosome, caudal rami, antennule, P5, and P6.

Urosome (Fig. 3D). Genital somite and third urosomite (first abdominal somite) completely fused, forming genital double-somite as in females, but with massive and globular ventral extension bearing a rod-shaped posterior process; genital flaps, representing P6, asymmetrical, left one articulated, but light one fused to supporting somite; spermatophore reservoir enclosed by 2 valves.

Caudal rami (Fig. 3D). Seta V slender, as long as urosome.

Antennule (Fig. 3E) modified for grasping, 9-segmented; fourth segment wedge-shaped and fifth segment swollen; aesthetasc fused to adjacent seta present on third, fifth, and last segments, respectively; 6 outer setae on last segment bi-articulated. Setal armature formulae as follows: 1-[1], 2-[9], 3-[5 + (1 + ae)], 4-[2], 5-[5 + (1 + ae)], 6-[1], 7-[2], 8-[2], 9-[10 + (1 + ae)].

P5 (Fig. 3D) 2-segmented, elongate, 45.7 μm; first segment with 1 plumose outer seta; second segment slightly longer than preceding one, with 1 plumose inner, 1 plumose distal, and 2 outer (1 plumose and 1 bare) setae.

Etymology. The specific name of the new species comes from the Ancient Greek λοβός (lobós), meaning lobe, and alludes to the presence of a distinct ventral projection on the penultimate somite in females. It is nominative singular. Gender: masculine.

Remarks. *Tegastes* stands out as the most speciose and morphologically varied genus within the Tegastidae (Wells, 2007). Historically, any tegastid copepods possessing the primitive 3-segmented rami of the P2–P4 have been classified under this genus through rudimentary generic categorization until 2000s. As a consequence, the monophyly of *Tegastes* remains uncertain (Ivanenko and Defaye, 2004; Kim and Lee, 2020), since many older species descriptions fall short of contemporary harpacticoid taxonomic standards and only 15 species are documented based on both sexes (Wells, 2007; Back et al., 2010; Huys, 2016). In spite of limited morphological information, our literature-based comparison of *Tegastes* species brought the questionable status of *Tegastes riedli* Pesta, 1959, and *Tegastes satyrus* (Claus, 1860) (type species) to light.

Huys (2016) proposed the monotypic genus *Aglaogastes* for *Tegastes cnidicus* Humes, 1981, a species associated with a hydroid host. Its differentiation was premised on several distinguishing features from other *Tegastes* species: a distinct P5-bearing somite, no formation of a genital triple-somite complex in either sex, a genital double-somite with a conspicuous ventral expansion in only males, a slender female P5,

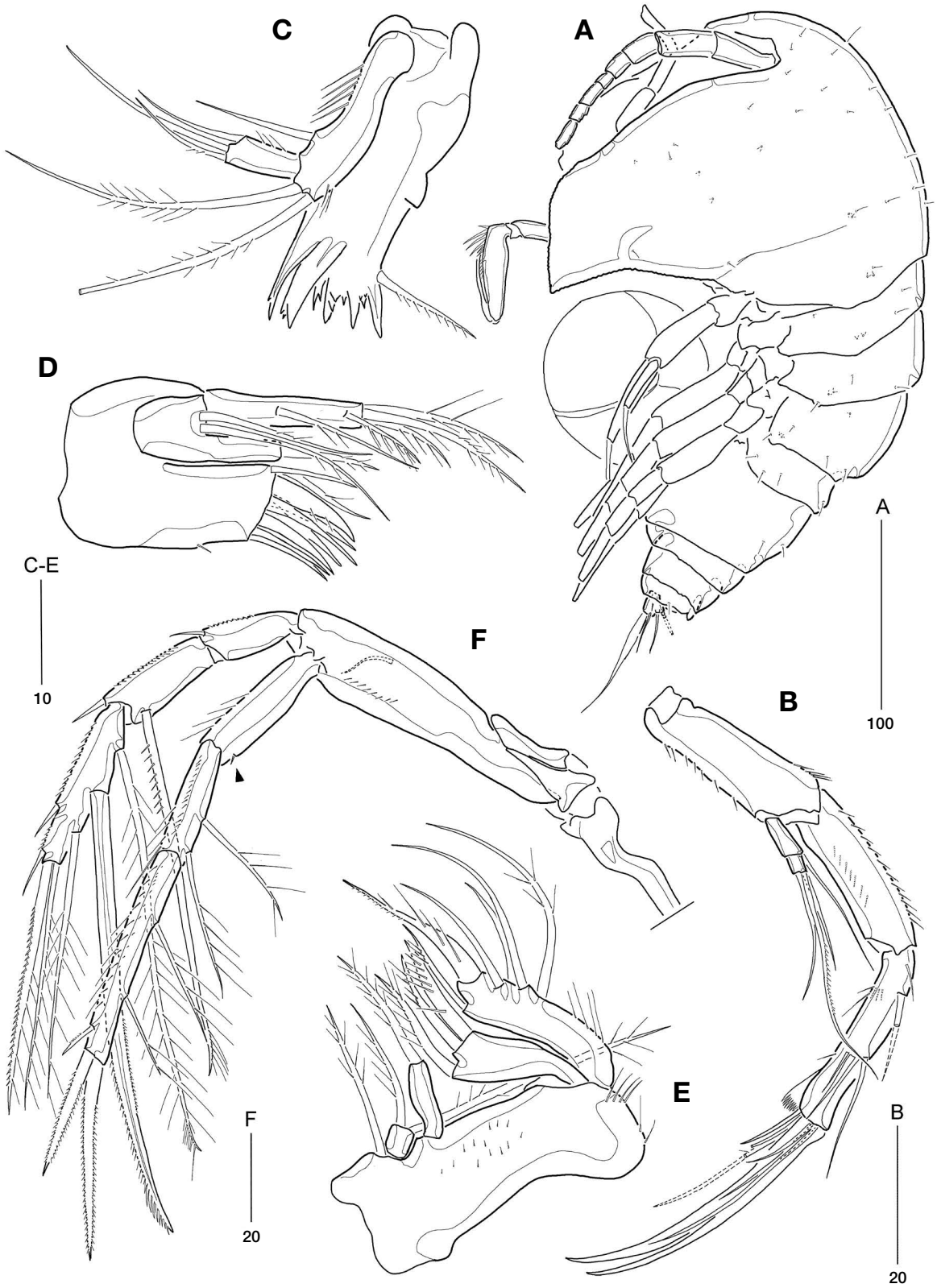

Fig. 1. *Tegastes lobus* sp. nov., female. A, Habitus, lateral; B, Antenna; C, Mandible; D, Maxillule; E, Maxilla; F, P4, anterior.

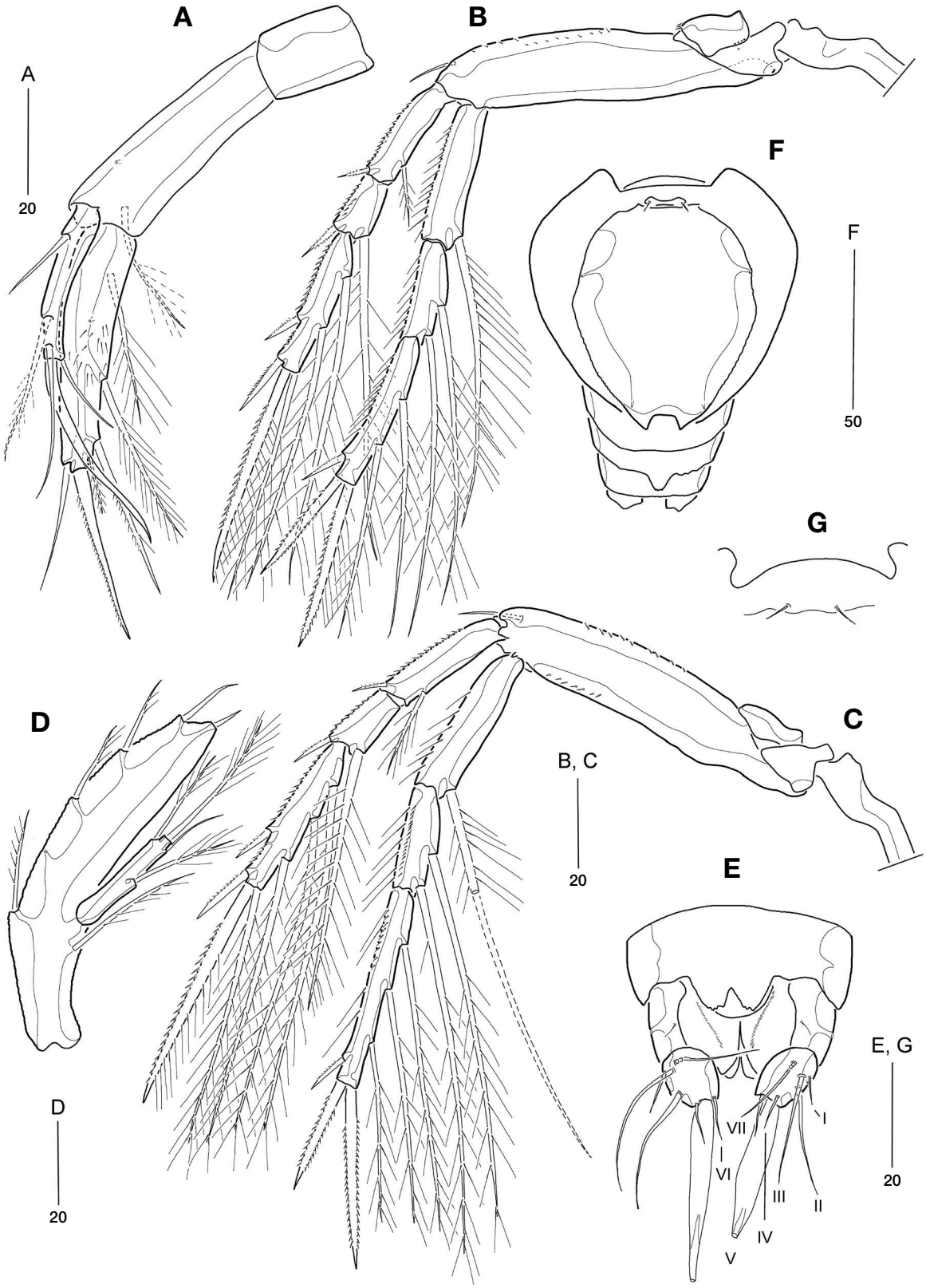

Fig. 2. *Tegastes lobus* sp. nov., female. A, P1, anterior; B, P2, anterior; C, P3, anterior; D, P5; E, Penultimate and anal somites, and caudal rami, setae on caudal rami are numbered using Roman numerals; F, Urosome, ventral; G, P6.

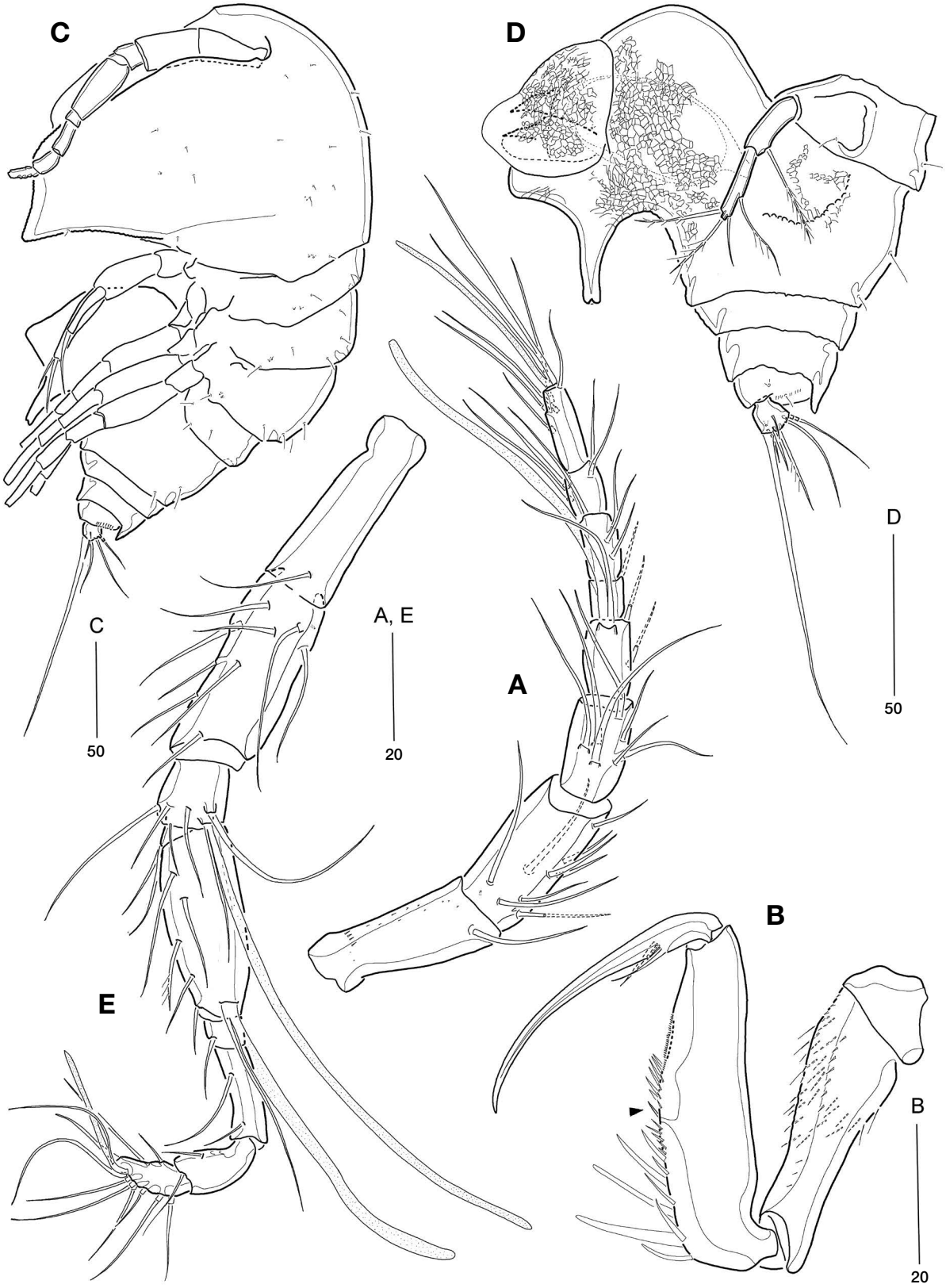

Fig. 3. *Tegastes lobus* sp. nov. A, B, Female: A, Antennule; B, Maxilliped, medial. C–E, Male: C, Habitus, lateral; D, Urosome, lateral; E, Antennule.

and an exclusive torsion process (45° clockwise rotation) in the male genital field. Within *Tegastes*, the first two features are found in *T. riedli*, *T. satyrus*, and the newly described *T. lobus* sp. nov. In contrast, other *Tegastes* species predominantly have genital triple-somites in both sexes and either a triangular or expanded P5 baseoendopod. These marked differences suggest a need to reaffirm the taxonomic identity of these species. However, the scarcity of detailed morphological data aligned with contemporary taxonomic requirements complicates conclusive comparisons. Notably, the mouthparts of *A. cnidicus* (Humes, 1981) appear tailored for symbiotic relationships through segment oligomerization and setae reduction in the mouthparts, resulting in enhanced maxillipedal grasping capabilities. In addition, its P4 EXP-3 possesses three moderate inner setae, a deviation from most tegastid copepods. Without a thorough comparison encompassing these traits, a definitive taxonomic decision for both species remains premature. Given the pending comprehensive review of *T. riedli* and *T. satyrus*, we have opted to retain these species under genus *Tegastes* rather than labeling them as species *incertae sedis* within Tegastidae or introducing a new genus, particularly because *T. satyrus* is the type species of *Tegastes*.

Claus (1860) described *T. satyrus* from Nice, France, in the Mediterranean Sea, providing a concise description accompanied by illustrations of the male lateral habitus and mouth appendages. Later, Claus (1863) introduced another species, *Tegastes harpactoides* (Claus, 1863), from Messina, Italy, also in the Mediterranean. This account featured a brief description and illustrations of the female lateral habitus and maxilliped. However, this species is considered as a junior subject synonym of the former species (Lang, 1948). Sars (1910) later provided the most detailed description of *T. satyrus* (then referred to as *T. harpactoides*), based on specimens of both sexes collected from the south and west coasts of Norway, specifically Skudeneshavn.

Within genus *Tegastes*, the newly identified *T. lobus* sp. nov. bears close resemblance to specimens described by Sars. However, notable distinctions include the following:

1. In *T. lobus* sp. nov., the robust ventral extension of the cephalosomal shield in females has a rounded postero-ventral corner, as opposed to the pointed corner observed in both sexes of *T. satyrus*.
2. The antennary exopod of *T. lobus* sp. nov. is 2-segmented, whereas *T. satyrus* has a 1-segmented antennary exopod.
3. The maxillary syncoxa of *T. lobus* sp. nov. has three endites and an additional proximal seta, a unique characteristic among known harpacticoids. In contrast, *T. satyrus* lacks the proximal endite.
4. The palmar margin of the maxillipedal endopod of *T. lobus* sp. nov. features several rows of spinules, whereas its counterpart in *T. satyrus* lacks such ornamentation.
5. The P3 ENP-3 and P4 ENP-3 in *T. lobus* sp. nov. have six and five elements, respectively, in contrast to the five and four elements, respectively, found in *T. satyrus*.
6. *T. lobus* sp. nov. exhibits a minute inner seta on the P4 ENP-1, which is absent in *T. satyrus*.
7. The inner seta of the second segment of male P5 in *T. lobus* sp. nov. is located distally, whereas it is located in the proximal two-fifths of the segment in *T. satyrus*.

Although the morphological information of *T. riedli* is very limited, in particular the setation of thoracic legs which is imperfectly known (Wells, 2007), it is possible to distinguish the new species from *T. riedli* based on the illustration of female's lateral habitus in the original description of Pesta (1959). The maxilliped of *T. riedli* has a swollen proximal palmar margin, but it is almost linear in our new species. Moreover, the most distal seta among five setae on the female P5 exopod is distinctly longer than others, whereas it is shorter than other setae in *T. lobus* sp. nov.

[1]*_Tegastes tresetosus_ sp. nov. (Figs. 4–7, 15B)

lsid:zoobank.org:act:E71790CF-B039-4BA0-9815-8D6437B2D5B3

Material examined. Holotype, ♀ (MABIK CR00254205) preserved in a vial filled with 95% ethanol, Korea: Jeju-si, Chuja-myeon, Sinyang-ri, Chuja-do Island, 33°56′24.5″N, 126°19′23.0″E, light trap, 12 Sep 2017, *leg*. JG Kim (HNIBR). Paratypes: 1♀ (MABIK CR00254210) dissected on 12 slides, 1♂ (MABIK CR00254211) dissected on three slides, and 1♂ (MABIK CR00254206) and 2♀♀, 2♂♂ (MInRB-Hr94-L001) preserved in a vial filled with 95% ethanol, respectively; all paratypes same data as in holotype.

Description. Female (holotype MABIK CR00254205, paratype MABIK CR00254210). Total body length about 636 μm (Figs. 4A, 15B); maximum width measured at level of cephalic ventral extensions 298 μm; body length/width ratio about 1.5 in lateral view. Color of specimens preserved in ethanol dark brown. Body amphipod-like, laterally compressed; integument of all somites strongly sclerotized with sensilla and pore, and covered with epicuticular droplets; dorsal outline not gibbous, with a notch between prosome and urosome. Rostrum prominent, completely fused basally to cephalothorax.

Prosome (Fig. 4A) comprising cephalothorax and 3 free pedigerous prosomites; P1-bearing somite completely incorporated into cephalothorax and original division marked by internal rib. Cephalothorax with massive ventral extensions

Korean name: [1]*세강모곱등노벌레 (신칭)

on cephalosomal shield, occupying 42% of body length; ventral extensions rounded anteriorly and pointed posteriorly. Length of dorsal outline from P2- to P4-bearing somites (telescoping of somites not considered) 35.7, 60.7, and 103.6 μm, respectively.

Urosome (Fig. 4A–C) 5-segmented, comprising genital triple-somite, and 3 free abdominal somites (fourth urosomite invisible in lateral view). P5-bearing, genital double-somites, and third urosomite fused, forming massive genital triple-somite (122.9 × 233.3 μm in lateral view). Genital triple-somite, with broad and rectangular ventral extension bearing a unguiform posterior projection; genital field (Fig. 4C) located at anterior third, composed of U-shaped genital slit and small median copulatory pores; without any setae or setules representing P6 (Fig. 4C). Penultimate somite with prominent pseudoperculum.

Caudal ramus (Fig. 4D) 1.2 times as long as wide (14.8 × 12.1 μm) in lateral view; dorsal margin slightly produced in middle; with 7 setae; seta I shorter than ramus, inserted at half-length of lateral surface; seta II uni-pinnate, about twice as long as ramus (30.4 μm), inserted at distal fifth of lateral margin; seta III 3.4 times as long as ramus (50.1 μm), inserted at distal fourth of latero-dorsal surface; terminal seta IV as long as seta III; terminal seta V plumose, longest (70.8 μm); seta VI as long as ramus, inserted at distal inner corner; seta VII arising from dorsal peduncle, tri-articulated basally, slightly shorter than seta III.

Antennule (Fig. 4E) 7-segmented, elongate, with 1 pore on second segment, and aesthetasc on fourth and distal segments, respectively; each aesthetasc fused basally to neighboring seta. Length of segments measured along inner margin 50, 43, 41, 32, 25, 13, and 15 μm, respectively. Setal armature formulae as follows: 1-[1], 2-[9], 3-[10], 4-[3 + (1 + ae)], 5-[6], 6-[4]. 7-[6 + (1 + ae)]. All setae bare; sixth and distal segments with 2 and 4 bi-articulated outer setae.

Antenna (Fig. 5A). Coxa small, unornamented. Basis elongate, about 3.3 times as long as wide (47.8 × 14.3 μm). Exopod very small, 1-segmented, with 2 setae, of which outer one about 1.7 times longer than inner one. Endopod 2-segmented; proximal segment shorter than basis, with pinnate seta at distal third of abexopodal margin; distal segment slightly shorter than basis, with 2 bare lateral setae and 7 distal elements (2 pinnate, claw-like, 1 long pinnate, 1 small pinnate, and 3 bare setae), of which outer bare seta fused basally to neighboring seta; outer margin with surface frill subdistally.

Mandible (Fig. 5B). Cutting edge of coxa with 1 uni-cuspidate and 3 multi-cuspidate teeth, and 1 weakly pinnate dorsal seta. Palp 2-segmented, comprising basis and 1-segmented endopod; basis about 3.5 times as long as wide, with 2 plumose setae distally; endopod small, about 3 times as long as wide, with 3 plumose setae distally; exopod represented by 1 plumose seta.

Maxillule (Fig. 5C). Praecoxal arthrite well-developed, subdistally with 2 ventral setae, of which ventral one over twice as long as dorsal, and distally with 2 strong spines, of which dorsal one with lateral protrusion, and 2 bare and 2 pinnate setae. Coxa small, with 1 long plumose seta representing epipodite; endite short, reaching proximal third of praecoxal arthrite, with 1 plumose seta distally. Basis elongate, 3.4 times as long as coxal endite, with 1 bare and 3 pinnate setae distally and subdistally. Endopod represented by 1 plumose seta. Exopod absent.

Maxilla (Fig. 5D). Syncoxa large, tapering towards distal end, with 2 endites (proximal coxal endite absent): praecoxal endite small, with 1 long plumose distal seta, as long as syncoxa, and 2 plumose lateral setae; distal coxal endite large, broad, with 3 pinnate (1 slender and 2 stout) setae distally and subdistally. Allobasis elongate, with 1 uni-pinnate, claw-like spine distally, 1 bare seta dorsally, and 1 plumose seta ventrally. Endopod probably represented by 1 bare and 2 plumose setae. Exopod absent.

Maxilliped (Fig. 5E, E′) inserted on small pedestal, subchelate. Syncoxa elongate, tapering towards distal end, forming groove for outer margin of basis, with 1 plumose seta distally. Basis longer than syncoxa, about 3.2 times as long as greatest width (73.0 × 23.0 μm), with convex outer margin; palmar margin somewhat waved in distal half, with 1 median row of long spinules in proximal half, and 1 lateral row of spinules and 1 medial row of small spinules in distal half; with 1 small pinnate seta in the middle and 1 mushroom-like process ornamented with numerous dorsal papillae at distal sixth of palmar margin. Endopod modified into as a naked claw reaching proximal third of palmar margin, accompanying 2 medial and 2 lateral setae proximally.

P1 (Fig. 6A) 170 μm long. Coxa small, about 1.4 times as long as wide, with outer protrusion. Basis elongate, about 2.3 times longer than coxa; outer margin straight, with 1 bare seta subdistally; inner margin somewhat expanded subdistally, with 1 plumose seta at level of greatest width; posterior surface with 1 pore subdistally. Both rami 1-segmented. Exopod slender, about 6.4 times as long as greatest width, with 3 uni-pinnate outer setae and 2 pinnate distal setae (1 long and 1 small). Endopod broad, as long as exopod, with 2 pinnate outer setae, 1 pinnate distal seta, and 1 spinulose (middle) and 2 plumose inner setae; outer margin with 2 pores in proximal half.

P2–P4 (Figs. 5F, 6B, C, C′). Intercoxal sclerites wide, somewhat arched (P4's figure omitted). Coxae asymmetric trapezoid, with oblique distal margin; outer margins produced distally in P2 (Fig. 6B) and P3 (Fig. 5F), and concave in P4 (Fig. 6C, C′); anterior surface divided into two parts, with 1 pore in proximal part in P2–P3 (absent in P4). Bases transversally

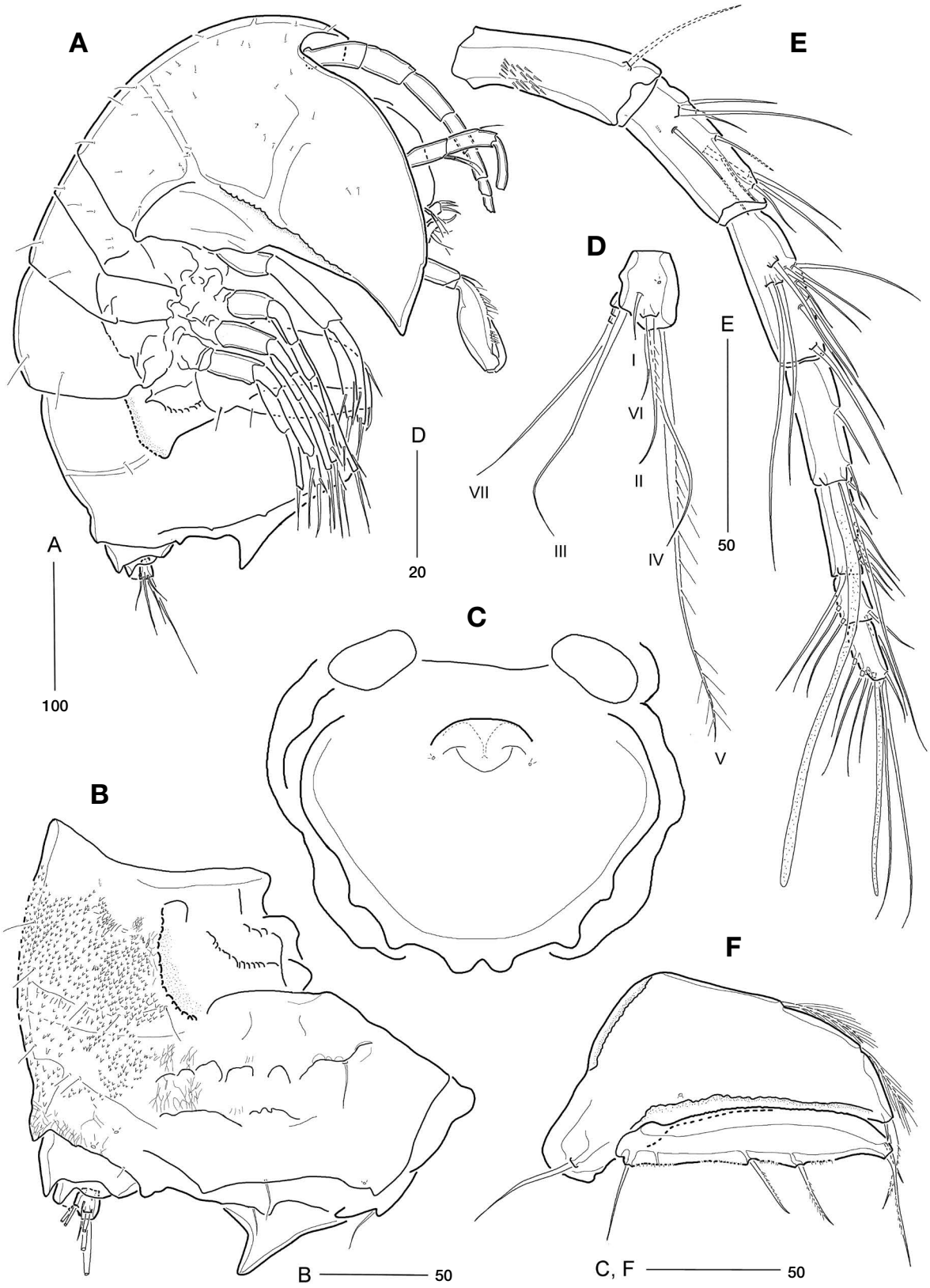

Fig. 4. *Tegastes tresetosus* sp. nov., female. A, Habitus, lateral; B, Urosome, lateral; C, Urosome, anterior; D, Caudal rami, outer, setae on caudal rami are numbered using Roman numerals; E, Antennule; F, P5.

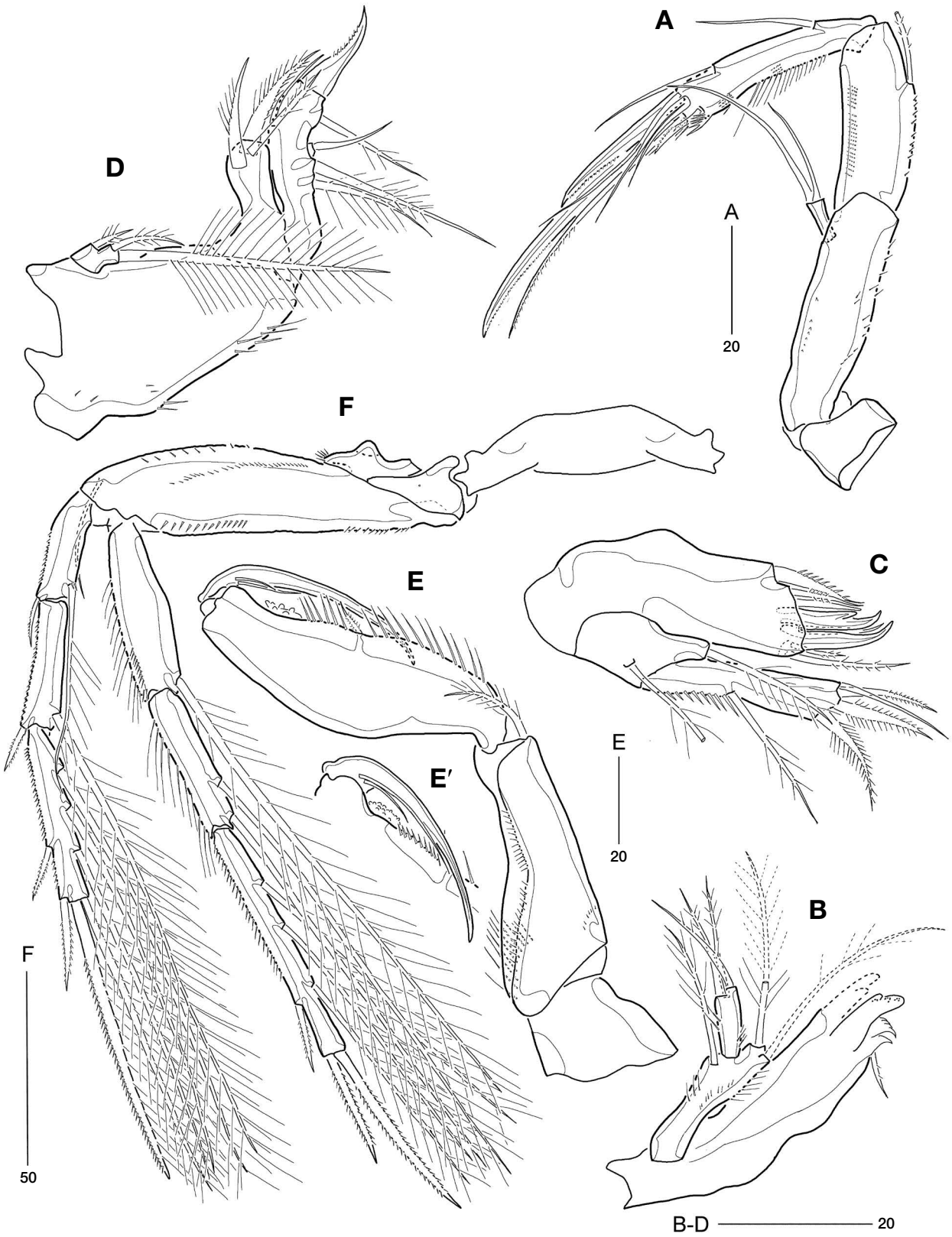

Fig. 5. *Tegastes tresetosus* sp. nov., female. A, Antenna; B, Mandible; C, Maxillule; D, Maxilla; E, Maxilliped, lateral; E′, Distal part of maxilliped, medial; F, P3, anterior.

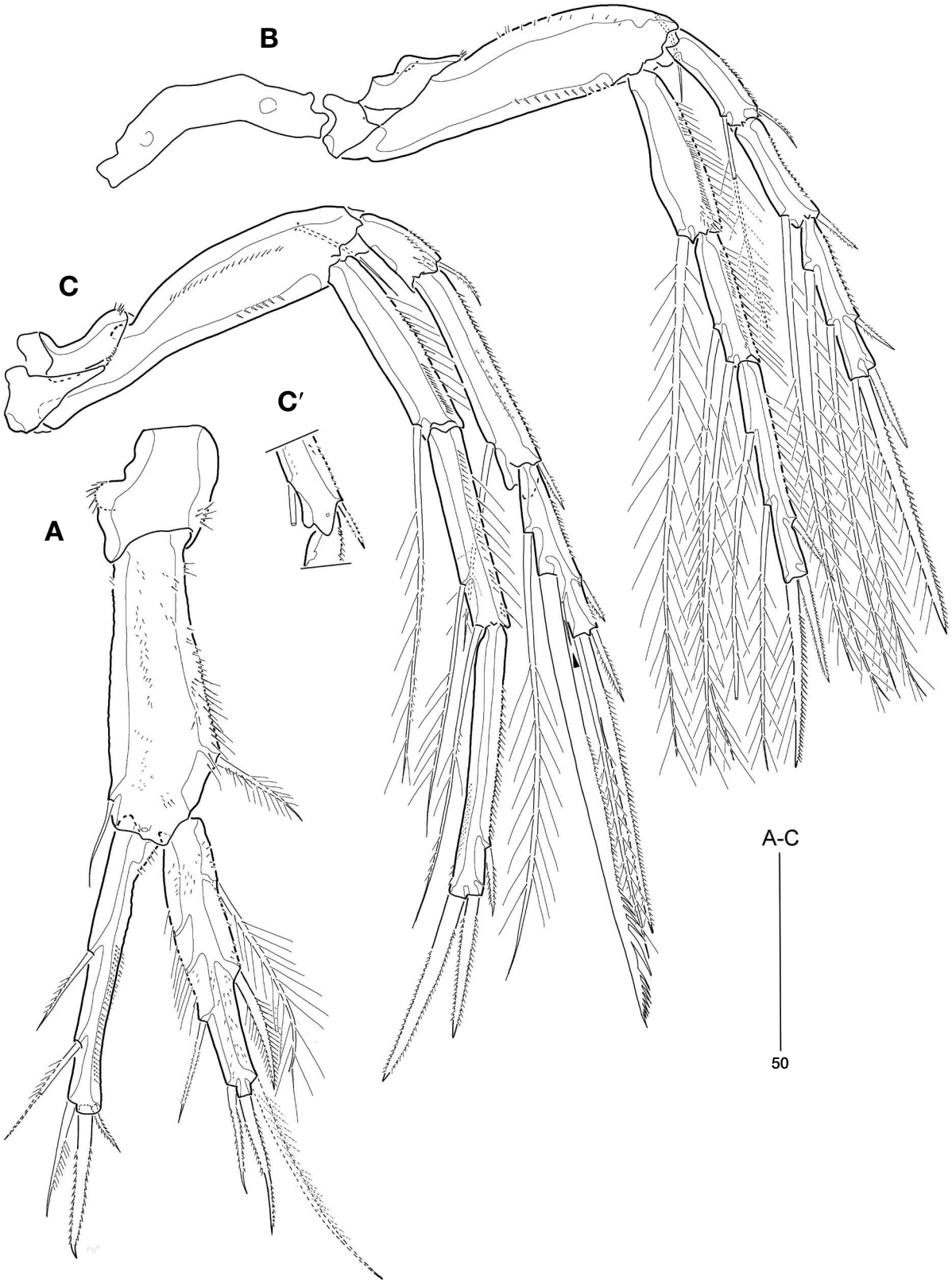

Fig. 6. *Tegastes tresetosus* sp. nov., female. A, P1, posterior; B, P2, anterior; C, P4, anterior; C′, Joint between EXP-2 and EXP-3 in P4.

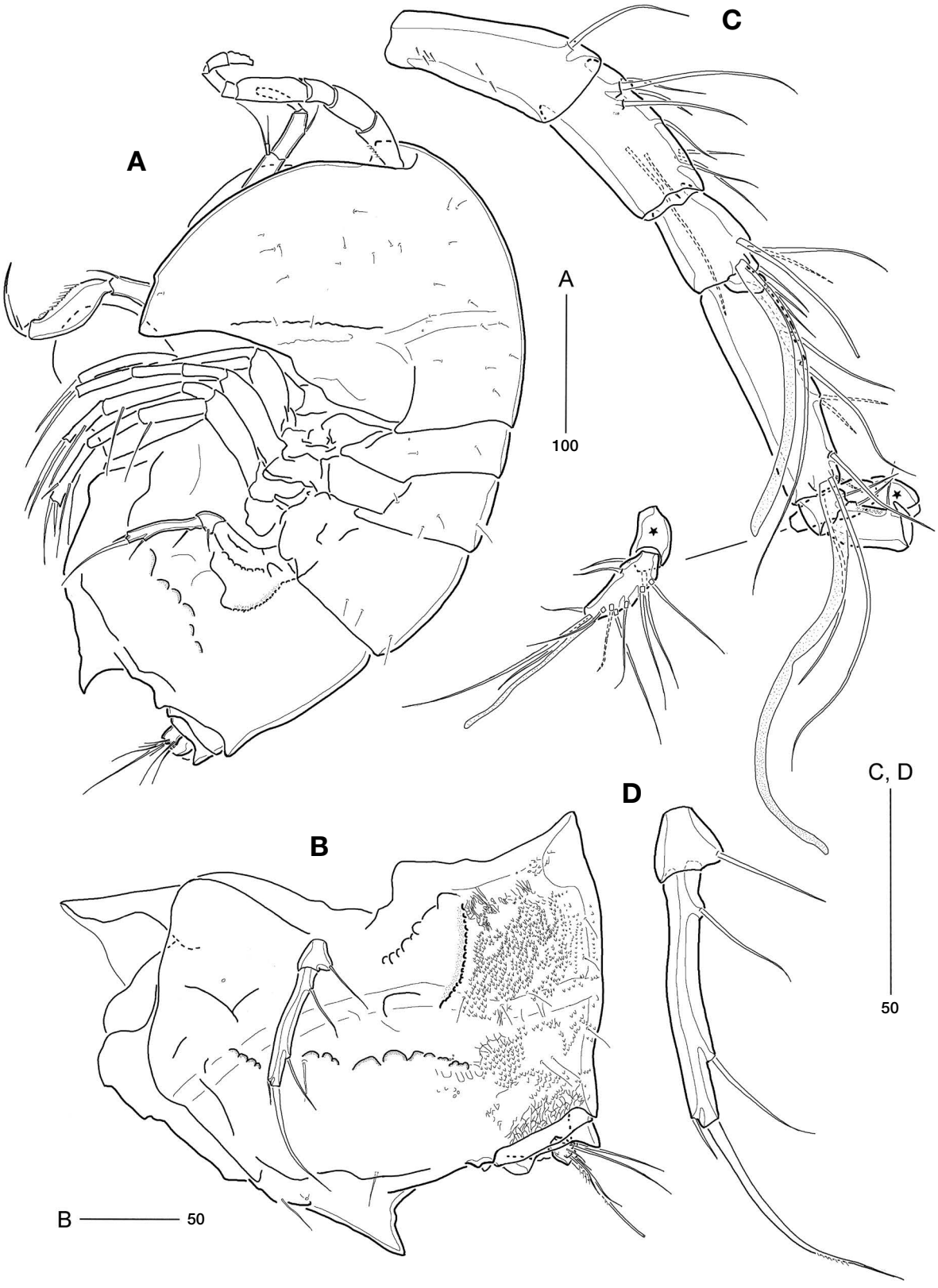

Fig. 7. *Tegastes tresetosus* sp. nov., male. A, Habitus, lateral; B, Urosome; C, Antennule; D, P5.

elongate, 3.5, 3.7, and 3.8 times as wide as long from P2 to P4, respectively; with 1 bare outer seta posteriorly. Both rami 3-segmented. Exopods, length ratio of each segment from proximal to distal 1 : 1.1 : 1.6 in P2, 1 : 1.1 : 1.5 in P3, and 1 : 2.6 : 1.5 in P4; P4 EXP-1 lacking inner seta; outer elements on exopods seta-like in EXP-1 and spine-like in EXP-2 and EXP-3; P4 EXP-2 with posterior pore and EXP-3 with outer pore subdistally (Fig. 6C′); middle inner seta of P4 EXP-3 modified as stout, distally uni-serrate spine, and distal seta very small, bare. Endopods distinctly longer than exopods; length ratio of each segment from proximal to distal 1 : 0.9 : 1.5 in P2, 1 : 0.8 : 1.3 in P3, and 1 : 1 : 1.4 in P4; P4 ENP-3 lacking inner elements.

Armature formula of P2–P4 as follows:

	Exopod	Endopod
P2	1.1.222	1.2.221
P3	1.1.322	1.2.321
P4	0.1.322	1.2.021

P5 (Fig. 4F) broad, forming brood pouch (113.8 × 87.9 μm). Baseoendopod broad, with 1 bare outer seta; endopodal lobe well-developed, foliaceous, tapering distally, without distinct rides; distal half of endopodal lobe with 2 plumose inner setae and distal tip slightly recurved posteriorly, with 1 long pinnate and 1 short bare seta; surface with 1 pore. Exopod elongate, slightly exceeding distal end of endopodal lobe, with 1 bare and 2 weakly pinnate outer setae, 1 weakly pinnate distal seta, and 1 bare inner seta; distal tip also slightly recurved posteriorly.

Male (paratypes MABIK CR00254206, MABIK CR 00254211). Total body length as long as females or slightly shorter than females, 627 μm (Fig. 7A); sexual dimorphism expressed in urosome, antennule, P5, and P6.

Urosome (Fig. 7B) with genital triple-somite (159.1 × 236.4 μm in lateral view) as in females; ventral margin of genital triple-somite wide, produced in the middle, with anterior genital flap and posterior attenuation.

Antennule (Fig. 7C) modified for grasping, 9-segmented; fourth segment wedge-shaped and fifth segment not swollen, longest; third, fifth, and last segments each with aesthetasc fused to adjacent seta; six outer setae on last segment biarticulated. Setal armature formulae as follows: 1-[1], 2-[10], 3-[4 + (1 + ae)], 4-[2], 5-[7 + (1 + ae)], 6-[1], 7-[2], 8-[1], 9-[10 + (1 + ae)].

P5 (Fig. 7B, D) 2-segmented, elongate, 87.5 μm long; first segment small, outer margin produced, bearing 1 bare seta; second segment 4 times as long as preceding one, with 1 bare inner (shortest), 1 weakly pinnate distal (longest), and 2 bare outer setae.

Etymology. The specific name *tresetosus* is a combination of Latin words *trēs* (three) and *sētōsus* (bristly), refers to the unique setal armature of P4 ENP-3 with three elements in the genus. Gender: masculine.

Remarks. In providing the tubular keys for harpacticoid copepods, Wells (2007) emphasized the need for caution when applying his key to family Tegastidae and advised cross-referencing with original descriptions and distribution data. Based on his tubular key, *Tegastes tresetosus* sp. nov. is tentatively placed in the group that includes *Tegastes calcaratus* Sars, 1910, *T. clausi* Sars, 1910, *T. minutus*, and *T. perforatus* Lang, 1965. This categorization hinges on the 1-segmented antennary exopod and the setal armature formula of the thoracic legs (6 : 7 : 7 for P2–P4 EXP-3, 1 : 1 : 0 for P2–P4 EXP-1, and 1 : 1 : 1 for P2–P4 ENP-1). Notably, Lang (1965) described the antennary exopod of *T. perforatus* as ambiguously 2-segmented. However, the new species *T. tresetosus* sp. nov. is distinguished from these four species as follows:

1. Its maxillipedal basis palmar margin is nearly linear. In contrast, *T. calcaratus*, *T. clausi*, and *T. minutus* feature palmar margins that are either slightly convex or proximally conical.
2. The tips of the exopod and endopodal lobe in the female P5 of the new species are subtly recurved posteriorly. This recurvature is absent in *T. calcaratus*, *T. clausi*, and *T. minutus* (with the condition in *T. perforatus* remaining unknown).
3. *Tegastes tresetosus* sp. nov. has pronounced ventral extension on the female genital triple-somite, characterized by a large conical posterior projection. In contrast, *T. calcaratus* has one spinous posterior projection; *T. clausi* has one rounded and one conical projection; and *T. minutus* has a rounded posterior margin without projections. The condition in *T. perforatus* is unknown.
4. The female antennule in the new species is 7-segmented, differing from the 8-segmented antennules found in *T. calcaratus*, *T. clausi*, and *T. minutus*. The segmentation in *T. perforatus* is not recorded.
5. Unique in the genus, *T. tresetosus* sp. nov. features a P4 ENP-3 setal armature with only three setae. The other four species in comparison each have five elements.

[1]**Tegastes pilosus* sp. nov. (Figs. 8–10, 15C, D)

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Material examined. Holotype, ♀ (MABIK CR00254212) dissected on 12 slides, Korea: Jeju-si, Chuja-myeon,

Korean name: [1]*털보곱등노벌레 (신칭)

Mung-ri, Mungni Port of Chuja-do Island, 33°56′44.0″N, 126°18′44.0″E, light trap, 10 Sep 2017, *leg*. JG Kim (HNIBR). Paratypes: 1♂ (MABIK CR00254213) dissected on three slides, and 2♀♀ (MABIK CR00254207) and 1♀, 1♂ (MInRB-Hr95-L001) preserved in a vial filled with 95% ethanol, respectively; all paratypes same data as in holotype.

Description. Female (holotype MABIK CR00254212). Body (Figs. 8A, 15C) laterally compressed, amphipod-like; integument chitinized, covered with numerous sensilla and pores; dorsal outline not gibbous, without clear distinction between prosome and urosome. Total length 470 μm; maximum width 220 μm measured at level of postero-ventral corner of ventral extensions. Rostrum weakly prominent, completly fused basally to cephalothorax.

Prosome (Fig. 8A) comprising cephalothorax and 3 free pedigerous prosomites; P1-bearing somite completely incorporated into cephalosome, but its original division marked by internal rid. Cephalothorax occupying 40% of body length; ventral extensions of cephalosomal shield with marginal lamellae anteriorly; postero-ventral corner of ventral extensions distinctly pointed. Length of dorsal outline from P2- to P4-bearing somites 35.0, 52.5, and 70.0 μm, respectively (telescoping of somites not considered).

Urosome (Fig. 8A, B) 4-segmented, comprising, genital triple-somite, and 3 free abdominal somites. Genital triple-somite with triangular ventral plate posteriorly; dorsal outline 1.4 times as long as preceding one, with 2 weak depressions anteriorly; lateral and dorsal surfaces sculptured by numerous dents; anterior angle of ventral plate with 1 ventro-median and 2 lateral processes, posterior edge with 1 distinct posterior process, reaching posterior margin of penultimate urosomite, near other urosomites; posterior edge between ventro-median and posterior process almost smooth. Genital field (Fig. 9G) with genital slit formed by fusion of gonopores; P6 not fused, elongate, with 1 distal seta either side; copulatory pore not exopod, located anterior to genital slit. Free abdominal somites visible in lateral view, very reduced; penultimate somite with prominent pseudoperculum. Anal somite smallest, with a deep cleft dorsally.

Caudal rami (Fig. 8B) small (10.0 × 11.9 μm in lateral view), dorsal surface prominently produced as peduncle for seta VII; with 1 latero-ventral pore and 7 setae; seta I 1.4 times as long as caudal ramus; seta II twice as long as seta I; seta III inserted near dorsal peduncle distal third of outer margin, 1.4 times as long as seta II; terminal seta IV slender, weakly plumose, as long as setae II; terminal seta V longest, weakly pinnate proximally (damaged); seta VI slender, arising from distal inner corner, about twice as long as ramus; dorsal seta VII tri-articulated basally, arising from midway of ramus length, slightly longer than seta II.

Antennule (Fig. 8A, C) 8-segmented, 127 μm long, reaching half of ventral extension of cephalosomal shield; aesthetasc present on fourth and last segments, fused basally to adjacent seta; length of segments from first to eighth, 33, 25, 20, 11, 10, 9, 8, 11 μm long; all setae bare, of which 2 and 4 outer bi-articulated setae present on seventh and eighth segments, respectively. Armature formula as follows: 1-[1], 2-[11], 3-[10], 4-[3 + (1 + ae)], 5-[2], 6-[4], 7-[4], 8-[6 + (1 + ae)].

Antenna (Fig. 8D) about 90 μm long. Coxa small, unornamented. Basis elongate, 3.3 times as long as wide (32.0 × 9.6 μm), lacking abexopodal seta. Exopod small, 9.6 μm long, 2-segmented; proximal segment slightly longer than width, with 1 uni-pinnate seta; distal segment small, about 0.5 times as long as proximal segment, with 1 uni-pinnate and 2 pinnate setae distally. Endopod 2-segmented: first segment elongate, about 2.8 times as long as wide (28.8 × 10.4 μm), with 1 plumose abexopodal seta; second segment shorter than preceding one, about 3.5 times as long as wide (22.4 × 6.4 μm), with 2 weakly pinnate setae laterally; distal armature consisting of 2 pinnate claw-like spines, 1 uni-spinulose seta, 2 weakly uni-pinnate setae, and 2 small bare setae.

Mandible (Fig. 8E) with well-developed coxal gnathobase with 4 uni-cuspid teeth, 1 tri-cuspid tooth, and 1 dorsal seta (missing) on cutting edge; dorsal bulge small. Palp comprising wide basis and elongate endopod. Basis gradually widening towards distal end, about 2.5 times as long as greatest width (18.4 × 7.4 μm), with 2 long plumose setae distally; inner margin concave proximally. Exopod incorporated into basis, represented by 3 bare setae. Endopod elongate, about 3.5 times as long as greatest width (11.1 × 3.2 μm), distally with 1 bare lateral seta and 4 bare distal setae.

Maxillule (Fig. 8F) with well-developed praecoxal arthrite; distally with 2 spine-like ventral setae (of which proximal one with 1 spinule), 1 stout ventral spine, 2 slender spines, and 4 spines bearing 1 or 2 spinules subdistally. Coxal endite cylindrical, wide, probably reaching proximal fourth of basis, with 1 bare seta distally; epipodite 1-segmented, slightly longer than width, with 3 bare distal setae. Basis elongate, 3.9 times as long as wide (11.1 × 3.2 μm), with 3 distal setae (1 pinnate distally and spinulose proximally, 1 pinnate, and 1 uni-spinulose) and 2 subdisal setae (1 uni-spinulose and 1 bare). Exopod absent. Endopod completely incorporated into basis, represented by 1 plumose and 1 bare seta.

Maxilla (Fig. 9A). Syncoxa elongate, 2.4 times as long as greatest width (34.3 × 14.3 μm), with 3 endites: praecoxal endite elongate, about 2.7 times as long as wide, with 2 plumose lateral setae, 1 bare distal seta, and 1 very long plumose distal seta (3.4 times as long as endite); proximal coxal endite small, with 2 distal setae; distal coxal endite large, reaching distal fourth of allobasis, with 3 uni-spinulose setae distally and subdistally. Allobasis elongate, 3.0 times as long as wide, with 1 bare dorsal, 1 spine-like distal, and 1 plumose ventral

seta, and 1 long tube pore (designated by arrowhead in Fig. 9A). Endopod completely incorporated into allobasis, represented by 1 bare and 2 plumose setae. Exopod absent.

Maxilliped (Fig. 9B, B′) subchelate by having claw-like endopod, arising from small pedestal. Syncoxa elongate, 3.0 times as long as greatest width, gradually tapering distally, with 1 uni-plumose seta at inner distal corner. Basis elongate oval, as long as syncoxa, 2.7 times as long as greatest width (53.6 × 19.6 μm); palmar margin somewhat evenly swollen, with 1 row of lateral spinules in distal half, 1 row of median spinules in proximal half, and 2 rows of medial spinules in distal two-third part; with 1 small bare seta (designated by arrowhead in Fig. 9B) inserted at distal third of palmar margin and 1 mushroom-like process inserted subdistally; mushroom-like process 10.3 μm wide (high: 4.1 μm), distally covered with numerous minute denticles. Endopod reaching half-length of palmar margin, accompanying 1 long and 1 short seta on either side; small seta on lateral side very reduced, unnoticeable.

P1 (Fig. 9C) 103 μm long. Intercoxal sclerite wide, slightly arched, smaller than those of other thoracic legs. Coxa small, slightly longer than wide; outer margin expanded. Basis elongate, gradually widening distally, 3.2 times as long as greatest width (52.6 × 16.5 μm), with 1 posterior pore, 1 bare outer seta, and 1 plumose inner seta. Exopod as long as endopod, but slenderer, with 3 bare outer setae, 1 uni-pinnate distal seta, and 1 uni-plumose inner seta; proximal part of inner margin weakly swollen. Endopod about 0.6 times as long as basis, with 1 plumose outer seta, 3 plumose distal setae, 1 plumose inner seta, and 1 uni-pinnate inner seta.

P2–P4 (Figs. 9D, E, 10A) 184–198 μm long; P2 (Fig. 9D) shortest and P3 (Fig. 9E) longest. Intercoxal sclerites wide, arched; width to length ratio gradually increasing from P2 to P4. Coxae asymmetric trapezoidal by triangular outer protrusion. Bases transversally elongate, 3.3, 3.1, and 2.6 times as wide as long from P2 to P4, respectively; outer seta inserted at distal sixth of outer margin in P2–P3 and inserted at distal third in P4 (Fig. 10A). Exopods 3-segmented; EXP-2 shortest in P2–P3, but EXP-1 shortest in P4; length ratio of segments from proximal to distal 1 : 0.72 : 1.0 in P2, 1 : 0.72 : 1.20 in P3, and 1 : 1.63 : 1.94 in P4; all outer spines weakly pinnate in P2–P3; P2 EXP-1 with 1 plumose inner seta shorter than segment length, but P3–P4 EXP-1 lacking inner seta; all inner setae plumose except for P4 EXP-2 bearing subdistally uni-serrate seta and P4 EXP-3 with spine-like and uni-serrate middle seta; distal inner seta of P4 EXP-3 slightly shorter than segments length. Endopods3-segmented, longer than exopods; length ratio of segments from proximal to distal 1 : 0.87 : 0.90 in P2, 1 : 0.66 : 0.89 in P3, and 1 : 0.91 : 0.97 in P4; all inner setae plumose subdistally except for P2 ENP-1 bearing spinulose seta in distal half.

Armature formula of P2–P4 as follows:

	Exopod	Endopod
P2	1.1.222	1.2.221
P3	0.1.322	1.2.321
P4	0.1.322	1.2.221

P5 (Fig. 9F). Baseoendopod wide, with largely enlarged, foliaceous endopodal lobe tapering distally, about 1.3 times as long as greatest width (68.6 × 91.4 μm); outer seta inserted at proximal fifth of outer margin; endopodal lobe with 3 bare inner setae, 1 small bare distal seta (5.7 μm), and 1 pinnate distal seta (30.0 μm); anterior surface with longitudinal chitinous ridge along outer margin. Exopod slender, 7.5 times as long as wide (42.9 × 5.7 μm), reaching distal fourth of endopodal lobe, with 1 weakly uni-pinnate and 2 bare outer setae, and 2 pinnate distal setae.

Male (paratype MABIK CR00254213). Total body length smaller than females, 450 μm (Figs. 10B, 15D); sexual dimorphism expressed in cephalosomal shield, urosome, caudal rami, antennule, P5, and P6.

Cephalosomal shield (Fig. 10B). Postero-ventral corner of ventral extension with blunt tip.

Urosome (Fig. 10B, C). Genital triple-somite with massive rectangular plate (93.8 × 116.3 μm), its ventral line as long as dorsal outline, with 1 unguiform median process ventrally and 1 unguiform protrusion posteriorly. Genital flap representing P6 not observed in lateral view.

Caudal rami (Fig. 10C). Setae II, IV, and VI plumose. Seta VI longer than seta IV.

Antennule (Fig. 10D) modified for grasping, 10-segmented; fourth segment wedge-shaped; aesthetasc fused to adjacent seta present on third, fifth, and last segments, respectively; 2 and 4 outer setae on penultimate and last segments, respectively, bi-articulated; all setae bare except for 1, 4, and 2 plumose setae from first to third segments, respectively. Setal armature formulae as follows: 1-[1], 2-[11], 3-[7 + (1 + ae)], 4-[2], 5-[8 + (1 + ae)], 6-[1], 7-[2], 8-[1], 9-[4], 10-[6 + (1 + ae)].

P5 (Fig. 10C) 2-segmented, elongate, 70.0 μm; first segment short, with 1 bare outer seta; second segment elongate, 2.5 times as long as preceding one, with 2 bare outer setae and 2 pinnate, spiniform distal setae.

Etymology. The specific epithet comes from the Latin adjective *pilōsus*, meaning hairy, and refers to the presence of plumose setae on the antennule and caudal rami in males. It is nominative singular. Gender: masculine.

Remarks. Within the genus, *T. pilosus* sp. nov. bears a morphological resemblance to *T. flavidus* Sars, 1904 described from muddy sand sediments at a depth of 5.4 m off the west coast of Norway, specifically Kalvåg and Eggesbønes (Sars, 1904). These two species have several commonalities, includ-

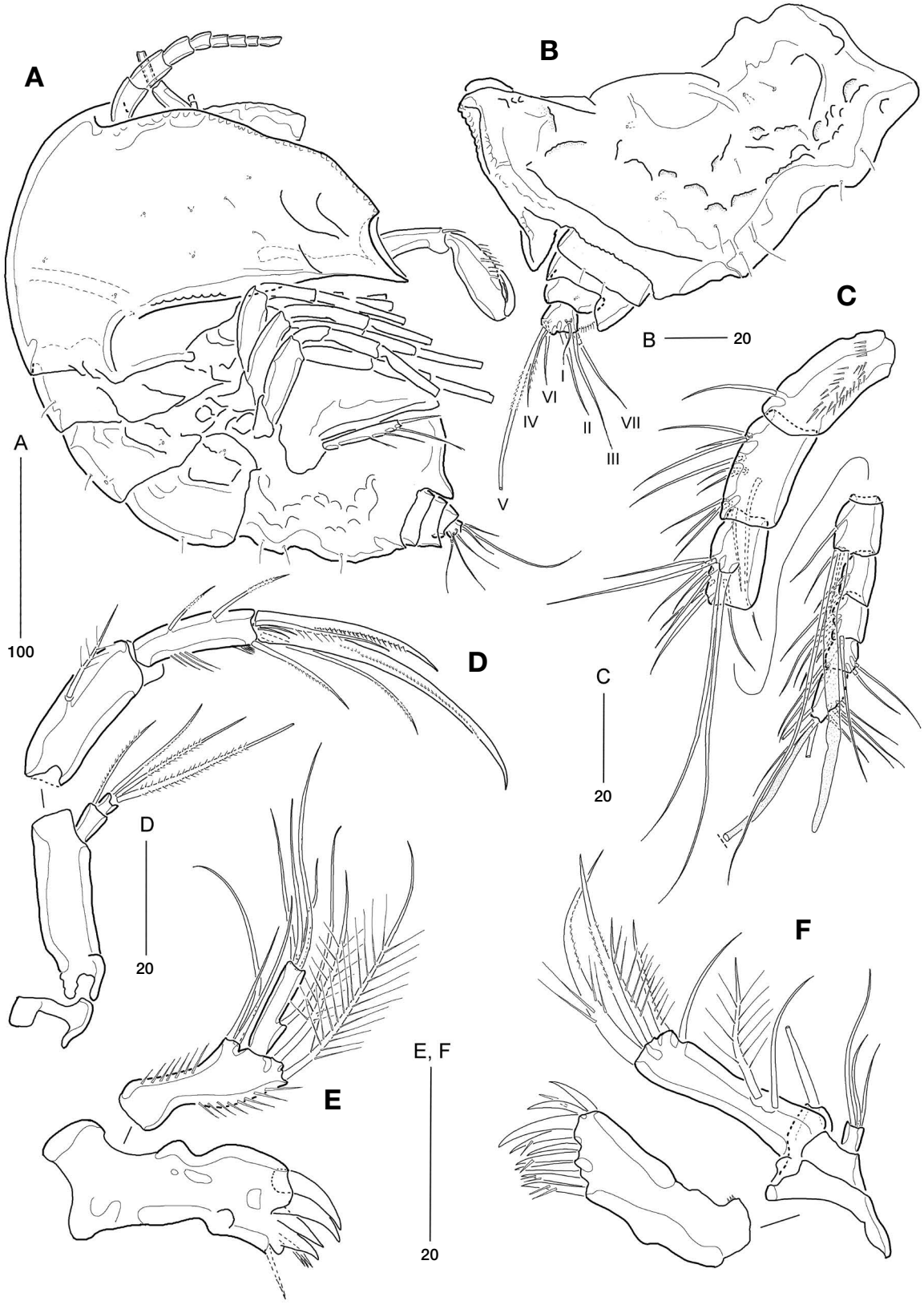

Fig. 8. *Tegastes pilosus* sp. nov., female. A, Habitus, lateral; B, Urosome, lateral; C, Antennule; D, Antenna; E, Mandible; F, Maxillule.

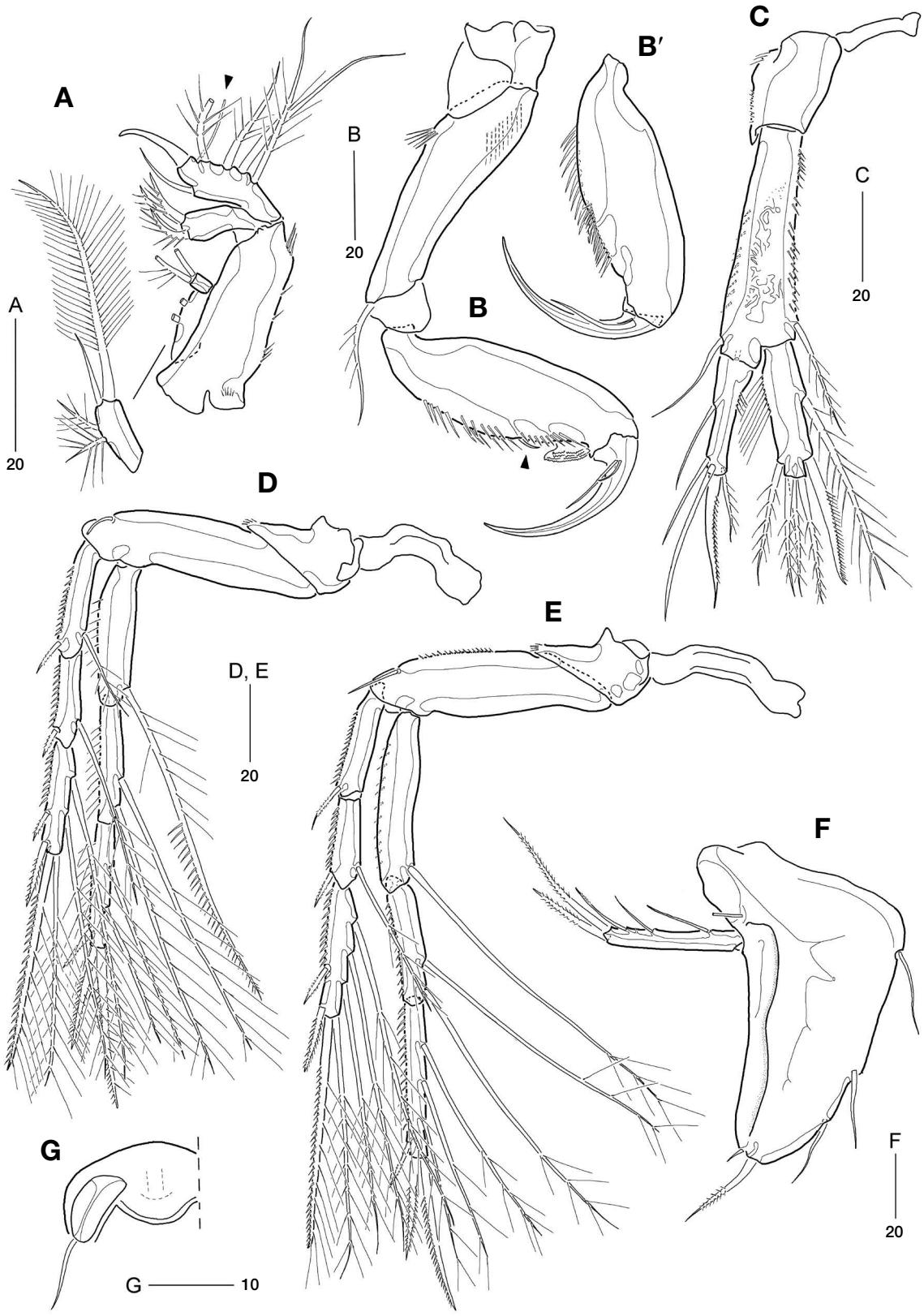

Fig. 9. *Tegastes pilosus* sp. nov., female. A, Maxilla; B, Maxilliped, medial; B′, Basis and endopod of maxilliped, lateral; C, P1, posterior; D, P2, posterior; E, P3, posterior; F, P5; G, P6.

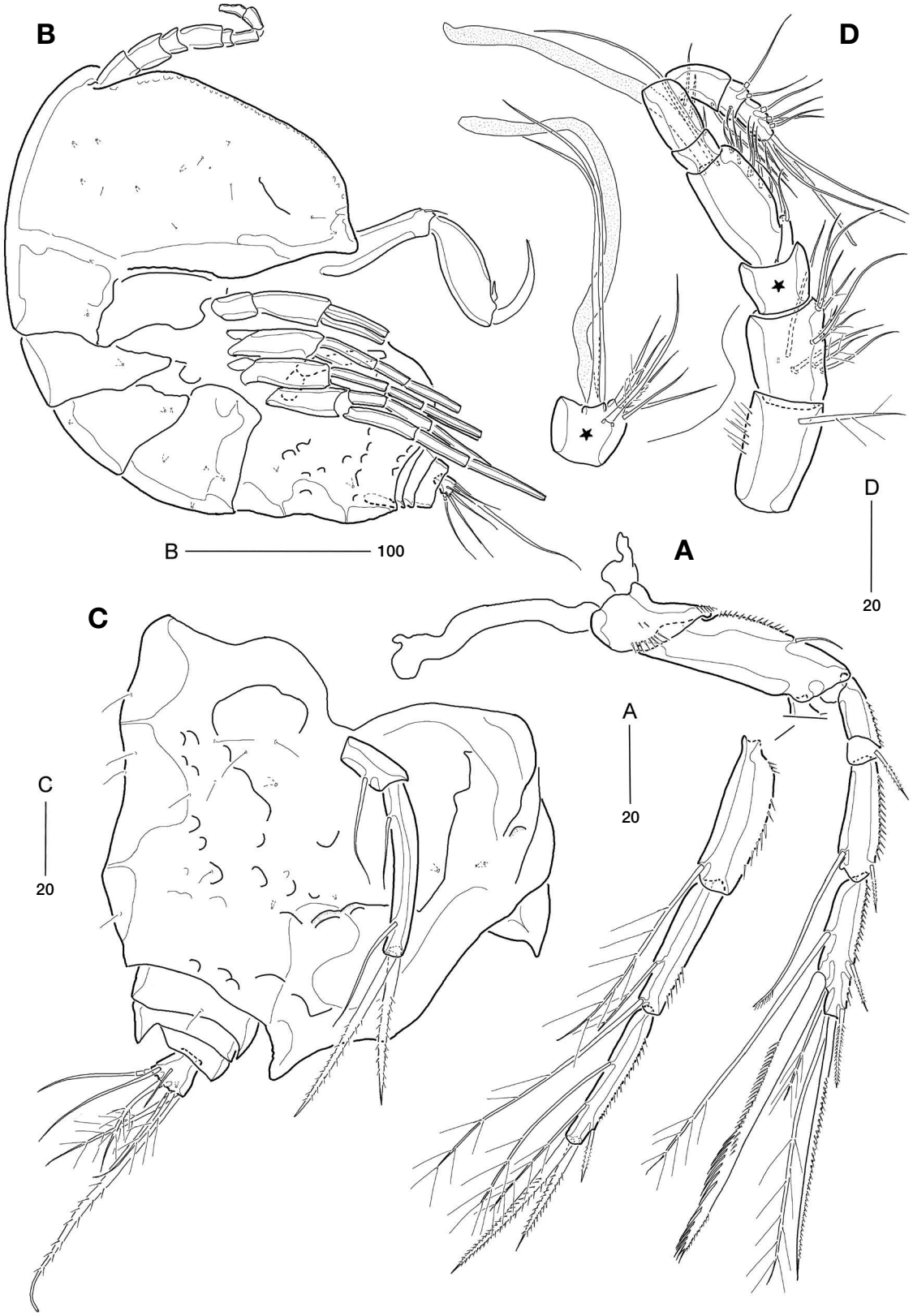

Fig. 10. *Tegastes pilosus* sp. nov. A, Female, P4, posterior. B–D, Male: B, Habitus, lateral; C, Urosome, lateral; D, Antennule.

ing the 8-segmented female antennule, 2-segmented antennary exopod, and setal armature formula of the thoracic legs (6 : 7 : 7 for P2−P4 EXP-3, 5 : 6 : 5 for P2−P4 ENP-3, 1 : 0 : 0 for P2−P4 EXP-1, and 1 : 1 : 1 for P2−P4 ENP-1). However, *T. pilosus* sp. nov. is distinguished from *T. flavidus* based on the following chitinous structures:

1. Pronounced ventral extension of the cephalosomal shield in *T. pilosus* sp. nov. terminates in a pointed postero-ventral corner, as opposed to the blunter ending observed in *T. flavidus*.
2. The posterior ventral cone on the female urosome in *T. pilosus* sp. nov. borders the last three urosomites, whereas in *T. flavidus* it is set further from the posterior urosomites.
3. The posterior edge of the male genital triple-somite in *T. pilosus* sp. nov. has one posterior ventral cone, contrasting with the three found in *T. flavidus*.

Wells (2007) outlined a tubular key that classifies *T. pilosus* sp. nov. within a group that includes *T. flavidus*, *T. longimanus* (Claus, 1863), and *T. nanus*. However, caution must be exercised in applying the key to this cluster due to the taxonomic ambiguities surrounding *T. nanus*. Originally, Sars (1904) described *T. nanus* as a new species found in sediments from Kalvåg, Eggesbønes, and Ålesund off the west coast of Norway. Although there were records of this species in the Atlantic Ocean (Ferrari et al., 2007), its morphological intricacies remained largely elusive until Ferrari et al. (2007) examined specimens from the collections of Sars; they supplied a comprehensive description of *T. nanus*, confirming its conspecificity using materials of Chislenko (1967) from the White Sea, and casting doubts over the authenticity of *T. nanus* sensu McAlice and Coffin, 1990 from the Gulf of Maine. Moreover, the findings of Ferrari et al. (2007) diverge from the Wells' (2007) key of *T. nanus*, particularly in the setal armature formula of the thoracic legs. Ferrari et al. (2007) observed the following:

1. The P3−P4 EXP-1 possesses an inner seta.
2. The P3 EXP-3 and ENP-3 have counts of six and five elements, respectively.

Because Wells (2007) may not have been privy to the study by Ferrari et al. (2007), *T. nanus* remains distinct from *T. flavidus*, *T. longimanus*, and *T. pilosus* sp. nov. The veracity of other reports suggesting the amphiatlantic distribution of *T. nanus* remains uncertain until a meticulous morphological analysis is undertaken.

Genus *Syngastes* Monard, 1926

[1]**Syngastes acutus* sp. nov. (Figs. 11−14, 15E, F)

lsid:zoobank.org:act:E46FE978-0E2C-46FC-B874-C4F65C012AE4

Material examined. Holotype, ♂ (HNIBRIV2479) preserved in a vail filled with 95% ethanol, Korea: Jeollanam-do, Yeosu-si, Samsan-myeon, Dongdo-ri, Geomun-do Island (Geomdeung-yeo), 34°02′41.9″N, 127°21′21.8.0″E, SCUBA diving, 6 Oct 2022, *leg*. JG Kim (HNIBR). Paratypes: 1♀ (HNIBRIV7737) dissected on 12 slides and 1♂ (HNIBRIV 7738) dissected on three slides; all paratypes same data as in holotype.

Description. Female (paratype HNIBRIV7737). Body (Figs. 11A, 15E) laterally compressed, amphipod-like; integument strongly chitinized, with hollow ornamentation as *S. multicavus*, covered with numerous sensilla and pores; dorsal outline slightly gibbous. Total length 910 μm; maximum width 447 μm measured at level of postero-ventral corner of ventral extensions. Rostrum weakly prominent, completely fused basally to cephalothorax.

Prosome (Fig. 11A). P1-bearing somite completely incorporated into cephalosome forming cephalothorax; original division between cephalosome and P1-bearing somite indicated by internal rid. Dorsal outline of cephalothorax occupying 46% of total body length; ventral extensions, anterior margin of somewhat rounded, with marginal lamellae, ventral margin short and truncated, and postero-ventral corner produced posteriorly. Length of dorsal outline from P2- to P4-bearing somites 57.9, 105.3, and 147.4 μm, respectively (telescoping of somites not considered).

Urosome (Fig. 11A−C) with genital triple-somite. Genital triple-somite, scoop-like, with subrectangular ventral plate posteriorly; ventral plate, ventral margin short (27.1 μm), anteriorly bearing 1 ventral median and 2 lateral processes, posterior margin somewhat waved, with 1 weak posterior process; in anterior view, height-to-width ratio of genital triple-somite 1.27; genital field (Fig. 11C) located anteriorly, with transverse genital slit; median copulatory pore located posterior to genital slit; trace of P6 not observed. Postgenital three urosomites very short; fourth and fifth urosomites visible in lateral view, but probably anal somite invisible by telescoping.

Caudal rami (Fig. 11D) small (12.0 × 11.0 μm in lateral view); with 1 latero-ventral pore and 7 setae; seta I slightly longer than caudal ramus; seta II 3.3 times as long as caudal ramus; seta III inserted near seta VII, 5.2 times as long as caudal ramus; seta IV inserted at distal fourth of latero-ventral surface, 2.3 times as long as caudal ramus; terminal seta V longest (74.0 μm); seta VI arising from distal inner corner, about twice as long as ramus; dorsal seta VII tri-articulated basally, as long as seta III.

Korean name: [1]*뾰족손넓은배장수노벌레 (신칭)

Antennule (Fig. 11E) elongate, exceeding to distal third of massive ventral extensions, 8-segmented; with 1 pore on second segment, and aesthetasc on fourth and terminal segments. Length of segments measured along inner margin 33, 29, 21, 11, 6, 5, 5, and 7 μm, respectively; proximal four segments occupying nearly 80% of total length. Setal armature formulae as follows: 1-[1], 2-[11], 3-[9], 4-[3 + (1 + ae)], 5-[2], 6-[4]. 7-[4], 8-[6 + (1 + ae)]. Outer setae on penultimate and terminal segments bi-articulated basally.

Antenna (Fig. 11F). Coxa lost during dissecting process. Basis elongate, about 4 times as long as wide (31 × 8 μm), longer than proximal endopodal segment, without any ornamentation. Exopod small (7 μm), 2-segmented; proximal segment 4 times as long as distal one, with 1 pinnate distal seta fused to segment laterally (opposite side separate); distal segment small, with 3 distal pinnate setae, of which lateral one fused to segment. Endopod 2-segmented; proximal segment about 2.5 times as long as wide (22 × 9 μm), with 1 abexopodal seta; distal segment distinctly smaller than preceding one (14 × 5 μm), with 2 small inner setae and 1 outer tube pore; distal armature comprising 2 uni-pinnate claws, 4 bare setae (2 long and 2 short), of which 1 small and 1 long seta fused basally, and 1 pinnate spine; outer margin with surface frill subdistally.

Mandible (Fig. 12A) with 2 uni-cuspid and 3 multi-cuspid teeth, and 1 uni-pinnate seta fused basally to 1 short spine on gnathobase; chitinized bulge recurved, displaced onto subdistal dorsal surface. Uni-ramus palp 2-segmented, comprising elongate basis and 1-segmented endopod. Basis with 2 long plumose setae distally. Endopod small, about 0.22 times as long as basis, with 3 plumose distal setae. Exopod represented by 1 long plumose seta.

Maxillule (Fig. 12B) with strongly chitinized and large praecoxa; arthrite with 2 uni-pinnate ventral setae, 2 bare spines, and 5 stout spines along diagonal distal margin. Coxa small, unornamented; endite short, with 1 long plumose seta. Basis elongate, with 4 pinnate/plumose setae along diagonal distal margin. Exopod small, slightly longer than width, with 1 uni-pinnate and 2 plumose setae distally. Endopod incorporated into basis, represented by 2 plumose setae.

Maxilla (Fig. 12C). Syncoxa elongate, with 3 endites; praecoxal endite about twice as long as wide, with 3 plumose setae, of which proximal one shortest and distal one longest; proximal coxal endite reduced, with 1 plumose seta; distal coxal endite large, elongate, with 2 pinnate setae, of which outer one fused to segment. Allobasis extremely elongate, about 6 times as long as wide, with 1 pinnate, claw-like spine distally, 1 pinnate seta dorsally, and 1 pinnate seta ventrally. Endopod probably represented by 1 uni-plumose and 2 pinnate setae. Exopod absent.

Maxilliped (Fig. 12D, E) well-developed. Syncoxa elongate, about 3.4 times as long as wide, with 1 uni-pinnate small seta at inner distal corner; outer margin with foveate ornamentation proximally. Basis enlarged, crescent form with pointed proximal end of palmar margin; palmar margin ornamented with minute median spinules gradually enlarged in size towards proximal end, and minute lateral spinules; mushroom-like process wide, covering two fifth of palmar margin, ornamented with numerous fine tubercles distally; button-like process distinct, ornamented with papillae distally and seta-like element; additional median seta present at basal of mushroom-like process (Fig. 12D).

P1 (Fig. 12F). Intercoxal sclerite wide, unornamented. Coxa small, outer margin more produced than inner, unornamented. Basis elongate, 5.2 times as long as wide, with 1 pore on mid-length of inner margin and 1 pore on subdistal anterior surface; outer seta bare and inner seta plumose. Exopod slenderer than endopod, with 3 bare outer setae, 2 uni-pinnate distal setae, of which outer one 2.6 times longer than inner; inner margin of proximal part swollen. Endopod slightly exceeding end of exopod, with 1 plumose outer seta, 2 pinnate distal setae, 1 small, pinnate inner seta, and 1 long, spinulose inner seta; outer margin with small protuberance proximally.

P2–P3 (Fig. 13A, B). Intercoxal sclerites wide, arched (that of P2 more arched). Praecoxa small, unornamented. Coxa small, trapezoid by protrusion of outer distal corner bearing spinular row distally. Basis transversally elongate, with outer seta subdistally; outer seta of P3 (Fig. 13B) longer than that of P2 (Fig. 13A). Exopod 2-segmented, EXP-1 longer than EXP-2, with 1 proximal outer seta and 1 distal outer spine; anterior surface of EXP-1 reticulated; EXP-2 with 2 pinnate outer spines; P3 EXP-2 with outer pore subdistally. Endopods longer than exopods, 3-segmented; length ratio of each segment similar in P2, but P3 ENP-3 noticeably longer than ENP-1 and ENP-2.

P4 (Fig. 14A). Protopods as in P2–P3 except for presence of anterior foveate ornamentation on basis. Exopod 3-segmented; EXP-1 very short, with outer seta; EXP-2 longest; length ratio of each segment from proximal to distal 1.0 : 2.8 : 2.3; EXP-2 and EXP-3 with emboss ornamentation; middle inner seta on EXP-3 transformed into serrate and stout spine. Endopod 2-segmented, comprising flattened proximal and rod-like segments; ENP-1 slightly shorter than exopod, with outer notch at proximal third and 3 inner setae, of which two distal setae unnoticeable at low magnification; distal third of ENP-1 narrower than proximal part; ENP-2 slightly shorter than preceding one.

Armature formula of P2–P4 as follows:

	Exopod	Endopod
P2	1.222	1.2.221
P3	1.322	1.2.321
P4	0.1.322	3.021

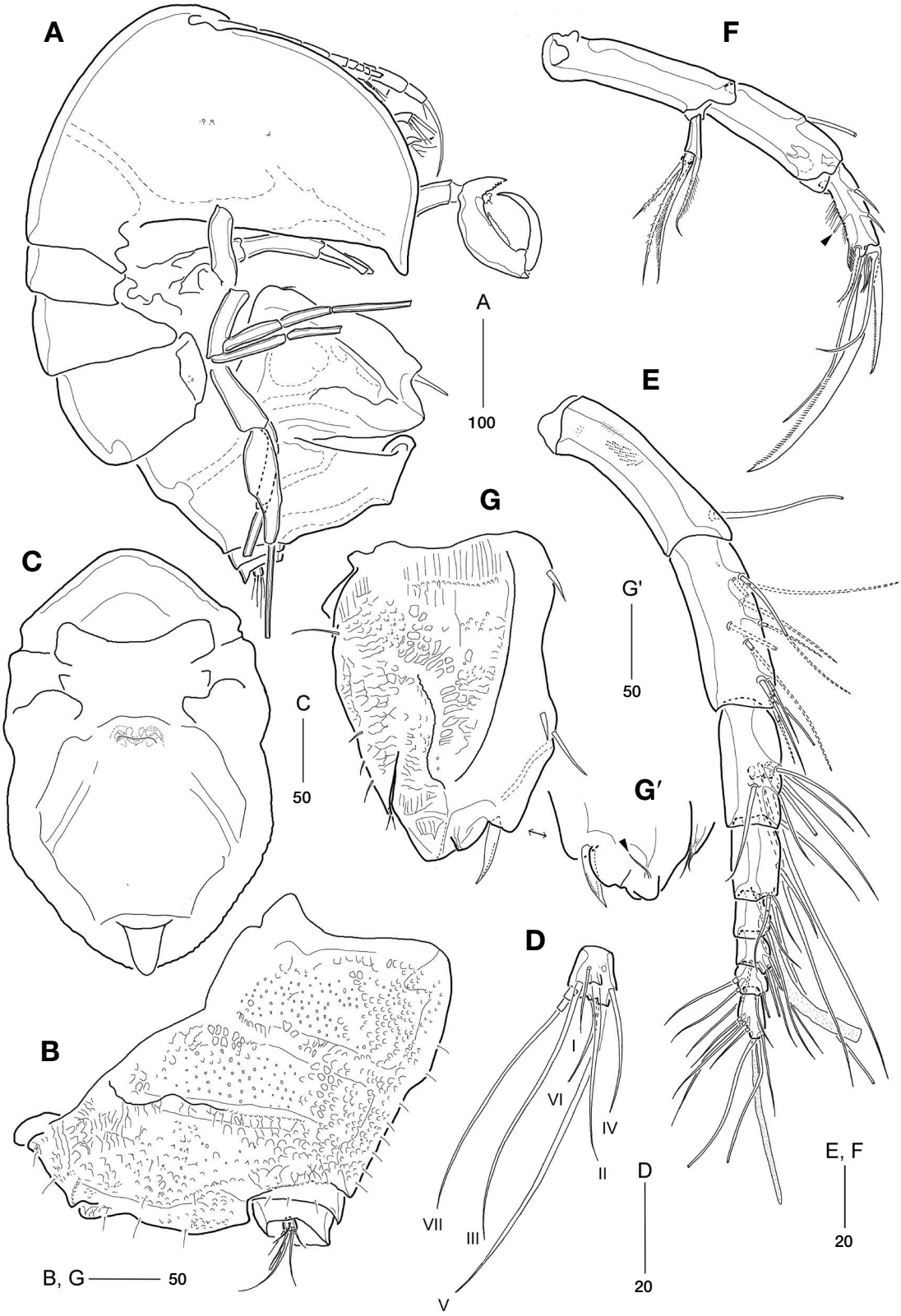

Fig. 11. *Syngastes acutus* sp. nov., female. A, Habitus, lateral; B, Urosome, lateral; C, Urosome, anterior; D, Caudal rami, outer, setae on caudal rami are numbered using Roman numerals; E, Antennule; F, Antenna; G, P5; G′, Distal part of P5 baseoendopod and exopod.

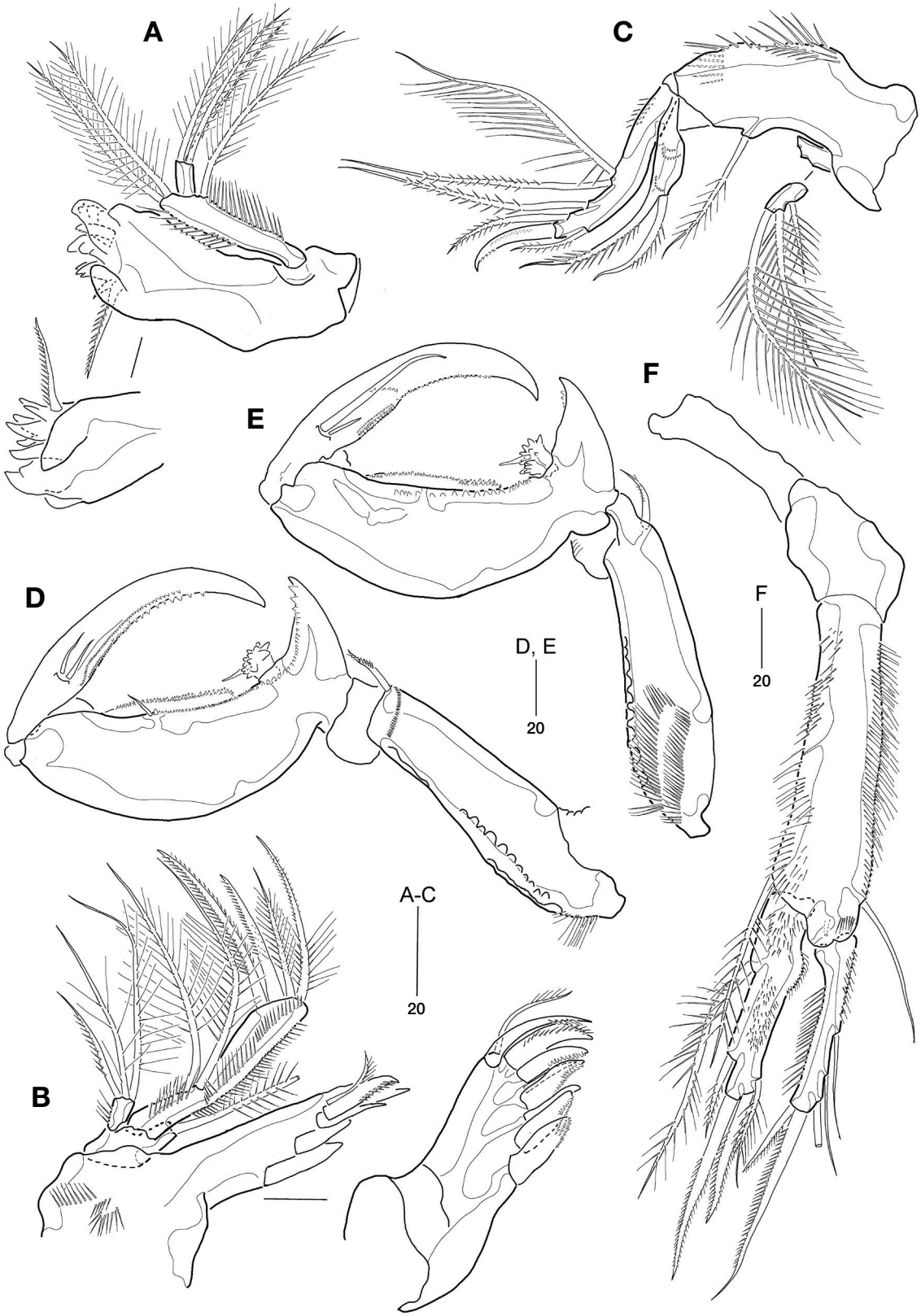

Fig. 12. *Syngastes acutus* sp. nov., female. A, Mandible; B, Maxillule; C, Maxilla; D, Maxilliped, medial; E, Maxilliped, lateral; F, P1, posterior.

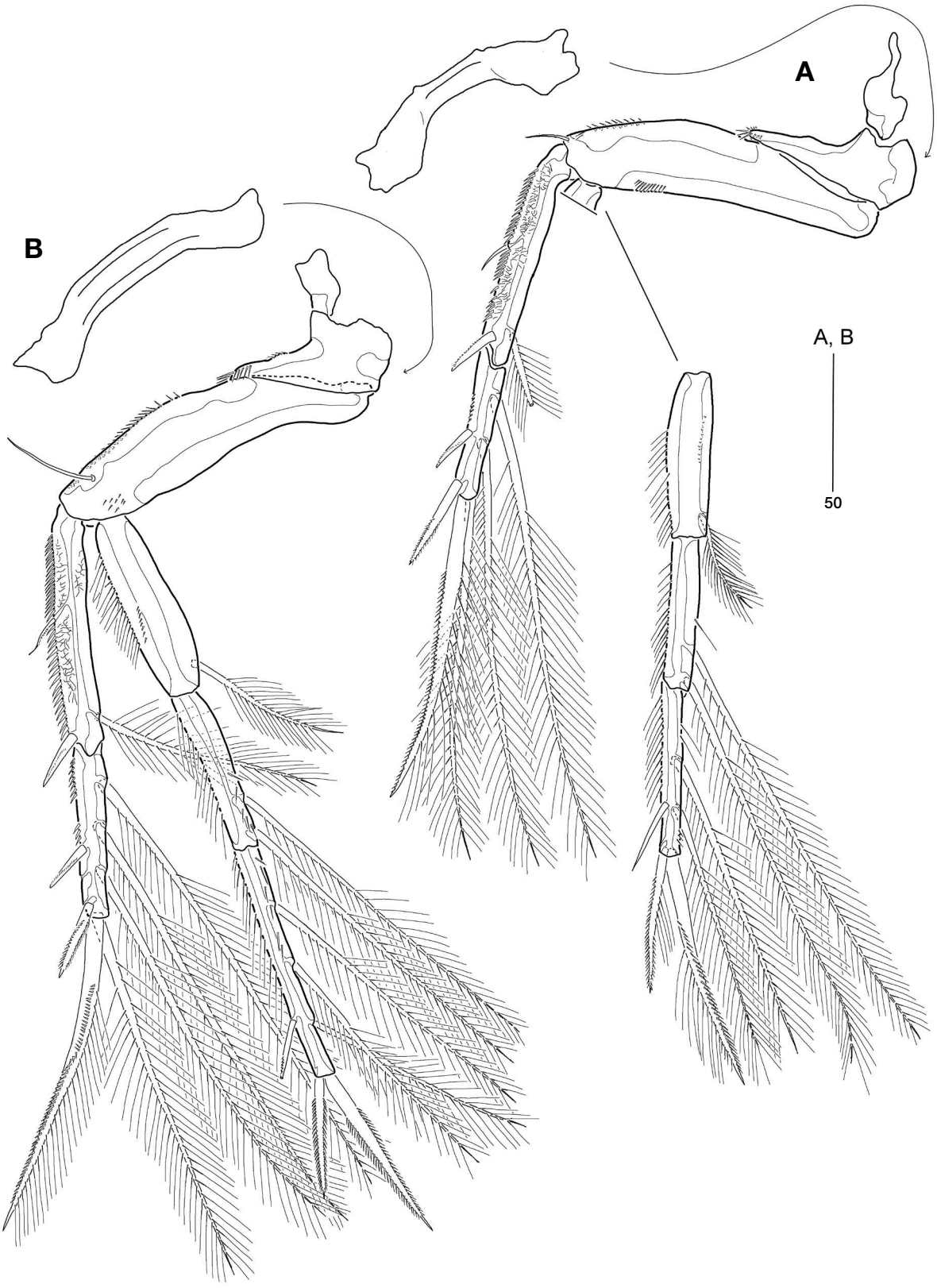

Fig. 13. *Syngastes acutus* sp. nov., female. A, P2, posterior; B, P3, posterior.

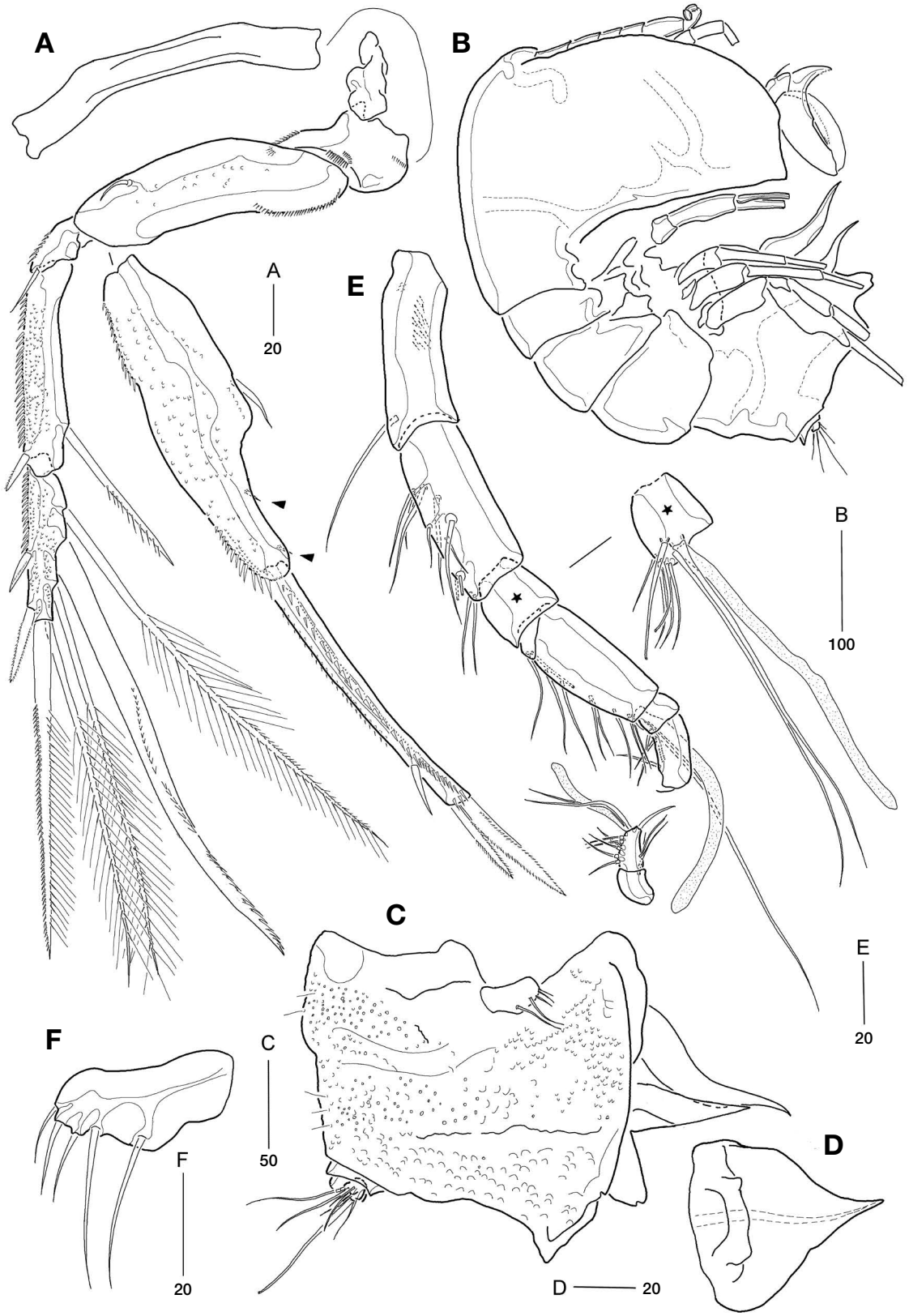

Fig. 14. *Syngastes acutus* sp. nov. A, Female, P4, posterior. B–F, Male: B, Habitus, lateral; C, Urosome, lateral; D, Genital flap, anterior; E, Antennule, F, P5.

P5 (Fig. 11G, G′). Baseoendopod and exopod nearly fused together forming massive foliaceous plate, but trace of original division indicated by a fissure (45.2 μm long) between exopod and endopodal lobe at distal third of endopoal lobe length; length to width ratio about 1.5 (222.6 × 150.0 μm); outer seta bare, inserted at proximal fourth of outer margin. Exopod conical, with 3 bare outer setae, 1 bare distal seta, 1 bare posterior seta, and 1 posterior pore (Fig. 11G′). Endopodal lobe broad, subdistally with 2 projections, of which distal one bilobed; with 3 bare inner setae, of which middle one arising from anterior surface, 1 weakly pinnate spine inserted in proximal projection, and 1 unnoticeable seta inserted at posterior surface of distal bilobed projection; anterior surface with areolated ornamentation and 2 longitudinal chitinous ridges.

Male (paratype HNIBRIV7738). Total body length distinctly smaller than females, 695 μm (Figs. 14B, 15F); sexual dimorphism expressed in cephalosomal shield, urosome, antennule, P5, and P6.

Cephalosomal shield (Fig. 14B). Ventral extensions with blunt postero-ventral corner.

Urosome (Fig. 14B, C). Genital triple-somite with massive rectangular plate (144.7 × 189.5 μm), its ventral outline as long as dorsal outline, rounded, with 2 finely pointed and broad valves (anterior one indicates genital flap and posterior one with bidentate tip); genital flap representing P6 triangular, remarkably tapering in distal half (Fig. 14D). Postgenital three urosomites very short.

Antennule (Fig. 14E) haplocer, 9-segmented, with geniculation between seventh and eighth segments; fourth segment wedge-shaped; third, fifth, and last segments each with aesthetasc fused to adjacent seta; all setae on each segment bare (six outer setae on last segment bi-articulated). Setal armature formulae as follows: 1-[1], 2-[11], 3-[7 + (1 + ae)], 4-[2], 5-[7 + (1 + ae)], 6-[1], 7-[2], 8-[1], 9-[10 + (1 + ae)].

P5 (Fig. 14C, F) 1-segmented, small (37.3 μm long), with 5 bare setae, of which two proximal setae longer than others.

Etymology. The specific epithet is derived from the Latin *acūtus* (sharpened, pointed), in reference to the pointed palmar margin of the maxilliped. Gender: masculine.

Remarks. This new species can be confidently classified within genus *Syngastes* based on a collection of defining characteristics. These include the maxillipedal basis, which has both a button-like and a tongue-like process along its palmar margin, the 2-segmented exopod of P2−P3, the 2-segmented endopod of P4, and the substantial, expanded female P5 formed by the fusion of the exopod and baseoendopod.

Although numerous species of the genus suffer from partial and inadequate descriptions, akin to those of *Tegastes* species, Bartsch (1993, 1994, 1995, 1999) offered detailed and enlightening descriptions of eight *Syngastes* species found along the Australian coasts. She further developed descriptive terminologies for the maxilliped and urosome, both now recognized as valuable specific character markers, along with body ornamentation, the structure of the cephalic shield, the specialized inner seta on P4 EXP-3, and the shape of P4 ENP-1 (as cited by Wells, 2007).

The maxilliped of *S. acutus* sp. nov. stands out due to its pointed proximal section, contrasting with the typically swollen or robustly convex bases observed in most other species, often adorned with rows of spinules. This distinct maxilliped structure is also observed in *Syngastes pietschmanni* Pesta, 1932, which has been identified in locations as varied as the Hawaiian Islands in the North Pacific Ocean (Pesta, 1932), the Bahamas in the Northwest Atlantic Ocean (Geddes, 1968), and Mbudya Island in the Southwest Indian Ocean (Marcus, 1977). Beyond this shared feature, the overall morphological similarities in their cephalic shield, urosome, and general structure and setation of the cephalosomal appendages and thoracic legs hint at a close evolutionary relationship between *S. acutus* sp. nov. and *S. pietschmanni*. However, distinguishing characteristics set the new species apart from the latter, including the following:

1. In anterior view, the height-to-width ratio of the female urosome in *S. acutus* sp. nov. is approximately 1.27, whereas that in *S. pietschmanni* is 1.1.
2. The button-like process on the maxilliped palmar margin in *S. acutus* sp. nov. has a pronounced papilla and an extra seta-like element, contrasting with that of *S. pietschmanni*, which is dotted with tiny denticles.
3. The P4 ENP-1 of *S. acutus* sp. nov. has a more ancestral setal armature featuring three setae, similar those of *Syngastes kunzi* Marcus, 1977 and *Syngastes gibbus* Geddes, 1968. In contrast, *S. pietschmanni* has only a single seta in this region.
4. As highlighted by Wells (2007), the P4 EXP-1 in *S. pietschmanni* uniquely lacks the outer element that is usually observed in harpacticoid copepods.

Notes on the validity of three tegastid copepods recorded by Kim (2014)

In 2014, Kim documented the presence of three tegastid copepods (*Tegastes nanus*, *T. minutus*, and *Syngastes dentipes*) in Korean waters, accompanied by cursory descriptions and only three photographs, which showcased the P2, P3, and P5 of the female *T. minutus*. However, the depictions of the Korean populations brought the accuracy of his identifications into question due to significant discrepancies:

1. The recorded total body lengths of both genders significantly exceeded those provided in the original descriptions (e.g., *T. nanus* at 310 μm in females, *T. minutus* at 290 μm in females, and *S. dentipes* ranging as 530−560 μm in females

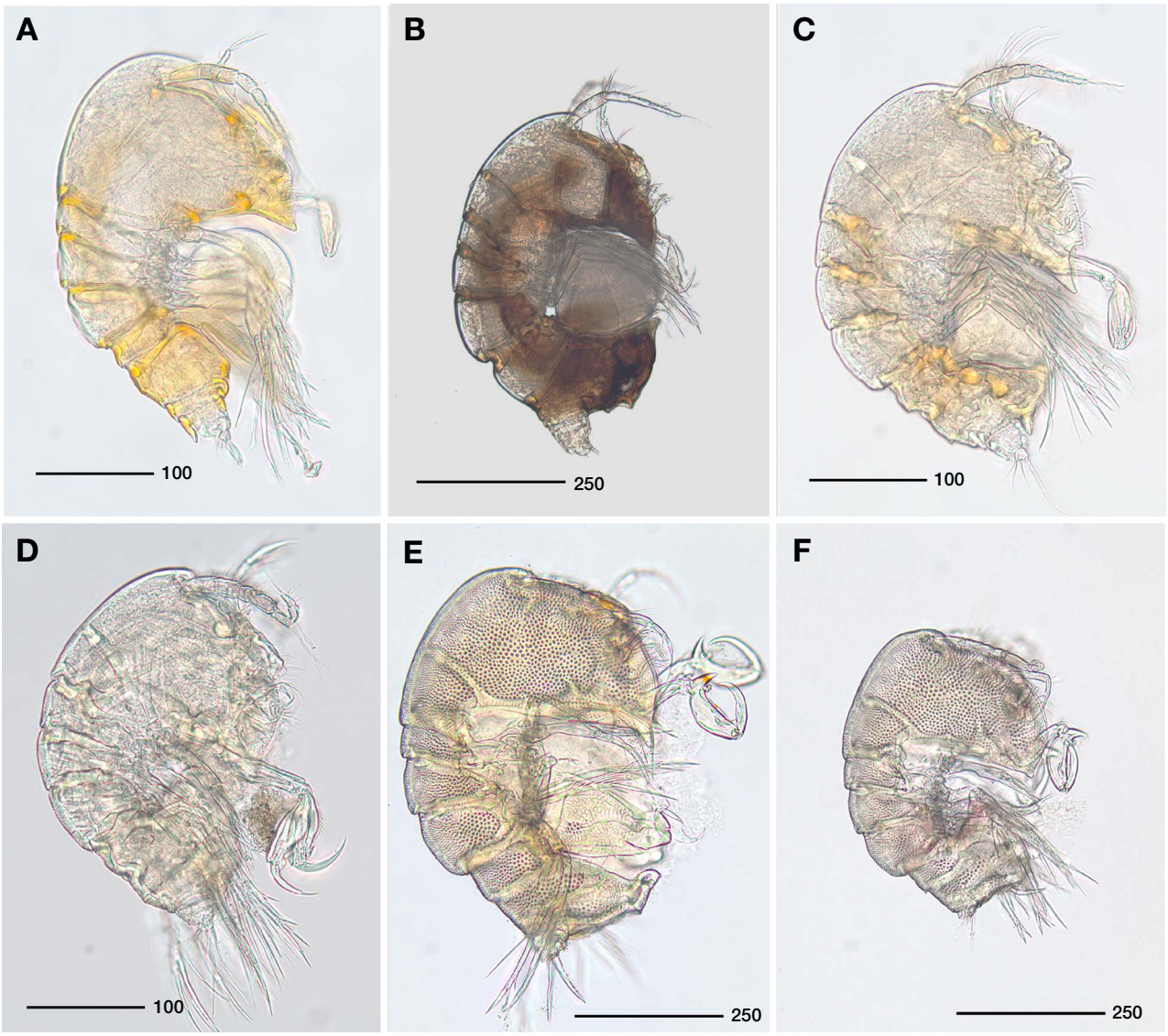

Fig. 15. *Tegastes lobus* sp. nov., microphotograph. A, Female, habitus. *Tegastes tresetosus* sp. nov., microphotograph. B, Female, habitus. *Tegastes pilosus* sp. nov., microphotographs. C, Female, habitus; D, Male, habitus. *Syngastes acutus* sp. nov., microphotographs. E, Female, habitus; F, Male, habitus.

and 427–458 μm in males).

2. Both rami of the P1 in the Kim's descriptions were either 2- or 3-segmented, with claws on the distal endopodal segment, whereas tegastid copepods typically exhibit 1-segmented rami in the P1.
3. The P2–P4 exp-3 in his findings had three outer elements, contrary to the two outer elements typically present in all tegastid species.
4. Kim indicates that the urosome possessed a genital double-somite in females, although these three species generally feature a genital triple-somite in both genders.
5. Kim mentioned sexual dimorphism in the antenna, P2 endopod, and P3 exopod.

However, it is well established that tegastid copepods occasionally manifest disparities in the setal armature on the P3 EXP-3 and P4 ENP-3 between males and females, as observed in species such as *T. nanus* and *T. okinawaensis* Back, Huys and Lee, 2010 (Ferrari et al., 2007; Back et al., 2010). Furthermore, Kim's brief depictions of these species do not align with their original descriptions, particularly regarding antennular segmentation and the setal armature of the thoracic legs. Among these characteristics, nos. 2, 3, and 5 are inconsistent with the diagnostic criteria of the family. In light

of these differences, it would be valuable to examine Kim's contributions more closely. From another perspective, the apparent lack of a robust peer review process for his work is a concerning issue. This concern has been previously raised in studies critiquing Kim's 2013 and 2014 research on Korean harpacticoid fauna (Huys and Lee, 2018; Lee and Huys, 2019; Song et al., 2020; Karanovic, 2023). As a result of these findings, we officially exclude the tegastid copepods *T. nanus*, *T. minutus*, and *S. dentipes* from the record of Korean harpacticoid species.

A key to species of the family Tegastidae Sars, 1904 known from Korean waters

1. P2–P4 with 3-segmented both rami; exopod and baseoendopod of female P5 distinctly separate·····2 (*Tegastes*)
– P2–P3 with 2-segmented exopods and 3-segmented endopods, P4 with 3-segmented exopod and 2-segmented endopod; exopod and baseoendopod of female P5 nearly completely fused together (trace of division remains distally), forming massive foliaceous plate····· 4 (*Syngastes*)
2. P5-bearing somite discrete in both sexes; baseoendopod of female P5 not expanded····· *T. lobus* sp. nov.
– P5-bearing, genital and first abdominal somites completely fused, forming genital triple-somite in both sexes; baseoendopod of female P5 expanded, as nearly rectangular or triangular forms ····· 3
3. Antennule 7-segmented in females and 9-segmented in males; antennary exopod 1-segmented; female P5 baseoendopod triangular form ····· *T. tresetosus* sp. nov.
– Antennule 8-segmented in females and 10-segmented in males; antennary exopod 2-segmented; female P5 baseoendopod triangular form ·····*T. pilosus* sp. nov.
4. Female antennule 8-segmented; P2–P3 EXP-1 with 1 inner seta; maxillipedal basis with pointed palmar margin in proximal part ····· *S. acutus* sp. nov.
– Female antennule 5- or 7-segmented; P2–P3 EXP-1 with 2 inner setae; maxillipedal basis with round and swollen palmar margin in proximal part ····· 5
5. Dorsal outline gibbose in both sexes; antennule 5-segmented in females and 9-segmented in males; P4 ENP-1 with 1 inner element·····*S. multicavus*
– Dorsal outline not gibbose in both sexes; antennule 7-segmented in females and 8-segmented in males; P4 ENP-1 with 2 inner elements (1 small and 1 long)·····
·····*S. pseudofoveatus*

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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REFERENCES

Back J, Huys R, Lee W, 2010. A new species of the genus *Tegastes* (Copepoda: Harpacticoida: Tegastidae) from hydrothermal vents in the Okinawa Trough. Zoological Science, 27:678-688. https://doi.org/10.2108/zsj.27.678

Bartsch I, 1993. *Syngastes craterifer*, ein neuer Tegastide (Harpacticoida, Copepoda) von Sudwestaustralien. Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut, Hamburg, 90:187-195.

Bartsch I, 1994. Three new species of *Syngastes* from southwestern Australia (Tegastidae, Harpacticoida, Copepoda). Spixiana, 17:161-173.

Bartsch I, 1995. A new tegastid (Tegastidae: Harpacticoida: Copepoda) from southwestern Australia: *Syngastes dentipes* sp. nov. Records of the Western Australian Museum, 17:221-226.

Bartsch I, 1999. Three new species of *Syngastes* (Tegastidae, Harpacticoida, Copepoda) from Western Australia. In: Proceedings of the Ninth International Marine Biological Workshop. The seagrass flora and fauna of Rottnest Island, Western Australia. Held at Rottnest Island (Western Australia), January 1996 (Eds., Walker DI, Wells FE). Western Australian Museum, Perth, pp. 295-313.

Boxshall GA, Halsey SH, 2004. An introduction to copepod diversity. The Ray Society, London, pp. 1-966.

Chislenko LL, 1967. Copepoda Harpacticoida of the Karelian coast of the White Sea. Proceedings of the White Sea Biological Station, Zoological Institute, 7:48-196.

Claus C, 1860. Beiträge zur Kenntnis der Entomostraken. Erstes Heft. Marburg, 1:1-28.

Claus C, 1863. Die frei lebenden Copepoden mit besonderer Berücksichtigung der Fauna Deutschlands, der Nordsee und des Mittelmeeres. Verlag von Wilhelm Engelmann, Leipzig, pp. 1-230. https://doi.org/10.5962/bhl.title.58676

Ferrari FD, Rybnikov PV, Dahms HU, 2007. Redescription of *Tegastes nanus* Sars, 1904 (Copepoda: Harpacticoida: Tegastidae) from Spitsbergen in the Arctic Ocean. Invertebrate Zoology, 4:1-14. https://doi.org/10.15298/invertzool.04.1.01

Geddes DC, 1968. Marine biological investigations in the Bahamas. 7. Harpacticoid copepods belonging to the families Porcellidiidae Sars, Peltidiidae Sars, and Tegastidae Sars. Sarsia, 35:9-56. https://doi.org/10.1080/00364827.1968.10413402

Gollner S, Ivanenko VN, Martínez Arbizu P, 2008. A new species of deep-sea Tegastidae (Crustacea: Copepoda: Harpacticoida) from 9°50′N on the East Pacific Rise, with remarks on its ecology. Zootaxa, 1866:323-336. https://doi.org/10.11646/zootaxa.1866.1.16

Humes AG, 1981a. A new species of *Tegastes* (Copepoda: Harpacticoida) associated with a scleractinian coral at Enewetak Atoll. Proceedings of the Biological Society of Washington, 94:254-263.

Humes AG, 1981b. Harpacticoid copepods associated with Cnidaria in the Indo-west Pacific. Journal of Crustacean Biology, 1:227-240. https://doi.org/10.2307/1548161

Humes AG, 1984. Harpacticoid copepods associated with cnidarians in the tropical Pacific Ocean. Zoologica Scripta, 13:209-221. https://doi.org/10.1111/j.1463-6409.1984.tb00038.x

Huys R, 2016. Harpacticoid copepods—their symbiotic associations and biogenic substrata: a review. Zootaxa, 4174:448-729. https://doi.org/10.11646/zootaxa.4174.1.28

Huys R, Boxshall GA, 1991. Copepod evolution. The Ray Society, London, pp. 1-468.

Huys R, Lee J, 2018. *Philippiphonte aspidosoma* gen. et sp. n., a radically divergent member of the Laophontidae from shell gravel in the East Sea, South Korea, including a review of *Folioquinpes* Fiers & Rutledge, 1990 (Copepoda, Harpacticoida). ZooKeys, 775:15-46. https://doi.org/10.3897/zookeys.775.26404

Ivanenko VN, Defaye D, 2004. A new and primitive genus and species of deep-sea Tegastidae (Crustacea, Copepoda, Harpacticoida) from the Mid-Atlantic Ridge, 37°N (Azores triple junction, Lucky Strike). Cahiers de Biologie Marine, 45:255-268.

Karanovic T, 2023. Four rare harpacticoid copepods from shallow littoral habitats in South Korea. Zootaxa, 5311:568-578. https://doi.org/10.11646/zootaxa.5311.4.4

Kim JG, Jung TW, Yoon SM, 2016. Two new species of the genus *Syngastes* (Copepoda, Harpacticoida, Tegastidae) from South Korea. Crustaceana, 89:431-458. https://doi.org/10.1163/15685403-00003533

Kim JG, Lee J, 2020. A new species of the genus *Smacigastes* Ivanenko & Defaye, 2004 (Tegastidae, Harpacticoida, Copepoda) from the Onnuri Vent Field in the Indian Ocean. Zoosystematics and Evolution, 96:699-714. https://doi.org/10.3897/zse.96.54507

Kim SH, 2013. Invertebrate fauna of Korea, 21(27), Marine Harpacticoida II. National Institute of Biological Resources, Incheon, pp. 1-113.

Kim SH, 2014. Invertebrate fauna of Korea, 21(36), Marine Harpacticoida III. National Institute of Biological Resources, Incheon, pp. 1-98.

Lang K, 1948. Monographie der Harpacticiden Vols. I & II. Nordiska Bøkhandeln, Stockholm, pp. 1-1682.

Lang K, 1965. Copepoda Harpacticoidea from the Californian Pacific coast. Kunglieren svenska Vetenskapsakademiens Handlingar, 10:1-560.

Lee J, Chang CY, Kim IH, 2022. Symbiotic copepods (Cyclopoida and Siphonostomatoida) collected by light trap from Korea. ZooKeys, 1115:1-71. https://doi.org/10.3897/zookeys.1115.83266

Lee J, Huys R, 2019. New Ancorabolidae (Copepoda: Harpacticoida) from Korea: two new genera, revisionary notes and updated identification keys. Zoological Journal of the Linnean Society, 187:331-377. https://doi.org/10.1093/zoolinnean/zlz019

Lee W, Park E, Song SJ, 2012. Invertebrate fauna of Korea, 21 (11), Marine Harpacticoida. National Institute of Biological Resources, Incheon, pp. 1-276.

Marcus A, 1977. The family Tegastidae Sars (Copepoda, Harpacticoida) from the Indian Ocean. Travaux du Museum d'Histoire Naturelle 'Grigore Antipa', 18:73-87.

McAlice BJ, Coffin WL, 1990. First records of *Tegastes falcatus* (Norman 1868) and *T. nanus* Sars, 1904 (Copepoda: Harpacticoida) from the east coast of the United States and a redescription of *T. nanus*. Journal of Crustacean Biology, 10:703-707. https://doi.org/10.2307/1548414

Médioni A, Soyer J, 1967. Copépodes Harpacticoïdes de Banyuls-sur-Mer. 6. Nouvelles formes associées a des Bryozoaires. Vie et Milieu A, 18:317-343.

Pesta O, 1932. Marine Harpacticiden aus dem Hawaiischen Inselgebiet. Zoologische Jahrbucher, 63:145-162.

Pesta O, 1959. Harpacticoiden (Crust. Copepoda) aus submarinen Höhlen und den benachbarten Litoralbezirken am Kap von Sorrent (Neapel). Pubblicazioni della Stazione Zoologica di Napoli, 30:94-177.

Plum C, Martínez Arbizu P, 2009. Discovery of *Smacigastes* Ivanenko & Defaye, 2004 (Copepoda: Harpacticoida: Tegastidae) in a deep-sea cold seep, with the description of a new species from the Gulf of Mexico. Zootaxa, 2096:338-355. https://doi.org/10.11646/zootaxa.2096.1.20

Sars GO, 1904. Copepoda Harpacticoida. Parts V & VI. Harpacticidae (concluded), Peltidiidae, Tegastidae, Porcellidiidae, Idyidae (part). An account of the Crustacea of Norway, with short descriptions and figures of all the species. Bergen Museum, 5:57-80.

Sars GO, 1910. Copepoda Harpacticoida. Parts XXIX & XXX.

Tachidiidæ (concluded), Metidæ, Balaenophilidæ, supplement (part). An account of the Crustacea of Norway, with short descriptions and figures of all the species. Bergen Museum, 5:337-368.

Seifried S, 2003. Phylogeny of Harpacticoida (Copepoda): revision of "Maxillipedasphalea" and Exanechentera. Cuvillier Verlag, Göttingen, pp. 1-266.

Shirayama Y, Kaku T, Higgins RP, 1993. Double-sided microscopic observation of meiofauna using an HS-Slide. Benthos Research, 1993:41-44. https://doi.org/10.5179/benthos1990.1993.44_41

Song SJ, Lee SK, Lee JS, Khim JS, 2020. A new species of *Xouthous* Thomson (Copepoda: Harpacticoida: Pseudotachidiidae), widely distributed in the Korean waters. Annales Zoologici, 70:507-519. https://doi.org/10.3161/00034541anz2020.70.4.003

Wells JBJ, 2007. An annotated checklist and keys to the species of Copepoda Harpacticoida (Crustacea). Zootaxa, 1568:1-872. https://doi.org/10.11646/zootaxa.1568.1.1

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