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Redescription on two calanoid copepods from Korean waters

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Pseudocalanus minutus (Clausocalanidae) and *Tortanus* (*Boreotortanus*) *discaudatus* (Tortanidae) are newly added in the Korean species list. The two species were collected from the East Sea under the influence of the southward cold current (North Korean Cold Current). *P. minutus* exhibits the following characteristics: in lateral view cephalosome of *P. minutus* is protruding, anterior rostrum is somewhat angular, and has spiniform processes on posteroventral margins of the second and third pedigerous somites. *T.* (*B.*) *discaudatus* is characterized by the following: the caudal rami of male and female are remarkably asymmetrical, the right caudal ramus is longer than the left one; in female, the outer marginal seta of right caudal ramus is modified into a swollen process; in male, thicker and longer than the left. In this study, we provide detailed descriptions of *P. minutus* and *T.* (*B.*) *discaudatus* due to their insufficient original descriptions, along with taxonomic keys to the species.

Keywords: Clausocalanidae, East Sea, Korean waters, *Pseudocalanus*, Tortanidae, *Tortanus*

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Introduction

The East Sea is hydrographically distinct in the upper water column: in the coastal region, the East Korean Warm Current characterized by high salinity flows northward along the Korean coast (Hase *et al*., 1999), while the North Korean Cold Current characterized with low salinity flows southward (Huh and Shim, 1987; Ashjian *et al*., 2005). Fronts typically have high productivity and diverse plankton species composition (Bowman and Esaias, 1977). In the East Sea, which has these hydrographic characteristics, we obtained two species, *Pseudocalanus* and *Tortanus*, respectively.

The genus *Pseudocalanus* Boeck (1873) is one of the genera of the family Clausocalanidae Giesbrecht (1892) and is widely distributed in temperate-boreal neritic waters of the Northern Hemisphere (Corkett and McLaren, 1978). On the other hand, the genus *Tortanus* Giesbrecht in Giesbrecht & Schmeil, 1898 which comprises five subgenera (*Acutanus* Ohtsuka, 1992; *Atortus* Ohtsuka, 1992; *Boreotortanus* Ohtsuka & Reid, 1998; *Eutortanus* Smirnov, 1935; *Tortanus* Giesbrecht in Giesbrecht & Schmeil, 1898) is widely distributed throughout the coastal regions of the Indo-Pacific and Northwest Atlantic, but each subgenus has a restricted distribution (Ohtsuka, 1992; Ohtsuka *et al*., 1992). In Korean waters, so far, the genus *Pseudocalanus* has comprised only one species, *P. newmani* Frost, 1989, while the genus *Tortanus* did eight species (*T.* (*Eutortanus*) *derjugini* Smirnov, 1935; *T.* (*E.*) *dextrilobatus* Chen & Zhang, 1965; *T.* (*Tortanus*) *forcipatus* (Giesbrecht, 1889); *T.* (*T.*) *gracilis* (Brady, 1883); *T.* (*E.*) *komachi* Itoh, Ohtsuka & Sato, 2001; *T.* (*Atortus*) *longipes* Brodsky, 1948; *T.* (*E.*) *spinicaudatus* Shen & Bai, 1956; *T.* (*E.*) *vermiculus* Shen, 1955).

In this study, we redescribe *Pseudocalanus minutus*

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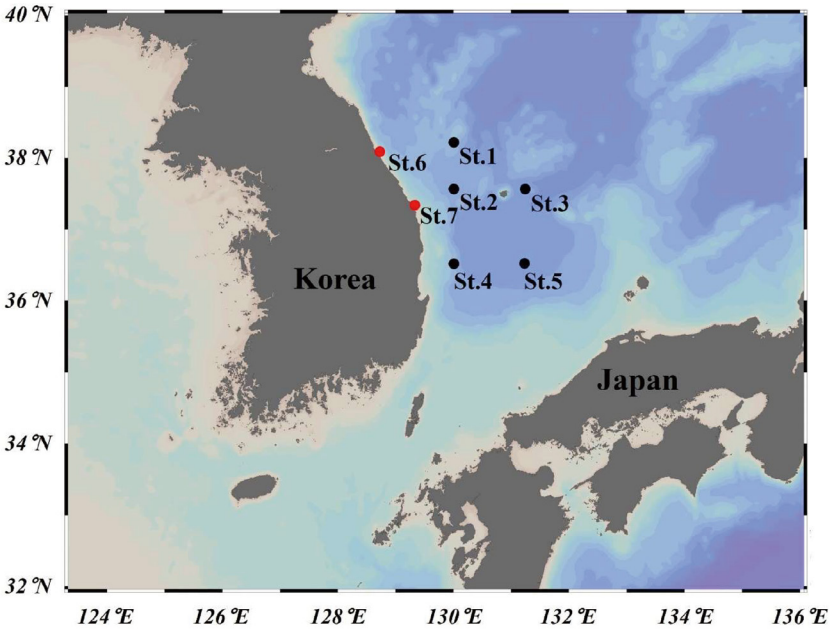

Fig. 1. Map of study area showing sampling location.

(Krøyer, 1845) and *Tortanus* (*Boreotortanus*) *discaudatus* (Thompson I.C. & Scott A., 1897) and these species are newly added to the Korean species list. Also, we provide key characteristics for species identification that were not described in previous records.

Materials and Methods

Zooplankton were collected from coastal waters of the East Sea (Fig. 1), using a conical net (mesh size 200 μm). The samples were fixed to a final concentration of 5% with neutralized formaldehyde for morphological description. *Pseudocalanus minutus* and *Tortanus discaudatus* were sorted out and dissected under a dissecting microscope (SMZ745T; Nikon, Japan) in CMC-10 aqueous mounting medium (Masters, Wood Dale, IL, USA), mounted on slides, and then sealed with high-quality nail varnish. Drawings were generated using a differential interference contrast microscope (ECLIPSE 80i, Nikon, Tokyo, Japan) equipped with a drawing tube and digital pen display (Cintiq 22HD, Wacom, Kazo, Japan). Morphological terminology follows Huys and Boxshall (1991). Voucher specimens were deposited in the National Marine Biodiversity Institute of Korea (MABIK), Seocheon, South Korea.

Systematic Accounts

Order Calanoida Sars G.O., 1903

Family Clausocalanidae Giesbrecht, 1892

Genus *Pseudocalanus* Boeck, 1873

***Pseudocalanus minutus* (Krøyer, 1845) (Figs. 2–4)**

Korean name: 미세가시헛노벌레 (신칭)

Calanus minutus Krøyer, 1845: pl. 41, fig. 4.

Pseudocalanus gracilis Sars, 1903: p. 154, suppl. pl. I; Mori, 1937: p. 36, pl. 14, figs. 12–17.

Pseudocalanus elongatus Brodsky, 1950: p. 112, fig. 34.

Pseudocalanus minutus Wilson, 1932: p. 43, fig. 25; Tanaka, 1956: p. 384; Geletin, 1977: p. 85, fig. 2; Brodsky *et al*., 1983: p. 221, fig. 103; Frost, 1989: p. 530, fig. 4; Samatov, 2001: p. 219, fig. 1; Markhaseva et. al., 2012: p. 65, figs. 7–9.

Material examined. 1♀ (MABIK CR00258688) dissected in 12 slides glasses, 37♀♀, East Sea (St. 1), 38°12′36.00″N, 130°0′0.00″E, Feb. 2023; 22♀♀, East Sea (St. 2), 37°33′11.88″N, 130°0′0.00′E, Feb. 2023; 33♀♀, East Sea (St. 3), 37°33′11.88″N, 131°14′35.88″E, Feb. 2023; 8♀♀, East Sea (St. 4), 36°30′18.00″N, 130°0′0.00″E, Feb. 2023; 7♀♀, East Sea (St. 5), 36°30′18.00″N, 131°13′58.80″E, Feb. 2023. 10 individuals were used for length measurement.

Description. Female. Body length 1.38–1.89 mm (n = 10). Body elongated; cephalosome somewhat triangular in dorsal view; cephalosome clearly fused with first pedigerous somite; cephalosome protruding anteriad of rostrum, with pair of filaments; fourth and fifth pedigerous somites fused; posterolateral corners of prosome symmetrical and rounded (Fig. 2A, B). Posteroventral margins of second

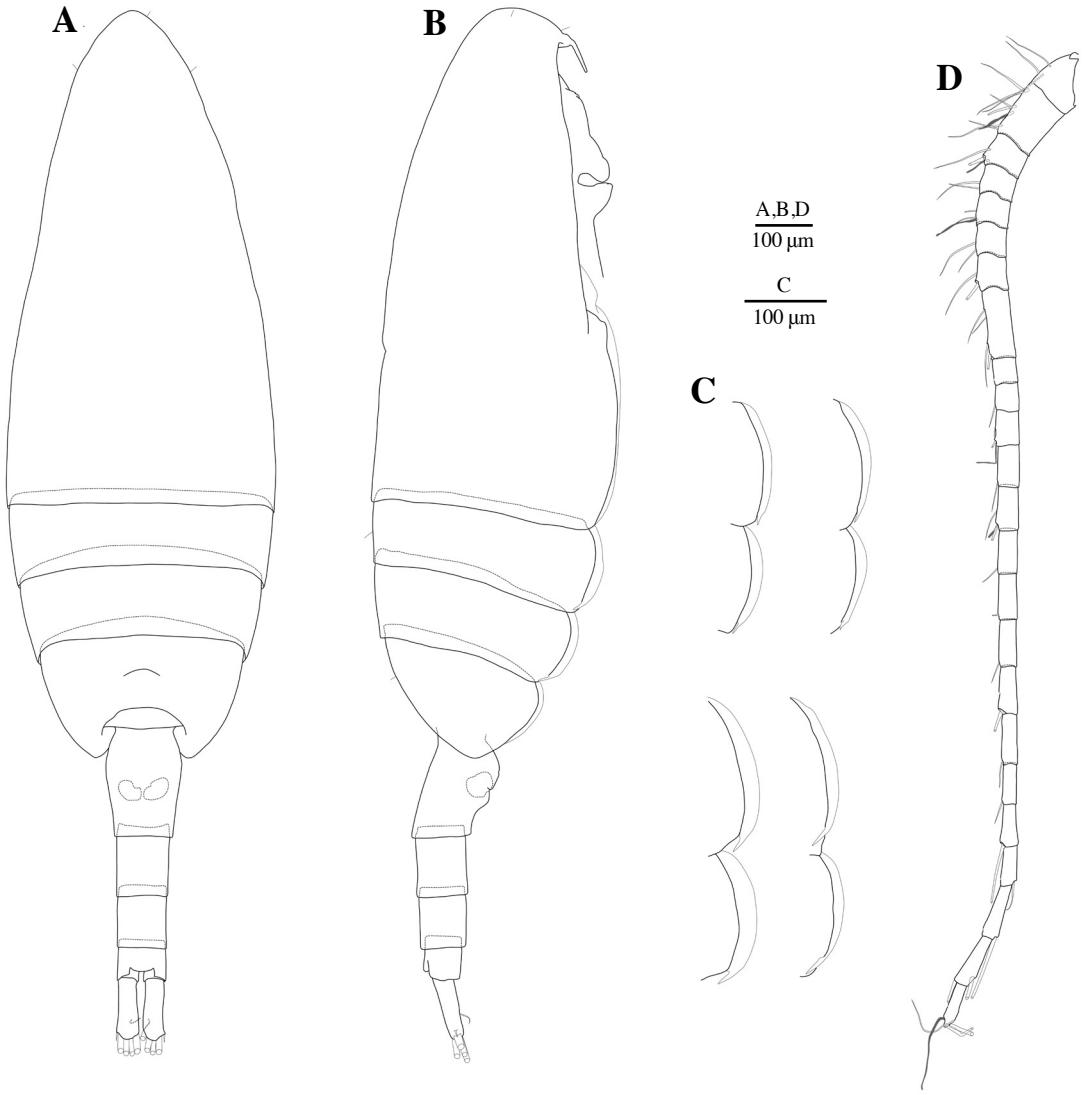

Fig. 2. *Pseudocalanus minutus* (Krøyer, 1845), female. A, Habitus, dorsal; B, Habitus, right lateral; C, Posteroventral margins of second and third pedigerous somites; D, Antennule. Scale bars in µm.

and third pedigerous somites with spiniform processes (Fig. 2B). Urosome 4-segmented; genital double somite symmetrical, spermathecae well visible in lateral view; anal segment shortest; anal segment and caudal rami separated (Fig. 2A, B). Caudal rami symmetrical; caudal rami with 1 small dorsolateral seta, 1 ventral seta and 4 setae (Fig. 2A, B).

Antennule symmetrical, 24-segmented; extends beyond anal segment (Fig. 2D). Fusion pattern and setal formula as follows: I-3, II-IV-6 + ae (aesthetasc), V-2 + ae, VI-2, VII-2 + ae, VIII-2, IX-2, X-XI-4 + ae, XII-1, XIII-1, XIV-2 + ae, XV-1, XVI-2 + ae, XVII-1, XVIII-1, XIX-1, XX-2, XXI-1 + ae, XXII-1, XXIII-1, XXIV-1 + 1, XXV-1 + 1, XXVI-1 + 1, XXVII-XXVIII-4 + ae.

Antenna biramous, exopod slightly larger than endopod; coxa with 1 seta; basis with 2 setae; endopod 2-segmented; first endopodal segment with 2 setae, row of posterior spinules on distal; second endopodal segment with 8 + 7 setae, row of posterior spinules on distal lobe; exopod incompletely 8-segmented, with setal formula 1-1, 1-1, 1, 1, 1, 1, 1, 3 (Fig. 3A).

Mandible with coxal gnathobase and biramous palp; gnathobase with about 8 teeth; basis of mandibular palp with 4 setae; endopod 2-segmented; first endopodal segment with 4 setae, row of posterior spinules on distal; second endopodal segment with 11 setae; exopod 5-segmented, setal formula 1, 1, 1, 1, 2 (Fig. 3B).

Maxillule praecoxal arthrite with 14 stout setae; coxal endite with 3 setae, epipodite with 9 setae; basis proximal and distal basal endite with each 4, 5 setae; endopod

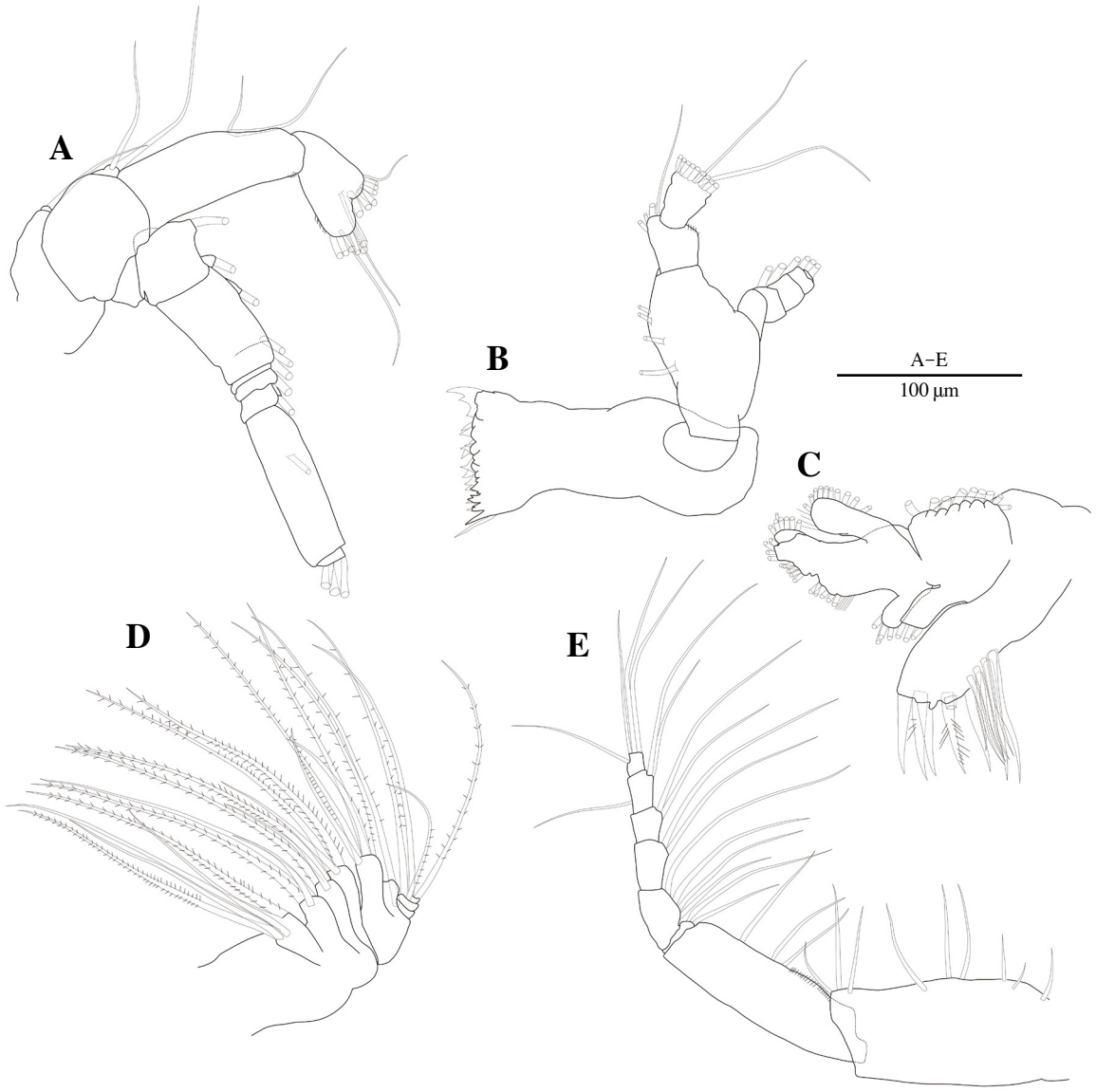

Fig. 3. *Pseudocalanus minutus* (Krøyer, 1845), female. A, Antenna; B, Mandible; C, Maxillule; D, Maxilla; E, Maxilliped. Scale bar in μm.

1-segmented, with 16 setae; exopod 1-segmented, with 10 setae (Fig. 3C).

Maxilla with praecoxa and coxa partly fused, endites setal formula 5, 3, 3, 3; basis endite with 4 setae; endopod 4-segmented, with 5 setae (Fig. 3D).

Maxilliped, syncoxa with endite setal formula 1, 2, 3, 3; basis with 3 setae, row of posterior spinules on proximal; 2 setae on incompletely incorporated first endopodal segment; endopod 5-segmented, segmental setal formula 4, 2, 2, 2 + 1, 4 (Fig. 3E).

Legs 1 to 4 biramous: leg 1 with 1-segmented endopod and 3-segmented exopod, leg 2 with 2-segmented endopod and 3-segmented exopod, legs 3 to 4 with 3-segmented endopod and exopod (Fig. 4A–D). Coxa of leg 1 without seta; basis with curved medial distal seta (Fig. 4A). Coxae of legs 2 to 4 with inner marginal seta (Fig. 4B–D). Seta and spine formula of legs 1 to 4 as follows (spines, Roman numerals; setae, Arabic numerals):

	Coxa	Basis	Exopodal segment	Endopodal segment
Leg 1	0-0	0-1	I-0; I-1; I,I,3	0,2,3
Leg 2	0-1	0-0	I-1; I-1; III,I,4	0-1; 1,2,2
Leg 3	0-1	0-0	I-1; I-1; III,I,4	0-1; 0-1; 1,2,2
Leg 4	0-1	0-0	I-1; I-1; III,I,4	0-1; 0-1; 1,2,2

Fifth leg of female absent.

Male not found in present study.

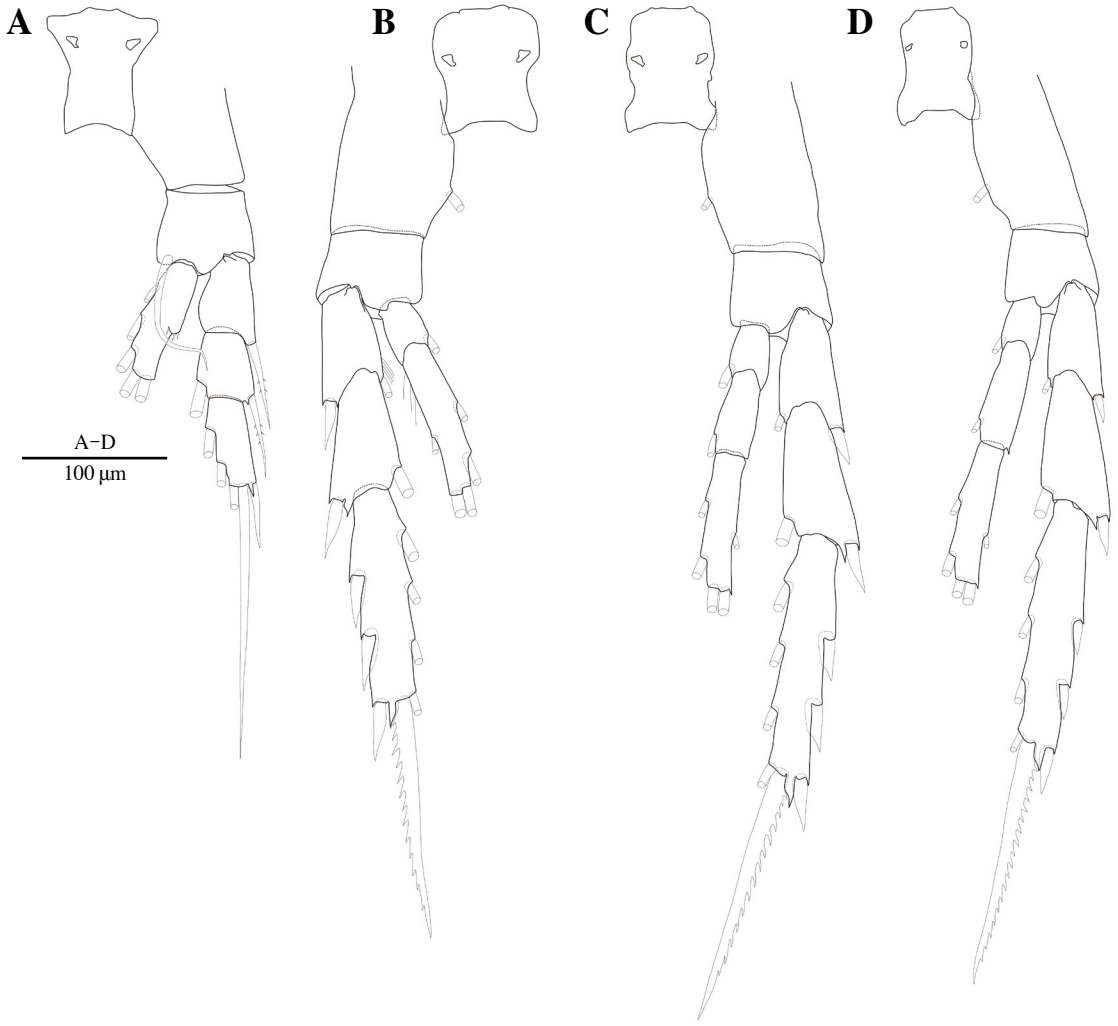

Fig. 4. *Pseudocalanus minutus* (Krøyer, 1845), female. A, Leg 1; B, Leg 2; C, Leg 3; D, Leg 4. Scale bar in μm.

Distribution. *Pseudocalanus minutus* was recorded in Norwegian coast (Sars, 1903), North Atlantic Ocean (Wilson, 1932), North Pacific Ocean (Mori, 1937), Sagami Bay (Tanaka, 1956), Black Sea (Brodsky, 1950), Northwestern Pacific (Geletin, 1977; Samatov, 2001), and White Sea (Markhaseva *et al*., 2012).

Remarks. *Pseudocalanus minutus* has wide geographical distribution, commonly co-existing with two or three other species of the genus. *P. minutus* and *P. newmani* are genus *Pseudocalanus* species that occur in the temperate-boreal coastal waters of the western Pacific. Compared to other *Pseudocalanus* species, the urosome of *P. minutus* tends to be shorter than its cephalosome (Frost, 1989). *P. minutus* exhibits the following morphological differences from *P. newmani*: 1) cephalosome of *P. minutus* in lateral view is protruding anteriad of rostrum and somewhat angular, but *P. newmani* is scarcely protruding anteriad of rostrum; 2) spiniform processes are present on posteroventral margins of second and third pedigerous somites in *P. minutus*, but not present in *P. newmani* (in *P. newmani*, spiniform processes may sometimes be present (Frost, 1989)). In *P. minutus*, the spiniform processes on the posteroventral margins of the second and third pedigerous somites show morphological variation. Spiniform processes may be long, short or absent (Markhaseva, 2012). In Korean waters, the long or short spiniform processes described by Markhaseva (2012) were also confirmed (Fig. 2C). However, *P. minutus* individuals without spiniform processes were not collected in Korean waters.

Key to species of genus *Pseudocalanus* in Korean waters

1. Posteroventral margins of second and third pedigerous somites with spiniform processes·····*P. minutus*
2. Posteroventral margins of second and third pediger-

ous somites without spiniform processes ··· *P. newmani*

Order Calanoida Sars G.O., 1903
Family Tortanidae Sars G.O., 1902
Genus *Tortanus* Giesbrecht & Schmeil, 1898

Tortanus* (*Boreotortanus*) *discaudatus
(Thompson I. C. & Scott A., 1897) (Figs. 5–8)
Korean name: 한쪽꼬리부푼긴노벌레 (신칭)
Corynura discaudata Thompson and Scott, 1897: p. 80, pl. VI, figs. 1–11, pl. VII, figs. 1–2.
Corynura bumpusii Wheeler, 1901: p. 184, fig. 21.
Tortanus discaudatus Esterly, 1924: p. 109, fig. P; Brodsky, 1950: p. 429, fig. 304; Anraku and Omori, 1963: p. 119, figs. 5–10; Gardner and Szabo, 1982: p. 424; Ohtsuka and Reid, 1998: p. 776, figs. 1–4.

Material examined. 1♀ (MABIK CR00258690) dissected in 12 slides glasses, 1♂ (MABIK CR00258689) dissected in 12 slides glasses, 14♀♀, 12♂♂, East Sea (St. 6), 38°04′50.20″N, 128°42′32.90″E, Jul. 2022; 3♀♀, East Sea (St. 7), 37°19′21.10″N, 129°18′56.80″E, Jul. 2022. 10 individuals were used for length measurement.

Description. Male. Body length 1.74–1.87 mm (n = 10). Body elongated; cephalosome clearly separated from first pedigerous somite; large nauplius eye situated at anterior margin of cephalosome; rostrum absent; fourth and fifth pedigerous somites separated; posterolateral

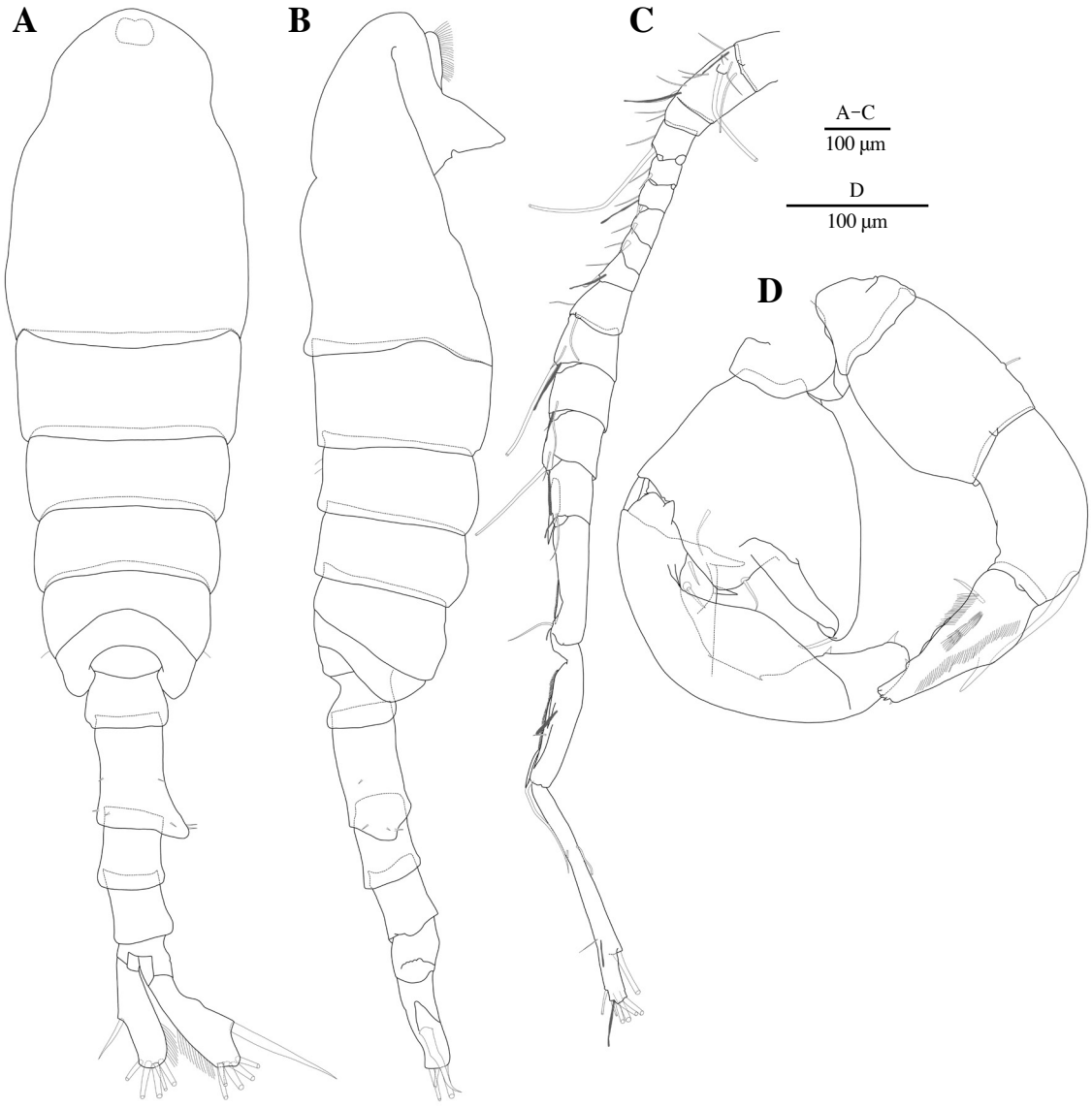

Fig. 5. *Tortanus* (*Boreotortanus*) *discaudatus* (Thompson I. C. & Scott A., 1897), male. A, Habitus, dorsal; B, Habitus, right lateral; C, Right antennule, posterior; D, Leg 5. Scale bars in μm.

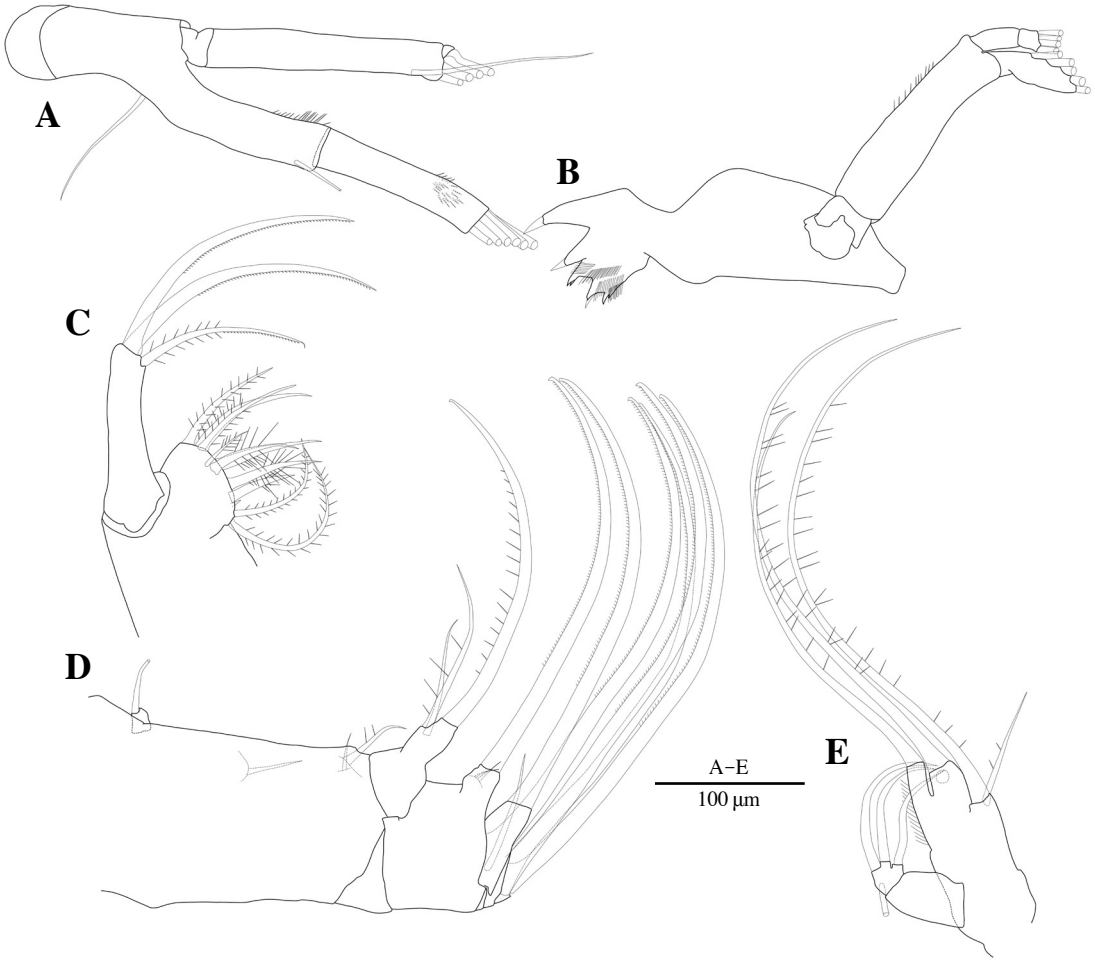

Fig. 6. *Tortanus* (*Boreotortanus*) *discaudatus* (Thompson I. C. & Scott A., 1897), male. A, Antenna; B, Mandible; C, Maxillule; D, Maxilla; E, Maxilliped. Scale bar in µm.

corners of fifth pedigerous somite rounded (Fig. 5A, B). Urosome 5-segmented; second urosomite produced laterally at right posterior corner; third urosomite and anal segment slightly asymmetrical; anal segment and caudal rami separated; caudal rami asymmetrical; right caudal ramus longer than left caudal ramus; right caudal ramus curved outward, with sclerotized right marginal seta (Fig. 5A, B).

Right antennule with segments II-XIV completely or incompletely fused (Fig. 5C). Fusion pattern and setal formula as follows: I-1, II-V-5 + ae, VI-2, VII-2 + ae, VIII-2, IX-2, X-2, XI-2 + ae, XII-2, XIII-2, XIV-2 + ae, XV-2, XVI-2 + ae, XVII-2 + ae, XVIII-2 + ae, XIX-1 + ae + 1 process, XX-1 + ae + 1 process, XXI-XXIII-2 + ae + 2 processes, XXIV-XXVIII-10 + 2ae.

Antenna biramous, endopod larger than exopod; coxa unarmed; basis fused with first endopodal segment, armed with 1 seta; endopod 2-segmented; proximal segment with 1 seta, row of posterior spinules on distal; second endopodal segment with 6 setae, row of spinules on distal; exopod 3-segmented; first exopodal segment unarmed; second exopodal segment with 3 setae; third exopodal segment with 2 setae (Fig. 6A).

Mandible with coxal gnathobase and biramous palp; gnathobase with 5 teeth; basis with row of spinules on distal; endopod 2-segmented; first endopodal segment without seta; second endopodal segment with 4 setae; exopod incompletely fused, with 5 setae (Fig. 6B).

Maxillule: basis, endopod and exopod absent; praecoxal arthrite with 10 setae and 1 minute seta, and 1 spinous process; coxal endite with 3 clawlike setae (Fig. 6C).

Maxilla developed; proximal and distal praecoxal endites with 1 and 2 setae; proximal and distal coxal endites with 2 and 3 setae; basal endite with 1 long clawlike and 2 short setae; endopod with 5 long clawlike and 1 rudimentary seta (Fig. 6D).

Maxilliped with setal formula of praecoxal and coxal

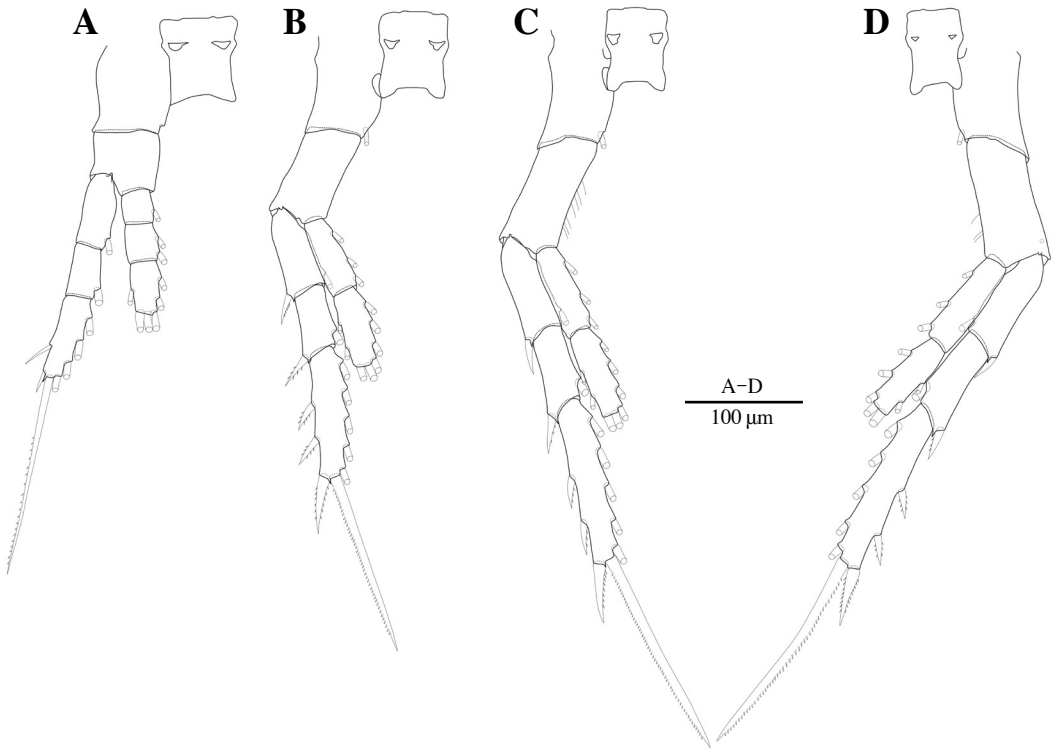

Fig. 7. *Tortanus* (*Boreotortanus*) *discaudatus* (Thompson I. C. & Scott A., 1897), male. A, Leg 1; B, Leg 2; C, Leg 3; D, Leg 4. Scale bar in μm.

endites: 0, 2, 2, 1. Basis unarmed; endopod 1-segmented, with 3 + 1 setae (Fig. 6E).

Legs 1 to 4 biramous: leg 1 with 3-segmented endopod and 3-segmented exopod, leg 2 to 4 with 2-segmented endopod and 3-segmented exopod (Fig. 7A–D). Coxae of legs 1 to 4 with inner marginal seta; basis of leg 4 with outer marginal seta (Fig. 7A–D). Seta and spine formula of legs 1 to 4 as follows (spines, Roman numerals; setae, Arabic numerals):

	Coxa	Basis	Exopodal segment	Endopodal segment
Leg 1	0-1	0-0	0-1; 0-1; II,1,4	0-1; 0-2; 1,2,3
Leg 2	0-1	0-0	I-1; I-1; III,I,5	0-3; 2,2,4
Leg 3	0-1	0-0	I-1; I-1; III,I,5	0-3; 2,2,4
Leg 4	0-1	1-0	I-1; I-1; III,I,5	0-3; 2,2,3

Fifth leg with right and left coxal segments fused to form common base. Basis of right leg expanded inward; basis with 2 triangular processes on distal and inner margin, each with minute seta; basis with 1 seta on posterior surface; exopod curved inward, proximal with 1 pointed process, 2 setae and short spine; distal of exopod with 2 spines. Basis of left leg with 1 seta on outer margin; exopod 2-segmented; first exopodal segment with 1 spiniform seta on distal outer margin; second exopodal segment tapering distally, with 1 outer spine, 1 inner seta and 1 distal spine; fringed with setules of various length (Fig. 5D).

Female: Body length 1.86–2.07 mm (n = 10). Similar male habitus except urosome. Fourth and fifth pedigerous somites separated; posterolateral corners of fifth pedigerous somite triangular process pointing backward (Fig. 8A, B). Urosome 3-segmented, asymmetrical; second urosomite and anal segment adorned with spinules on right side; anal segment and caudal rami fused; right caudal ramus thicker and longer than left caudal ramus, right marginal seta modified as large acute process (Fig. 8A, B).

Antennule symmetrical, 19-segmented; segments II-XIV almost completely or incompletely fused (Fig. 8C). Fusion pattern and setal formula as follows: I-1, II-IX-9 + 2ae (aesthetasc), X-2, XI-2 + ae, XII-2, XIII-2, XIV-2 + ae, XV-2 + ae, XVI-2 + ae, XVII-2 + ae, XVIII-2 + ae, XIX-2 + ae, XX-2, XXI-2 + ae, XXII-1, XXIII-1, XXIV-1 + 1, XXV-1 + 1 + ae, XXVI-XXVIII-6 + ae.

Fifth leg 3-segmented; both coxae and intercoxal sclerite fused to form base; basis with 1 outer marginal seta; endopod absent; exopod 1-segmented, curved inwardly, left leg longer than right leg; outer margin with 4 minute spinules (Fig. 8D).

Distribution. *Tortanus discaudatus* was recorded in the

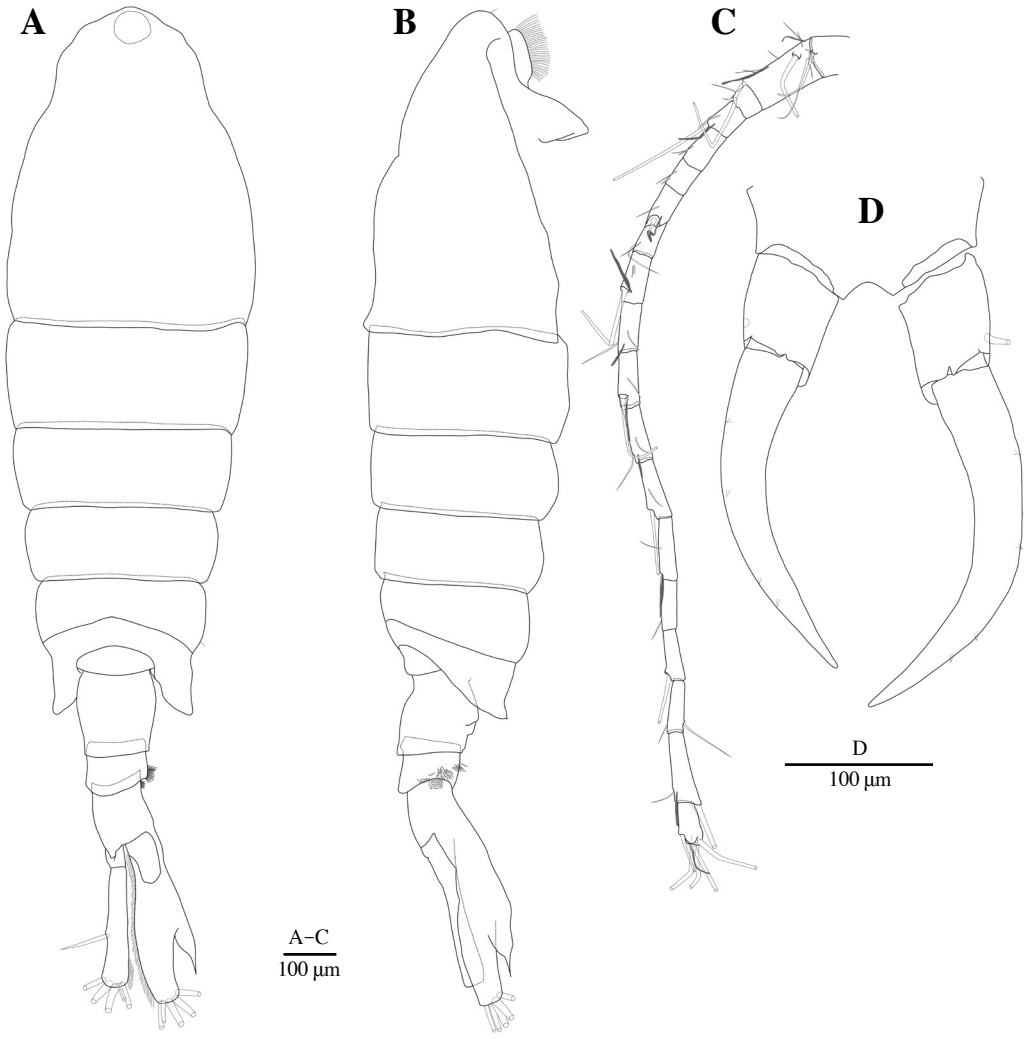

Fig. 8. *Tortanus* (*Boreotortanus*) *discaudatus* (Thompson I. C. & Scott A., 1897), female. A, Habitus, dorsal; B, Habitus, right lateral; C, Antennule, posterior; D, Leg 5. Scale bars in μm.

Woods Hole (Wheeler, 1901), San Francisco Bay (Esterly, 1924), Chukchi Sea, Bering Sea, Sea of Japan, shores of North Korea, Sea of Okhotsk, North Sea, Atlantic shore of North America (Brodsky, 1950), British Columbia coast (Gardner and Szabo, 1982).

Remarks. Ohtsuka and Reid (1998) established a new subgenus, *Boreotortanus* for *T. discaudatus*. The genus *Boreotortanus* is distinguished from other subgenera by the following morphological characteristics (Ohtsuka and Reid, 1998): 1) the caudal rami of males and females are remarkably asymmetrical, with the right caudal ramus being longer than the left caudal ramus. In female, the outer marginal seta of right caudal ramus is modified into a swollen process, and in male, it is thicker and longer than the left; 2) the characteristics of antennule segmentation and armature elements represent the most primitive state among all subgenera; 3) maxillule praecoxal arthrite with 11 setae; 4) second endopodal segment of leg 4 with 7 setae; and 5) structure of both exopods of male leg 5. The Korean specimen is consistent with the description of previous records, but there are some differences. In the illustration by Ohtsuka and Reid (1998), there are 3 minute outer spinules on the exopodal segment of the female fifth leg, but in the Korean specimen, there are 4 minute outer spinules. In males, the exopodal segment of fifth leg has bifurcate process on proximal inner margin, but in the Korean specimen, there is a pointed process on the proximal inner margin. *T.* (*B.*) *discaudatus* is distributed in the cold waters of the northwestern and northeastern Pacific coasts, extending into the southern part of the Arctic Sea and the northwestern Atlantic (Ohtsuka and Reid, 1998).

Key to species of genus *Tortanus* in Korean waters

1. Antennule asymmetrical····· 2 (Male)
1a. Antennule symmetrical····· 10 (Female)
2. Outer marginal seta of right caudal ramus much thicker and longer than left; second endopodal segment of leg 4 with 7 setae····· ····· *Tortanus* (*Boreotortanus*), *T.* (*B.*) *discaudatus*
2a. Caudal rami of male not as above; second endopodal segment of leg 4 with 6 setae ·····3
3. Leg 1 endopod 3-segmented, terminal endopodal segments of legs 2 and 3 with 8 setae ····· ····· *Tortanus* (*Eutortanus*), 4
3a. Leg 1 endopod 3-segmented, terminal endopodal segments of legs 2 and 3 with 6–7 setae ·····8
4. Fifth leg right exopod with pointed process on about 1/3 of exopodal segment···· *T.* (*E.*) *vermiculus*
4a. Fifth leg right exopod without pointed process of exopodal segment·····5
5. Fifth leg right exopod with fingerform process, wave on outer margin ····· *T.* (*E.*) *spinicaudatus*
5a. Fifth leg right exopod without fingerform process ···· ·····6
6. Fifth leg right basis with inwards long isosceles triangular proces····· *T.* (*E.*) *komachi*
6a. Fifth leg right basis without inwards long isosceles triangular process ·····7
7. Fifth leg right exopod relatively wider····· ····· *T.* (*E.*) *dextrilobatus*
7a. Fifth leg right exopod relatively narrower ····· ····· *T.* (*E.*) *derjugini*
8. Fourth and fifth pedigerous somites fused; terminal exopodal segment of leg 1 with 1 spine; terminal endopodal segments with 6 setae ····· ····· *Tortanus* (*Atortus*), *T.* (*A.*) *longipes*
8a. Fourth and fifth pedigerous somites separated; terminal exopodal segment of leg 1 with 2 spines; terminal endopodal segments with 7 setae····· ····· *Tortanus* (*Tortanus*), 9
9. Fifth leg right exopod with process on inner margin ····· *T.* (*T.*) *gracilis*
9a. Fifth leg right exopod without process on inner margin····· *T.* (*T.*) *forcipatus*
10. Outer marginal seta of right caudal ramus much thicker and longer than left; second endopodal segment of leg 4 with 7 setae····· ····· *Tortanus* (*Boreotortanus*), *T.* (*B.*) *discaudatus*
10a. Caudal rami of male not as above; second endopodal segment of leg 4 with 6 setae ·····11
11. Leg 1 endopod 3-segmented, terminal endopodal segments of legs 2 and 3 with 8 setae····· ····· *Tortanus* (*Eutortanus*), 12
11a. Leg 1 endopod 3-segmented, terminal endopodal segments of legs 2 and 3 with 6–7 setae ·····16
12. Right caudal ramus uneven dorsolateral process on anterior right side····· *T.* (*E.*) *vermiculus*
12a. Right caudal ramus unarmed on right side·····13
13. Anal segment with spiniform process on right side · ····· *T.* (*E.*) *spinicaudatus*
13a. Anal segment without spiniform process on right side·····14
14. Anal segment and caudal rami completely fused ····· ····· *T.* (*E.*) *komachi*
14a. Anal segment and caudal rami completely separated ·····15
15. Anal segment with anterolateral process ····· ····· *T.* (*E.*) *dextrilobatus*
15a. Anal segment without anterolateral process····· ····· *T.* (*E.*) *derjugini*
16. Fourth and fifth pedigerous somites fused; terminal exopodal segment of leg 1 with 1 spine; terminal endopodal segments with 6 setae ····· ····· *Tortanus* (*Atortus*), *T.* (*A.*) *longipes*
16a. Fourth and fifth pedigerous somites separated; terminal exopodal segment of leg 1 with 2 spines; terminal endopodal segments with 7 setae····· ····· *Tortanus* (*Tortanus*), 17
17. Right fifth leg about twice as long as left leg····· ····· *T.* (*T.*) *forcipatus*
17a. Right fifth leg slightly longer than left leg····· ····· *T.* (*T.*) *gracilis*

Conflicts of Interest

The author of this paper have no affiliation with any interests and is solely responsible for the paper.

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