



## On two new species of *Nannopus* Brady, 1880 (Copepoda: Harpacticoida: Nannopodidae) from intertidal mudflats of the Korean west coast (Yellow Sea)

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### Abstract

Two new species in the genus *Nannopus* Brady, 1880 (Copepoda: Harpacticoida) from intertidal mudflats of the Yellow Sea along the Korean peninsula, *Nannopus cylindricus* sp. nov. and *N. robustus* sp. nov., are described. *Nannopus cylindricus* belongs to the group of *Nannopus* species with seven elements on P4 exp-3. Within this group, it is closest to a cryptic species complex related to *N. ganghwaensis* Vakati, Kihara & Lee, 2016 based on an inflated caudal seta IV. However, *N. cylindricus* differs from the other species in this complex with respect to caudal seta V (inflated and heavily cylindrical at its base in *N. cylindricus*, inflated only in the *N. ganghwaensis* cryptic complex). *Nannopus robustus* belongs to the group of species displaying two setae on P2 enp-2. Within this group, *N. robustus* is closely related to *N. serratus* Vakati & Lee, 2017 based on the presence of one endopodal naked seta arising from a stem-like protrusion on the mandibular palp. However, *N. robustus* can be distinguished from *N. serratus* based on the following characters: outermost distal spine on P2 exp-3 (extremely strong, smooth and recurved in *N. robustus*, moderately strong, denticulate and normal-shaped in *N. serratus*, and spine 1.6 times as long in *N. robustus* as in *N. serratus*), P2 exp-2 inner seta (absent in *N. robustus*, present in *N. serratus*), shape of caudal seta V (anterior part distinctly cylindrical in *N. robustus*, normal-shaped in *N. serratus*), and ornamentation of caudal seta VI (naked in *N. robustus*, pinnate in *N. serratus*). An updated key to the 17 valid species of *Nannopus* is provided.

**Key words:** Crustacea, Harpacticoida, new species, taxonomy, East Asia

### Introduction

The genus *Nannopus* Brady, 1880 was established by Brady (1880) as the type genus of the family Nannopodidae (for a review of the nomenclature surrounding this name see Huys (2009: 30)). Currently, fifteen valid species of *Nannopus* have been reported from different parts of the world: United Kingdom (one species), Lake Tanganyika in Zambia (one species), China (one species), Svalbard (one species), the Netherlands (two species), Sweden (one species), Belgium (one species), and Korea (seven species) (Table 1). In addition to these valid species, several specimens of *Nannopus* have been reported without clear confirmation from several parts of the world, indicating a wider distribution of the genus on a global scale (Fiers & Kotwicki 2013; Garlitska *et al.* 2012).

The Korean West Coast is covered with a vast quantity of mudflats that provide suitable habitats for a variety of invertebrate fauna. Among the harpacticoids that inhabit these mudflats, a dominant genus is *Nannopus* Brady, 1880. The first report of the genus *Nannopus* from Korean waters was by Yoo & Lee (1995) followed by Vakati *et al.* (2016), Kim *et al.* (2017), Vakati & Lee (2017) and Vakati *et al.* (2019). During previous studies of harpacticoids from intertidal mudflats of the Korean West Coast, nine species of *Nannopus* have been reported and described: *N. ganghwaensis* Vakati, Kihara & Lee, 2016, *N. parvipilis* Kim, Choi & Yoon, 2017, *N. bulbiseta* Vakati & Lee, 2017, *N. dimorphicus* Vakati & Lee, 2017, *N. minutus* Vakati & Lee, 2017, *N. parvus* Vakati & Lee, 2017, *N. serratus* Vakati & Lee, 2017, and two cryptic species (Vakati *et al.* 2019).

Sediment samples were collected from 15 intertidal mudflats along the Korean West Coast during the years 2013, 2015 and 2016 as part of ecological surveys (Vakati *et al.* 2019). Here we describe and illustrate two additional new species from stations 6a and 8 that were collected as part of the 2013 and 2015 sampling campaigns. We discuss their similarities and differences to other species in the genus *Nannopus* and highlight the morphological characters that distinguish these species from other congeners living in the region.

**TABLE 1.** Species of *Nannopus* currently recognized as valid and their respective distribution.

No.	Species	Authority	Locality
1	<i>N. palustris</i>	Brady, 1880	Seaton sluice, United Kingdom
2	<i>N. flexibilis</i>	(Lilljeborg, 1902)	Lake Malaren, Sweden
3	<i>N. perplexus</i>	(Sars, 1909)	Lake Tanganyika, Zambia
4	<i>N. unisegmentatus</i>	Shen & Tai, 1964	Canton (Pearl River), China
5	<i>N. didelphis</i>	Fiers & Kotwicki, 2013	Spitsbergen, Svalbard
6	<i>N. hirsutus</i>		Oosterschelde, The Netherlands
7	<i>N. procerus</i>		Oosterschelde, The Netherlands
8	<i>N. scaldicola</i>		Kallo, Belgium
9	<i>N. ganghwaensis</i>	Vakati, Kihara & Lee, 2016	Ganghwa Island, Korea
10	<i>N. parvipilis</i>	Kim, Choi & Yoon, 2017	Jindo Island, Korea
11	<i>N. bulbiseta</i>	Vakati & Lee, 2017	Ganghwa Island, Korea
12	<i>N. dimorphicus</i>		Seocheon-gun, Korea
13	<i>N. minutus</i>		Ganghwa Island, Korea
14	<i>N. parvus</i>		Ganghwa Island, Korea
15	<i>N. serratus</i>		Ganghwa Island, Korea

## Materials and methods

Specimens of both new species were identified from samples collected from stations 6a and 8 (described in Vakati *et al.* (2019)). All specimens were sorted under an Olympus SZX12 dissecting microscope and preserved in 99% ethanol at 4°C. Specimens of both species presented here were first processed for non-destructive DNA extraction as described in Vakati *et al.* (2019).

Specimens for line drawings were mounted on glass slides in lactophenol and placed in 70% ethanol. Morphological observations and drawings were made from whole specimens. Microscopic observations and drawings were prepared under an Olympus BX51 microscope equipped with a drawing tube. The terminology proposed by Huys & Boxshall (1991) for morphological descriptions was adopted. Abbreviations used in the text are as follows: A1, antennule; A2, antenna; ae, aesthetasc; exp, exopod; end, endopod; exp (enp)-1(2, 3) to denote the proximal (middle, distal) segment of the exopods (endopod); P1–P6, first to sixth thoracopods. Digital photographs were processed and combined into plates using Adobe Photoshop CS6. All specimens were deposited in the collection of the National Institute of Biological Resources (NIBR). The area map was obtained from Quantum GIS Geographic Information System and all figures were combined into a final plate in Adobe Photoshop CS6.

## Systematics

### Order Harpacticoida Sars, 1903

### Family Nannopodidae Brady, 1880

### Genus *Nannopus* Brady, 1880

***Nannopus cylindricus* sp. nov.**

(Figs. 2–3)

**Type locality.** Intertidal mudflat, St-6a—Gilsang-myeon, Ganghwa Island, Korea, Yellow Sea, 37°35'55.9"N 126°30'49.2"E (Fig. 1).

**Type material.** Holotype: 1 female adult in 70% ethanol (NIBRIV0000860820). Samples were collected by Vinod Vakati, 06 March 2015.

**Etymology.** The species epithet is derived from the Latin “cylindricus”, cylindrical, and alludes to the shape of the proximal region of caudal seta V.

**Description of female (based on holotype).** Body (Fig. 2A–B) fusiform narrow, total body length 719 µm, measured from tip of rostrum to posterior margin of caudal rami. Maximum width 218 µm, measured at posterior margin of cephalothorax. Boundary between prosome and urosome clearly visible, urosome/prosome length ratio 0.73, and body length/width ratio about 3.2. Body ornamentation consisting of dorsal denticles, and horizontal row of setules as in *N. ganghwaensis* (see Vakati *et al.* 2016: 217, Fig. 3A–D). Cephalothorax (Fig. 2A) anteriorly attenuated in dorsal view, comprising 28% of total body length, posterior margin serrated, with several paired sensilla and one row of sensilla (Fig. 2A).

Rostrum as in *N. ganghwaensis* and with pair of sensilla as in *N. didelphis* (see Fiers & Kotwicki 2013: 41, Fig. 4G; Vakati *et al.* 2016: 216, Fig. 2C).

Prosome (Fig. 2A) 4-segmented, comprising cephalothorax and three subequal pedigerous somites. P1-bearing somite fused to cephalothorax, posterior margin of free pedigerous somites serrated, and with row of sensilla posteriorly.

Urosome (Fig. 2A–B) tapering posteriorly, comprising P5-bearing somite, genital double-somite, two free abdominal somites, and anal somite. Posterior margin of P5-bearing somite and first half of genital double-somite serrated dorsally; second half of genital double-somite, fourth and fifth urosomites with posterior margin serrated dorsally and ventrally; each somite with sensilla dorsally except for penultimate somite and one row of spinules ventrally. Genital double-somite as in *N. ganghwaensis* (see Vakati *et al.* 2016: 221, Fig. 7A), completely fused ventrally, distinct dorsally and laterally (Fig. 2A–B), with serrated posterior margin dorsally, and smooth ventrally except for spinular row along posterior margin; copulatory pore not visible (completely translucent).

Anal somite (Figs. 2A, 3A–B) with well-developed operculum, covered with setules posteriorly; almost as long as wide, with pair of dorsal sensilla and with one row of spinules on either side of somite ventrally.

Caudal rami (Fig. 3A–C) cylindrical, clearly separated from anal somite, 1.7 (in dorsal view) and 2 (in ventral view) times as long as wide. Ornamentation consisting of setules as in *N. ganghwaensis* (see Vakati *et al.* 2016: 222, Fig. 8A–B), and row of spinules along posterior margin ventrally (Fig. 3B). Caudal ramus bearing seven setae: seta I naked, shorter than ramus width, located anterodorsally; seta II naked, shorter than ramus width, inserted anterodorsally midway and close to outer margin; seta III naked, almost as long as ramus length, and inserted anterolaterally midway along outer margin; seta IV bipinnate, located distally, and 0.5 times as long as seta V; seta V longest, bipinnate, located distally, anterior part inflated and heavily cylindrical (arrowed in Fig. 3A–C); seta VI small, and naked; seta VII triarticulate, naked, and located midway along inner margin.

Antennule, antenna, mouth parts, P1–P6 as in *N. ganghwaensis* (see Vakati *et al.* 2016: 218–221, Figs. 4A–F, 5A–B, 6A–B, 7A–D, E).

**Male.** Unknown.

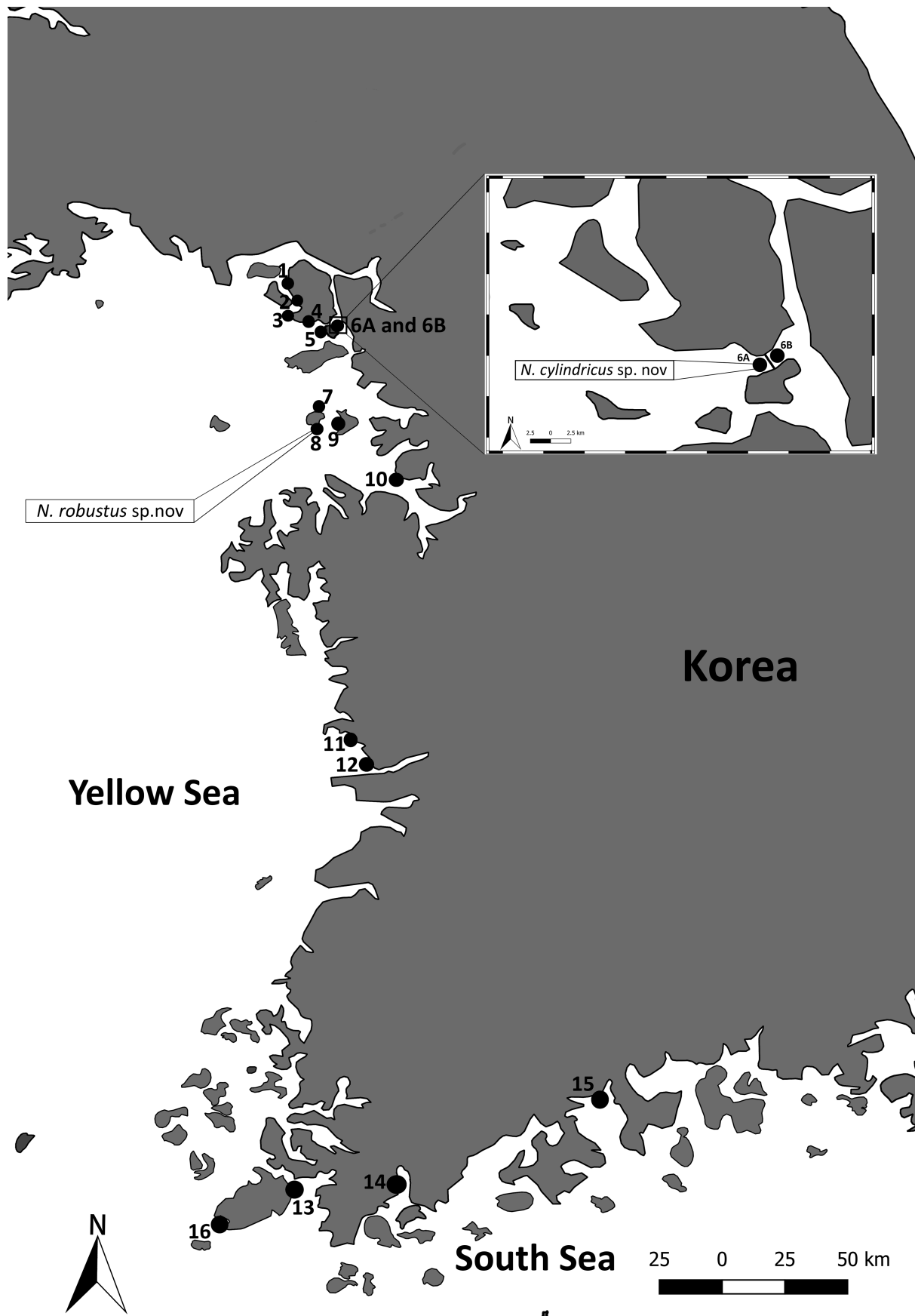
***Nannopus robustus* sp. nov.**

(Figs. 4–5)

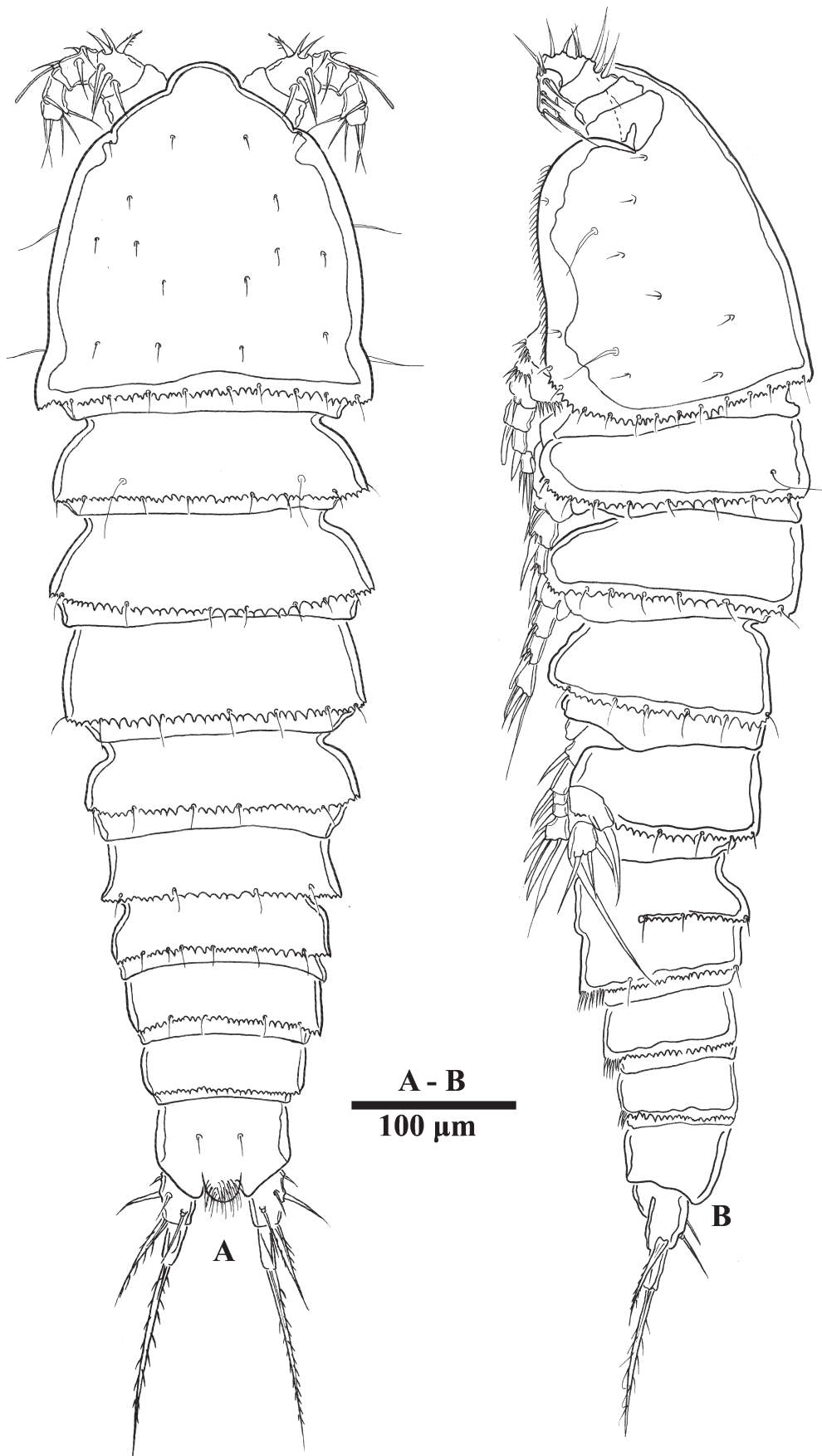
**Type locality.** Intertidal mudflat, St-8—Yeongheung-myeon, Ongjin-gun, Korea, Yellow Sea, 37°14'16.6"N 126°28'16.8"E (Fig. 1).

**Type material.** Holotype: 1 male adult in 70% ethanol (NIBRIV0000860821). Samples were collected by Vinod Vakati, 20 November 2013.

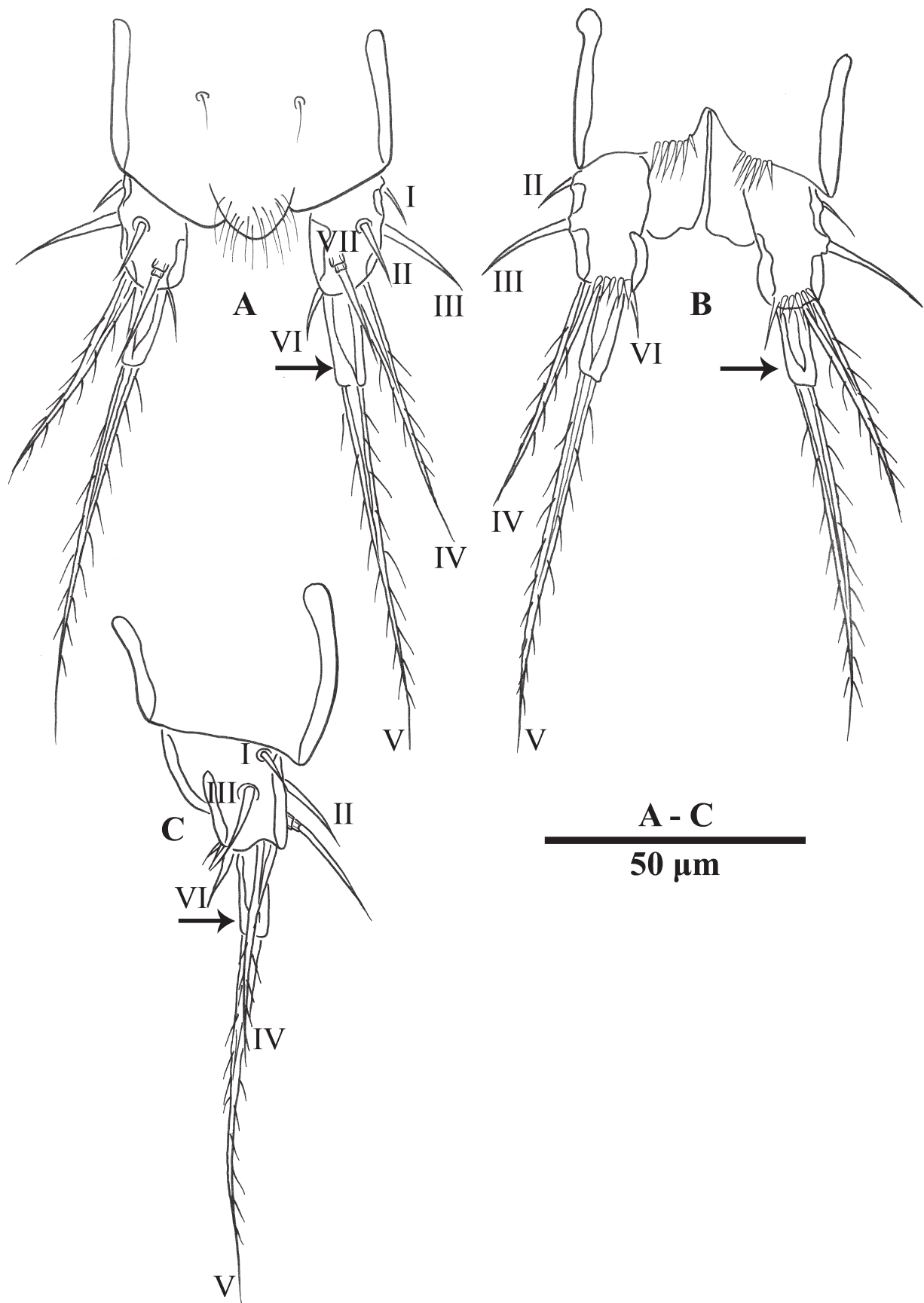
**Etymology.** The species epithet is derived from the Latin “robustus”, referring to the very strong and sturdy distal-most apical spine of P2 exp-2.



**FIGURE 1.** Map showing the sampling localities and distribution of all valid Korean species identified and described so far. The black line between Stations 6a and 6b represents a man-made road with no gap for water entry from either side. Stations 1 to 15 refer to the study sites in Vakati *et al.* (2019), station 16 refers to the study site in Kim *et al.* (2017).

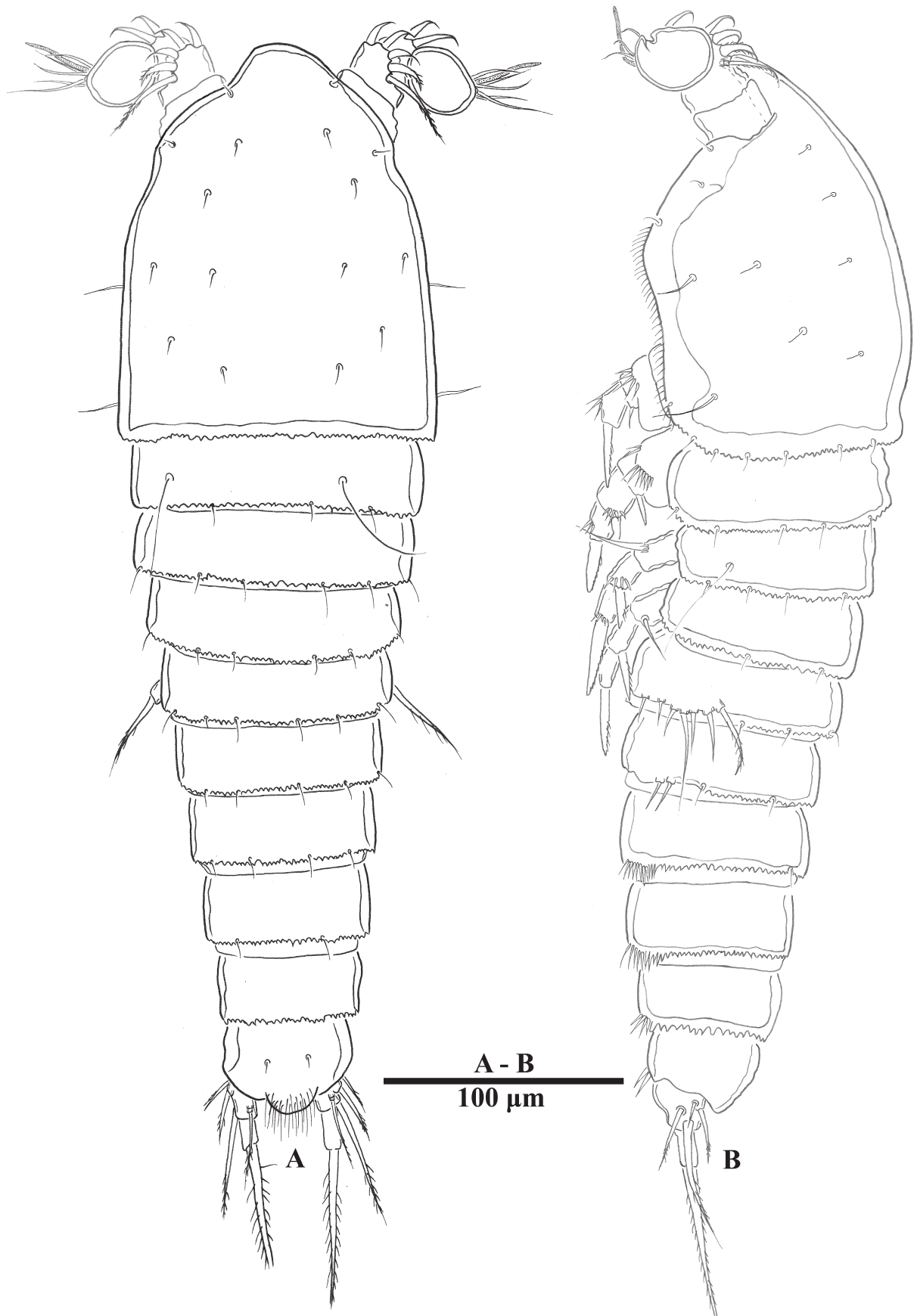


**FIGURE 2.** *Nannopus cylindricus* sp. nov. (holotype ♀). A, habitus, dorsal; B, habitus, lateral.

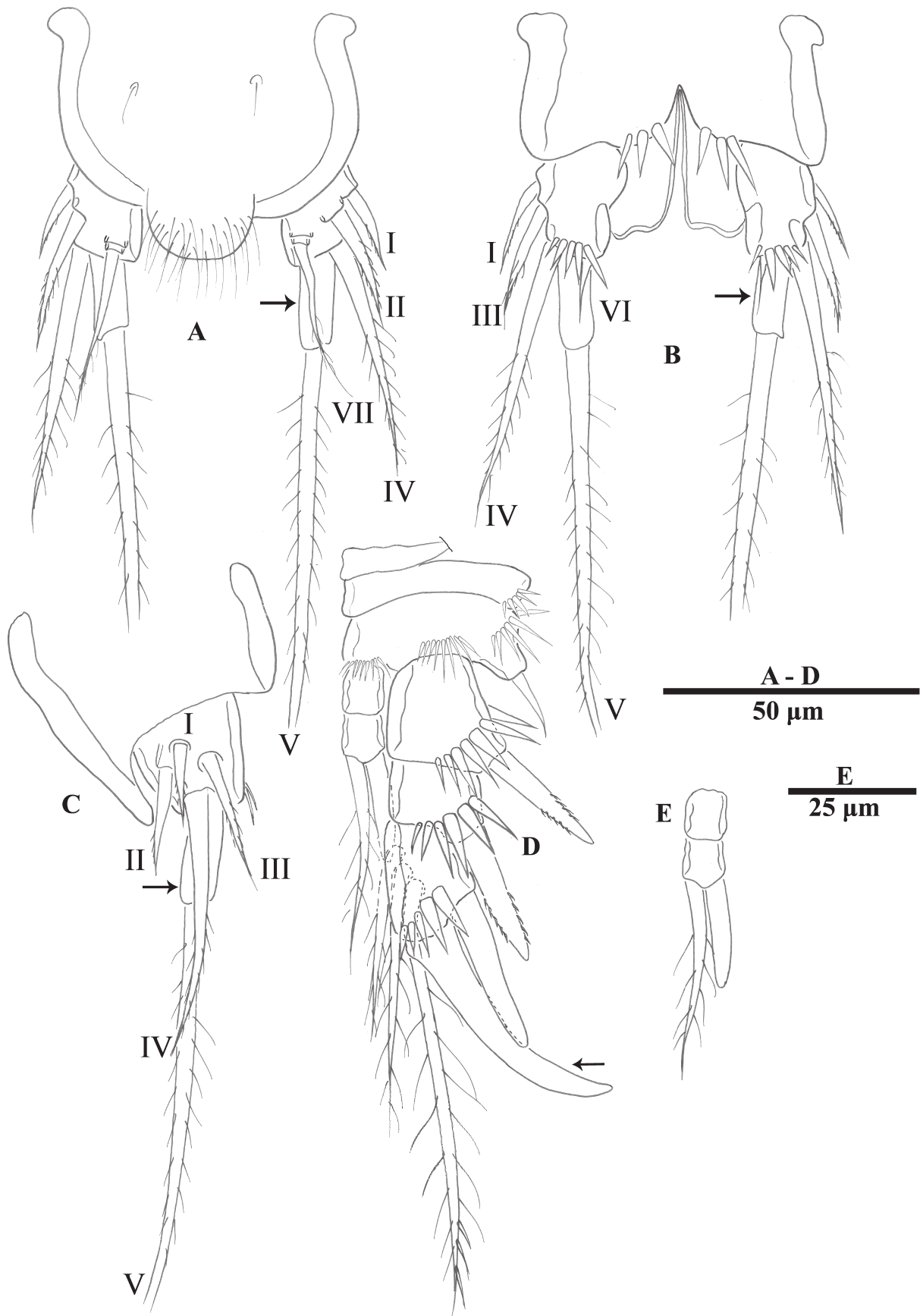


**FIGURE 3.** *Nannopus cylindricus* sp. nov. (holotype ♀). A, anal somite and caudal rami, dorsal (cylindrical shape arrowed); B, anal somite and caudal rami, ventral (cylindrical shape arrowed); C, anal somite and caudal ramus, lateral (cylindrical shape arrowed).





**FIGURE 4.** *Nannopus robustus* sp. nov. (holotype ♂). A, habitus, dorsal; B, habitus, lateral.



**FIGURE 5.** *Nannopus robustus* sp. nov. (holotype ♂). A, anal somite and caudal rami, dorsal (cylindrical shape arrowed); B, anal somite and caudal rami, ventral (cylindrical shape arrowed); C, anal somite and caudal ramus, lateral (cylindrical shape arrowed); D, P2 (recurved spine arrowed); E, P2 endopod.



**Description of male (based on holotype).** Body fusiform (Fig. 4A–B) narrow, total body length 461  $\mu\text{m}$ , measured from tip of rostrum to posterior margin of caudal rami. Maximum width 138  $\mu\text{m}$ , measured at posterior margin of cephalothorax. Body slightly slender, tapering posteriorly. Urosome/prosome length ratio 0.71 (Fig. 4A) and body length/width ratio about 3.3. Body ornamentation as in *N. serratus* (see Vakati & Lee 2017: 24, 27, Figs. 17A–F, 19A–D). Each urosomite with rows of slim setules ventrally as in *N. serratus* (see Vakati & Lee 2017: 24, Fig. 17F). Cephalothorax (Fig. 4A) bell-shaped, slightly narrow, comprising 36% of total body length, with a few paired sensilla and serrated posterior margin.

Rostrum as in *N. serratus* (see Vakati & Lee 2017: 23, Fig. 16C).

Prosome (Fig. 4A–B) 4-segmented, comprising cephalothorax and three subequal free pedigerous somites. P2-bearing somite with two long medial sensilla dorsally, posterior margins of prosomites serrated, and with few sensilla as figured.

Urosome (Fig. 4A–B) 5-segmented, comprising P5-bearing somite, genital double-somite, two free abdominal somites, and anal somite. Posterior margins of urosomites serrated dorsally and ventrally. Posterior margin of genital double-somite and following somite with pair of strong sensilla ventrally as in *N. serratus* (see Vakati & Lee 2017: 29, arrowed in Fig. 21B). Each somite with one transverse row of spinules along posterior margin ventrally. Genital double-somite as in *N. serratus* (see Vakati & Lee 2017: 29, Fig. 21B), clearly distinct dorsally and ventrally, with serrated dorsal posterior margin.

Anal somite (Figs. 4A, 5A–C) almost as long as wide with unique pattern of surface ornamentation dorsally as in *N. serratus*, ventral surface with six spinules (see Vakati & Lee 2017: 29, Fig. 21C–D).

Caudal rami (Fig. 5A–C) square (dorsally) or sub-cylindrical (ventrally), almost as long as wide (in dorsal view), almost twice as long as wide (in ventral view), and with row of spinules along posteroventral margins. Caudal ramus bearing seven setae: seta I pinnate, shorter than ramus width, and located anterolaterally; seta II pinnate, almost as long as ramus length, and inserted anterolaterally midway along outer margin; seta III pinnate, as long as ramus length, and inserted anterolaterally midway along outer margin; seta IV bipinnate, 0.5 times as long as seta V, located at outer posterior margin and wide at proximal region; seta V strongest, bipinnate with proximal part heavily cylindrical and smooth (arrowed in Fig. 5A–C), and located at inner posterior margin; seta VI naked, small, and located at inner posterior corner; seta VII slender, flexible, triarticulate, pinnate, located midway along inner margin.

Antennule, maxillule, maxilla, and maxilliped as in *N. ganghwaensis* (see Vakati *et al.* 2016: 218, Fig. 4A, D–F).

Antenna, mandible, P1– P6 as in *N. serratus* (see Vakati & Lee 2017: 23, 25, 30, Figs. 16D–F, 18A, E, 22 B–D).

P2 (Fig. 5D–E) with smooth and short concave intercoxal sclerite (not illustrated). Praecoxa somewhat triangular and shorter than coxa. Coxa with one spinular row on anterior surface. Basis with one row of outer spinules on anterior surface, one row of distal spinules near insertion of exopod, and one row of distal spinules near insertion of endopod. Basal outer seta naked. Exopod 3-segmented, and all segments subequal in length. Each exopodal segment with robust outer spinules and without inner setules. Exp-2 without inner seta. Exp-1 to -2 with serrated outer spines, exp-3 outer spines smooth, and outer distal-most spine heavily robust (arrowed in Fig. 5D), hook-shaped or recurved, and relatively longer. Endopod 2-segmented, both segments subequal in size, with one smooth outer distal spine and one pinnate inner distal seta.

**Female.** Unknown.

## Discussion

The two new species described here were placed in *Nannopus* based on three synapomorphies as explained in Vakati & Lee (2017): a) fused rostrum, deeply protruding and downwardly recurved, with a pair of sensilla, and anterior margin densely hirsute, b) dorsal surface of second antennular segment with a tri-articulate seta, and c) P4 exp-3 with a pectinate inner subdistal seta.

*Nannopus cylindricus* sp. nov. shares the presence of seven elements on P4 exp-3 with *N. flexibilis* (Lilljeborg, 1902), *N. didelphis* Fiers & Kotwicki, 2013, *N. hirsutus* Fiers & Kotwicki, 2013, *N. ganghwaensis* cryptic complex (*cf.* Vakati *et al.* 2016, 2019), *N. minutus* Vakati & Lee, 2017, and *N. dimorphicus* Vakati & Lee, 2017 (see Table 2). Among them, *N. cylindricus* is closely related to the members of the *N. ganghwaensis* cryptic complex based on the presence of and inflated caudal seta IV (see Table 4).

**TABLE 2.** Armature formula and ornamentation of P1–P5 in female specimens of valid species of *Nannopus*. Roman numerals: spines; Arabic numerals: setae; N: naked seta; P: pinnate seta; Pe: pectinate seta; X: absent; F: fused, ?; details need to be confirmed; #: ornamentation and setal number are variable for the P5 endopod. Data are from Vakati & Lee (2017).

Characters	<i>N. palustris</i> s. str.	<i>N. parvipilis</i>	<i>N. scaldicola</i>	<i>N. procerus</i>	<i>N. flexibilis</i>
P1:P2:P3:P4 ornamentation of inner setae	Exp-2 ? : IN : ? : IN	X : 1P : 1P : 1P	1P : 1P : 1P : 1P	1P : 1N : 1P : 1P	1 : 1 : 1 : 1
Setal formula and ornamentation (listed from outer to inner margin)	P1 Exp-3 Enp	II, I+1P, 0=4 0, I, 1N=2	II, I+1P, 0=4	II, I+1P, 0=4	II, I+1, 0=4
P2	Exp-3 Enp-2	III, 1P, 1P=5 I, 1N, 1N=3	I, 1P, 1P=3 III, 2P, 1P=6	I, 1P, 1P=3 III, I+1P, 1P=6	I, I, 1=3 III, 2, 1=6
P3	Exp-3 Enp Enp-2	II, 2P, 2P=6 0, 1N, 0=1	III, 2P, 2P=7	III, I+1P, 1P=6	I, 1, 1=3 III, 2, 2=7
P4	Exp-3 Enp	II, 2P, 2N?=6 0, 1P, 0=1	I, 1P, 1P=3 III, 1P+1P, 1P=6	I, 1P, 1P=3 III, 2P, 1Pe=6	I, 1, 1=3 III, 2, 2(Pe+?)=7
P5	Exp Enp	P, P, N, P=4 P, P, Pe=3	P, P, P, P=5 P, P, Pe, Pe=4	P, P, N, N, P(F)=5 P, P, Pe, Pe=4	=5 =4
Total no. of elements (from outer to inner margin) and ornamentation					

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**TABLE 2. (Continued)**

Characters	<i>N. didelphis</i>	<i>N. hirsutus</i>	<i>N. ganghwensis</i>	<i>N. cylindricus</i> sp. nov.	<i>N. minutus</i>
P1:P2:P3:P4 ornamentation of inner setae	IP : IP : IP : IP	IP : IP : IP : IP	IP : IP : IP : IP	IP : IP : IP : IP	IP : IP : IP : IP
Setal formula and ornamentation (listed from outer to inner margin)	P1 Exp-2 Exp-3 Enp	II, I+IP, 0 = 4 I, IP, IP = 3 III, 1P+1P, 1P = 6 I, 1P, 1P = 3	III, 1P, 0 = 4 I, 1P, IP = 3 III, 2P, 1P = 6 I, 1P, 1P = 3	III, 1P, 0 = 4 I, 1P, IP = 3 III, 2P, 1P = 6 I, 1P, 1P = 3	III, 1P, 0 = 4 I, 1P, IP = 3 III, 2P, 1P = 6 I, 1P, IP = 3
P2	III, 2P, 2P = 7	III, 1P+1P, 2P = 7	III, 2P, 2P = 7	III, 2P, 2P = 7	III, 2P, 2P = 7
P3	Enp	Enp	I, 1P, IP = 3	I, 1P, IP = 3	I, 1P, IP = 3
P4	Enp-2 Exp-3 Enp	I, 1P, IP = 3 III, 2P, 2(Pe+P) = 7 0, 2P, 0 = 2	I, 1P, IP = 3 III, 2P, 2(Pe+P) = 7 0, 1P+1N, 0 = 2	III, 2P, 2(Pe+P) = 7 0, 1P+1N, 0 = 2 N, N, P, P, P(F) = 5	III, 2P, 2(Pe+P) = 7 0, 1P+1N, 0 = 2 N, N, P, P, P(F) = 5
P5	Exp Enp	P, P, P, P, P(F) = 5 P, P, Pe P, Pe, Pe, Pe = 3 to 4 (#) P, Pe, Pe	P, P, P, P, P = 5 P, P, Pe, Pe = 3 to 4	P, P, Pe, Pe = 4	P, P, Pe, Pe = 4
Total no. of elements (from outer to inner margin) and ornamentation	P, P, P, P, P(F) = 5 P, P, Pe P, Pe, Pe, Pe = 3 to 4 (#) P, Pe, Pe	P, P, P, P, P = 5 P, P, Pe, Pe = 3 to 4 (#) P, P, Pe	N, N, P, P, P(F) = 5 P, P, Pe, Pe = 4	P, P, Pe, Pe = 4	P, P, Pe, Pe = 4

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**TABLE 2. (Continued)**

Characters	<i>N. dimorphicus</i>	<i>N. perplexus</i>	<i>N. parvus</i>	<i>N. bulbiseta</i>	<i>N. unisegmentatus</i>	<i>N. serratus</i>
P1:P2:P3:P4 ornamentation of inner setae	1P : 1P : 1P : 1P	× : 1N : 1N : 1N	X : 1P : 1P : 1P	× : 1P : 1P : ×	× : 1P : 1P : ×	× : 1P : 1P : ×
Setal formula and ornamentation (listed from outer to inner margin)						
P1	Exp-2 Exp-3 Enp	III, 1P, 0 = 4 II, 1+1P, 0 = 4	II, 1+1P, 0 = 4	II, 1+1P, 0 = 4	III, 1P, 0 = 4 0, 1, 0 = 1	II, 1+1P, 0 = 4 0, 1, 1N = 2
P2	Enp-2 Exp-3 Enp-2	I, 1P, 1P = 3 II, 2P, 2P = 6 I, 1P, 1N = 3	I, 1P, 1P = 3 II, 2P, 1P = 5 I, 1P, 1P = 3	I, 1P, 1P = 3 II, 1+1P, 0 = 4 I, 1P, 1N = 3	II+1P, 1P, 1P = 5 I, 1P, 0 = 2	II, 1P, 2P = 5 0, 1, 1P = 2
P3	Exp-3 Enp-2	III, 2P, 2P = 7 I, 1P, 1N = 3	II, 2P, 2P = 6 I, 1P, 1P = 3	II, 2P, 1P = 5 I, 1P, 1N = 3	II, 2P, 2P = 6 I, 1P, 1P = 3	II, 2P, 2P = 6 I, 1P, 1N = 3
P4	Exp-3 Enp	III, 2P, 2(Pe+P) = 7 0, 1P+1P, 0 = 2	II, 2P, 2(Pe+P) = 6 0, 1P, ? = 1	II, 2P, 1(Pe) = 5 0, 1P, 1N = 2	II, 2P, 2(Pe+P) = 6 0, 2P, 0 = 2	II, 2P, 2(Pe+P) = 6 0, 1, 1N = 2
Total no. of elements (from outer to inner margin) and ornamentation	P5	Exp Enp	P, P, P, P = 4 P, P, Pe = 4	P, P, P, P = 4 N, N, Pe, Pe = 4	N, P, P, N = 4 N, N, Pe, Pe = 4	P, P, P, P = 4 P, P, Pe = 3

**TABLE 3.** Armature formula and ornamentation of P1–P5 in male specimens in valid species of *Nannopus*. Roman numerals: spines; Arabic numerals: setae; N: naked seta; P: pinnate seta; Pe: pectinate seta; X: absent; F: fused; ?: details need to be confirmed; #: ornamentation and setal number are variable for the P5 endopod. Even though the setal ornamentation of swimming legs in *N. flexibilis* is not clear (see Lilljeborg 1902), the armature formula is the same as in *N. ganghwaensis* males, thus *N. flexibilis* is not included. In the case of *N. parvipilis*, the armature formula and ornamentation have been described only for females and are referred to in Table 2, and are therefore not included here.

Characters	<i>N. scaldicola</i>	<i>N. procerus</i>	<i>N. didelphis</i>	<i>N. ganghwaensis</i>	<i>N. minutus</i>
P1:P2:P3:P4 ornamentation of inner setae	Exp-2 IP : 1P : 1P : 1P	IP : 1N : 1P : 1P	IP : X : 1P : 1P	IP : 1P : 1P : 1P	IP : 1P : 1P : 1P
Setal formula and ornamentation (listed from outer to inner margin)	P1 Exp-3 Enp Exp-2 Exp-3 Enp-2 Exp-3 Enp-2 P2 Exp-3 Enp-2 P3 Exp-3 Enp-2 P4 Exp-3 Enp P5 Exp Enp	II, I+1P, 0=4 I, 1P, 1P=3 III, I+1P, 1P=6 I, 1P, 1P=3 III, I+1P, 1P=6 I, 1P, 1P=3 III, 1P, 2P=7 I, 1P, 1P=3 III, 1P+1P, 1P=6 0, 2P, 0=2 N, P, N, P, N=5 P, P, Pe, Pe=4	II, I+1P, 0=4 I, 1P, 1P=3 III, 1P, 1P=6 I, 1P, 1P=3 III, 1P, 2P=7 I, 1P, 1P=3 III, 1P, 1P=3 III, 2P, 2(Pe+P)=7 0, 1P, 1N=2 P, P, P, P, P=5 P, P, Pe, Pe=3 to 4 N, P, Pe	III, 1P, 0=4 I, 1P, 1P=3 III, 0, 2P=6 I, 1P, 1P=3 III, 1P, 2P=7 I, 1P, 1P=3 III, 1P, 1P=3 III, 2P, 2(Pe+P)=7 0, 1P+1N, 0=2 P, P, P, P, P=5 N, N, Pe, Pe=4	III, 1P, 0=4 I, 1P, 1P=3 III, 2P, 1P=6 I, 1P, 1P=3 III, 2P, 2P=7 I, 1P, 1P=3 III, 2P, 2(Pe+P)=7 0, 1P+1N, 0=2 P, N, P, P, N=5 P, P, Pe, Pe=4
Total no. of elements (from outer to inner margin) and ornamentation					

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**TABLE 3. (Continued)**

Characters	<i>N. dimorphicus</i>	<i>N. parvus</i>	<i>N. bulbiseta</i>	<i>N. serratus</i>	<i>N. robustus sp. nov.</i>
P1:P2:P3:P4 ornamentation of inner setae	Exp-2 IP: 1P: 1P: 1P	X: 1P: 1P: 1P	×: 1P: 1P: ×	×: 1P: 1P: ×	×: ×: 1P: ×
Setal formula and ornamentation (listed from outer to inner margin)	P1 Exp-3 Enp	III, 1P, 0 = 4	II, I+1P, 0 = 4	II, I+1P, 0 = 4	II, I+1P, 0 = 4
	Enp-2	I, 1P, 1P = 3	I, 1P, 1P = 3	0, I, 1N = 2	0, I, 1N = 2
P2	Exp-3 Enp-2	III, 0, 2P = 6	II, I+1P, 0 = 4	II, 1P, 2P = 5	II, 0, 3P = 5
	Enp-2	I, 1P, 1P = 3	I, 1P, 1N = 3	0, I, 1P = 2	0, I, 1P = 2
P3	Exp-3 Enp-2	III, 1P, 2P = 7	II, 2P, 1P = 5	II, 2P, 2P = 6	II, 2P, 2P = 6
	Enp-2	I, 1P, 1P = 3	I, 0, 2P = 3	I, 1P, 1N = 3	I, 1P, 1N = 3
P4	Exp-3 Enp	III, 2P, 2(Pe+P) = 7	II, 2P, 1(Pe) = 5	II, 2P, 2(Pe+P) = 6	II, 2P, 2(Pe+P) = 6
	Enp	0, 1P, 1N = 2	0, 1P+1N, 0 = 2	0, 1, 1N = 2	0, 1, 1N = 2
P5	Exp Enp	P, N, P, P, P = 5	N, N, P, N = 4	P, P, P, N = 4	P, P, P, N = 4
	Enp	N, N, Pe, Pe = 4	N, N, Pe, Pe = 4	N, N, Pe = 3	N, N, Pe = 3
Total no. of elements (from outer to inner margin) and ornamentation					



**TABLE 4.** Relevant morphological characters of species of *Nannopus*. N: naked seta; P: pinnate seta; ?: details need to be confirmed.

Characters	<i>N. palustris</i> s. str.	<i>N. scaldicola</i>	<i>N. procerus</i>	<i>N. flexibilis</i>
Shape of habitus (dorsally) ♀ and ♂	Fusiform and broad at posterior region of cephalothorax	Ovate, dorsoventrally depressed	Fusiform narrow	Fusiform and broad at posterior region of cephalothorax
Body length ♀ : ♂ (in µm)		460–515 : 460	615–635 : 510–525	
A1 no. of segments ♀	5	5	5	5
A1 armature formula ♀		1-[1], 2-[9], 3-[6+(1+ae)], 4-[1], 5-[8 + acrothek]		
A2 exopodal setae ♀ and ♂	4 (N)	4 (3N + 1P)	4 (3N + 1P)	4 (?)
A2 endopodal spines ♀ and ♂	6 (3 modified and 3 unmodified)	6 (unmodified)	6 (unmodified)	6 (unmodified)
A2 abexopodal seta ♀ and ♂	2 (P)	2 (P)	2 (P)	2 (?)
Mandibular palp total no. of elements ♀ and ♂	5 (3N + 2P)	3 to 4 (P)	3 to 4 (P)	4 (?)
Maxillule praecoxal arthrite no. of elements at distal margin ♀ and ♂	10 (2 smooth and stout, 1 smooth and normal, 5 spinulose and stout + 2 recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	
Integumental windows on cephalothorax ♀	Absent	1 integumental window	Absent	1 integumental window
P1–P4 endopod segments ♀ and ♂	?:2:1:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented
P2 emp-2 innermost seta ♀	Absent	2.6 times as long as the outer spine of its segment	0.5 times as long as the outer spine of its segment	
P2–P3 exp-3 outer spines ♀ and ♂	2-2 : 2-2	3-3 : 4-4	3-3 : 3-3	
P3 emp-2 ♂	Absent		Rectangular, and distal spine fused forming sharp apophysis	Square or globular, and distal spine fused forming triangular apophysis
P4 exp-3 inner subdistal element ♀ and ♂	Pectinate : Pectinate	Setiform	Pectinate	Pectinate
P5 exopod articulation to baseoendopod ♀	Not fused	Not fused	Not fused	Not fused
P6 articulation ♂	Symmetrically confluent	Asymmetrically confluent	Symmetrically confluent	
Caudal rami seta IV ♀ : ♂	Normal : Normal	Normal	Normal	Globular at its insertion site
Caudal rami setae V ♀ : ♂	Anterior region inflated : Anterior region inflated	Normal	Normal	Heavily globular and inflated
Caudal rami setae ornamentation I:II:III:IV:V:VI:VII ♀	N:N:?:N:?:?	N:N:N:P:P:N	N:N:N:P:P:N	N:N:N:P:P:N
Shape of caudal rami ♀ and ♂	Normal : Male unknown	Normal	Anteriorly swollen and notched	
Caudal rami ventrally ♀ and ♂	cylindrical	cylindrical	cylindrical	cylindrical
	Rami hangs out completely	Half the rami hangs out of the anal somite on ventral view		

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**TABLE 4. (Continued)**

Characters	<i>N. didelphis</i>	<i>N. hirsutus</i>	<i>N. ganghwaensis</i>	<i>N. cylindricus</i> sp. nov.
Shape of habitus (dorsally) ♀ and ♂	Fusiform and broad at posterior region of cephalothorax	Fusiform and broad at posterior region of cephalothorax	Fusiform and broad at posterior region of cephalothorax	Fusiform and broad at posterior region of cephalothorax
Body length ♀ : ♂ (in µm)	538–698 : 505–528	445 : unknown	772 (n=22) : 667 (n=10)	719 : unknown
A1 no. of segments ♀	5	5	5	5
A1 armature formula ♀		1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]		
A2 exopodal setae ♀ and ♂	4 (3N + 1P)	4 (3N + 1P)	4 (3N + 1P)	4 (3N + 1P) : Unknown
A2 endopodal spines ♀ and ♂	6 (unmodified)	6 (unmodified)	6 (unmodified)	6 (unmodified)
A2 abexopodal seta ♀ and ♂	2 (P)	2 (P)	2 (P)	2 (P)
Mandibular palp total no. of elements ♀ and ♂	3 to 4 (P)	3 to 4 (P)	4 (P)	4 (P)
Maxillule praecoxal arthrite no. of elements at distal margin ♀ and ♂	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)
Integumental windows on cephalothorax ♀	Absent	Absent : Male unknown	Absent	Absent : Male unknown
P1–P4 endopod segments ♀ and ♂	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented
P2 emp-2 innermost seta ♀	Almost as long as the outer spine of its segment	0.8 times as long as the outer spine of its segment	1.7 times as long as the outer spine of its segment	1.7 times as long as the outer spine of its segment
P2–P3 exp-3 outer spines ♀ and ♂	3-3 : 4-4		3-3 : 4-4	3-3 : Male unknown
P3 emp-2 ♂	Rectangular, and distal spine fused forming sharp apophysis		Rectangular, and distal spine robust, fused forming sharp apophysis	
P4 exp-3 inner subdistal element ♀ and ♂	Pectinate	Pectinate seta : Male unknown	Pectinate	Pectinate seta : Male unknown
P5 exopod articulation to baseoendopod ♀	Not fused	Not fused	Not fused	
P6 articulation ♂	Symmetrically confluent		Asymmetrically confluent	
Caudal rami seta	Normal	Globular at its insertion site : Male unknown	Inflated	Inflated : Male unknown
IV ♀ : ♂				
Caudal rami setae	Inflated and with a restricted globular expansion	Semi cylindrical and densely hirsute at the anterior region : ♂ unknown	Inflated	Heavily cylindrical at its base: Male unknown
V ♀ : ♂				
Caudal rami setae ornamentation	N:N:N:P:P:N:N	N:N:N:P:P:N:N	N:N:N:P:P:N:N	N:N:N:P:P:N:N
I:II:III:IV:V:VI:VII ♀				
Shape of caudal rami ♀ and ♂	cylindrical	cylindrical (unknown in ♂)	cylindrical	cylindrical (unknown in ♂)
Caudal rami ventrally ♀ and ♂		Half the rami hangs out of the anal somite on ventral view		

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**TABLE 4. (Continued)**

Characters	<i>N. minutus</i>	<i>N. dimorphicus</i>	<i>N. perplexus</i>	<i>N. parvus</i>	<i>N. bulbiseta</i>
Shape of habitus (dorsally) ♀ and ♂	Fusiform narrow	Fusiform and broad at posterior region of cephalothorax	Fusiform, nearly cylindrical	Fusiform and broad at posterior region of cephalothorax	Fusiform and broad at posterior region of cephalothorax
Body length (µm) ♀ and ♂	500 µm (n=3) : 431 µm (n=2)	408 µm (n=3) : 377 µm (n=2)	490 µm : Unknown	428 µm (n=4) : 369 µm (n=2)	437 µm (n=4) : 401 µm (n=3)
A1 no. of segments ♀	5	5	5	5	5
A1 armature formula ♀	1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]	1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]	1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]	1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]	1-[1], 2-[9], 3-[6+ (1+ae)], 4-[1], 5-[8 + acrothek]
A2 exopodal setae ♀ and ♂	4 (3N + 1P)	4 (3N + 1P)	3 (N)	4 (N)	4 (N)
A2 endopodal spines ♀ and ♂	6 (unmodified)	6 (unmodified)	7? (unmodified)	6 (unmodified)	6 (unmodified)
A2 abexopodal seta ♀ and ♂	2 (P)	2 (P)	1 (N)	2 (1P+1N)	2 (1P+1N)
Mandibular palp total no. of elements ♀ and ♂	4 (P)	4 (P)	3 (N)	5 (3P+2N)	5 (3P+2N)
Maxillule praecoxal arthrite no. of elements at distal margin ♀ and ♂	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	10 (8 smooth and stout spines + 2 long recurved pinnate elements)	7? (6? smooth and stout spines + 1? long naked element)	9 (8 smooth and stout spines + 1 long recurved pinnate element)	9 (8 smooth and stout spines + 1 long recurved pinnate element)
Integumental windows on cephalothorax ♀	3 integumental windows	1 integumental window	1 integumental window	Absent	Absent
P1-P4 endopod segments ♀ and ♂	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented	2:2:2:1-segmented
P2 exp-2 inner most seta ♀	0.7 times as long as the outer spine of its segment	0.7 times as long as the outer spine of its segment	0.5 times as long as the outer spine of its segment	0.6 times as long as the outer spine of its segment	0.5 times as long as the outer spine of its segment
P2-P3 exp-3 outer spines ♀ and ♂	3-3 : 3-3	3-3 : 4-4		2-2 : 2-2	2-2 : 2-2
P3 exp-2 ♂	Rectangular, and distal spine fused forming sharp apophysis	Rectangular, and distal spine fused forming sharp apophysis		Square or globular, and distal spine fused forming wide and hook-shaped apophysis	Square or globular, and distal spine fused forming wide and hook shaped apophysis
P4 exp-3 inner subdistal element ♀ and ♂	Pectinate seta	Pectinate seta	Pectinate seta	Pectinate seta/spine	Pectinate seta/spine
P5 exopod articulation to basoendopod ♀	Not fused	Not fused	Fused	Fused	Fused
P6 articulation ♂	Asymmetrically confluent	Asymmetrically confluent		Asymmetrically confluent	Asymmetrically confluent
Caudal rami setae IV ♀ and ♂	Slightly bulbous	Globular at its insertion site	? : Male unknown	Normal	Normal
Caudal rami setae V ♀ and ♂	Normal : Normal	Heavily bulbous and inflated : Normal	Hook shaped leaving slender and flexible edge : Male unknown	Unique seta (very short, spine-like appearance)	Unique seta (bulbous anteriorly, and extremely slender posteriorly)
Caudal rami setae ornamentation I:II:III:IV:V:VI:VII ♀	N:N:P:P:P:N:N	N:N:P:P:P:N:N	?:?:?:?:?:?	N:N:P:P:P:P:P	N:N:N:N:P:P:P
Shape of caudal rami ♀ and ♂	Cylindrical	Cylindrical	Cylindrical : Male unknown	Trapezoidal or square	Sub-cylindrical
Caudal rami ventrally ♀ and ♂	Half the rami are outside the anal somite	Half the rami are outside the anal somite	Half the rami hang out of the anal somite	Half the rami hang out of the anal somite	Strongly or completely attached to the anal somite until the terminal margin of the rami

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**TABLE 4. (Continued)**

Characters	<i>N. unisegmentatus</i>	<i>N. serratus</i>	<i>N. robustus</i> sp.nov.
Shape of habitus (dorsally) ♀ and ♂	Fusiform and broad at posterior region of cephalothorax	Fusiform narrow	Fusiform narrow
Body length (µm) ♀ and ♂	540 µm : Unknown	562µm (n=3) : 538µm (n=2)	Unknown : 461 µm
A1 no. of segments ♀	5	5	
A1 armature formula ♀		1-[1], 2-[9], 3-[6+(1+ae)], 4-[1], 5-[8 + acrothek]	
A2 exopodal setae ♀ and ♂	4 (N)	4 (N)	4 (N)
A2 endopodal spines ♀ and ♂	6 (modified)	6 (modified)	6 (modified)
A2 abexopodal seta ♀ and ♂	5 (2P+3N)	2 (P) 5 (3P + 2N)	2 (P) 5 (3P + 2N)
Mandibular palp total no. of elements ♀ and ♂			
Maxillule praecoxal arthrite no. of elements at distal margin ♀ and ♂		10 (8 smooth and stout spines + 2 long recurved pinnate element)	10 (8 smooth and stout spines + 2 long recurved pinnate element)
Integumental windows on cephalothorax ♀	Absent	Absent	
P1-P4 endopod segments ♀ and ♂	1:2:2:1-segmented	1:2:2:1-segmented	1:2:2:1-segmented
P2 enp-2 inner most seta ♀	Absent	Absent	
P2-P3 exp-3 outer spines ♀ and ♂		2-2 : 2 -2	Unknown-Unknown : 2-2
P3 enp-2 ♂			Square, and distal spine fused forming sharp apophysis
P4 exp-3 inner subdistal element ♀ and ♂	Pectinate seta : males unknown	Pectinate seta	Female unknown : Pectinate seta
P5 exopod articulation to basicoendopod ♀	Not fused	Not fused	
P6 articulation ♂		Asymmetrically confluent	Asymmetrically confluent
Caudal rami setae	Normal : Male unknown	Normal : Normal	Female unknown : Normal
IV ♀ and ♂			
Caudal rami setae	Normal : Unknown	Normal : Normal	Unknown : Heavily cylindrical at its base
V ♀ and ♂			
Caudal rami setae ornamentation		P : P : P : P : P : P	P : P : P : P : P : P
I:II:III:IV:V:VI:VII ♀	N:N:?:P:P:N:?		
Shape of caudal rami ♀ and ♂	Cylindrical : Male unknown	Cylindrical	Female unknown : Cylindrical
Caudal rami ventrally ♀ and ♂		Half the rami hang out of the anal somite	

However, *N. cylindricus* can be differentiated from species in the *N. ganghwaensis* cryptic complex by the distinctly cylindrical shape of the base of the inflated caudal seta V (arrowed in Fig. 3A–C; Table 4); species of the *N. ganghwaensis* cryptic complex have only an inflated caudal seta V (see Vakati *et al.* 2016: 221, 222, Figs. 7A–C, 8C). Although these two species have only one morphological difference, the observed difference is symmetrical, distinctive, and sufficient to separate *N. cylindricus* from species in the *N. ganghwaensis* cryptic complex.

Despite the recognition of *N. cylindricus* as a distinct species is based on only one specimen without supporting genetic evidence, we consider this course of action justified since the cylindrical shape at the base of caudal seta V appears to be present across several species globally. For example, *N. hirsutus* from the Netherlands and *N. robustus* sp. nov. from Korea have a cylindrical shape at the anterior region of caudal seta V, clearly indicating that this character is widely present across several species within *Nannopus*.

*Nannopus robustus* sp. nov. shares the presence of two setae on P2 enp-2 with *N. unisegmentatus* Shen & Tai, 1964 and *N. serratus* Vakati & Lee, 2017 (see Table 3). Although the male of *N. unisegmentatus* is unknown, it is most likely that the number of setae on P2 enp-2 is not sexually dimorphic. *N. robustus* is closely related to *N. serratus* because of the presence of one naked endopodal seta arising from a stem-like protrusion on the mandibular palp. However, *N. robustus* and *N. serratus* are well differentiated by the size and shape of the distalmost outer spine on P2 exp-3 in the males; this element is markedly robust, smooth, hook-shaped or recurved (arrowed in Fig. 5D) in *N. robustus*, whereas it is only moderately robust, denticulate, and normally-shaped in *N. serratus*. Furthermore, the spine of *N. robustus* is almost 1.6 times as long as that of *N. serratus* (Vakati & Lee 2017: 30, Fig. 22A); P2 exp-2 does not have an inner seta in *N. robustus* (Fig. 5D; Table 3) in contrast to *N. serratus* (Vakati & Lee 2017: 30, Fig. 22A); caudal seta V is distinctly cylindrical in its proximal region in *N. robustus* (arrowed in Fig. 5A–C; Table 4) whereas it is normal in *N. serratus* (Vakati & Lee 2017: 29, Fig. 21C); and caudal seta VI is naked in *N. robustus* (Fig. 5B; Table 4) but pinnate in *N. serratus* (Vakati & Lee 2017: 29, Fig. 21B).

Both species were used for non-destructive DNA extraction as described in Vakati *et al.* (2019). Several PCR reactions to amplify the cytochrome oxidase C subunit I gene (mtCOI) were attempted but failed, and the total genomic DNA extracted was used up. It is therefore important to collect more specimens of both new species in the future to obtain molecular data that could confirm their specific distinctiveness and shed light on their phylogenetic relationships.

A key to the valid species of *Nannopus* is presented below.

- 1) P4 exp-3 without pectinate inner subdistal seta . . . . . 2
- P4 exp-3 with pectinate inner subdistal seta . . . . . 3
- 2) P2 and P4 exp-2 inner seta naked in female; male condition unknown . . . . . *N. palustris* Brady, 1880
- P2 and P4 exp-2 inner seta pinnate in both sexes . . . . . *N. scaldicola* Fiers & Kotwicki, 2013
- 3) P1 endopod 1-segmented . . . . . 4
- P1 endopod 2-segmented . . . . . 5
- 4) P2 exp-2 with inner seta; inner seta on P3 enp-2 robust, relatively long and pinnate; distal seta on P4 endopod small and pinnate; female caudal seta V of normal shape; male unknown . . . . . *N. unisegmentatus* Shen & Tai, 1964
- P2 exp-2 with inner seta in both sexes; inner seta on P3 enp-2 extremely slender, very small and naked in both sexes; distal seta on P4 endopod small and naked in both sexes; caudal seta V of normal shape . . . . . *N. serratus* Vakati & Lee, 2017
- P2 exp-2 with inner seta in both sexes; P3 enp-2 absent in both sexes; distal seta on P4 endopod small and naked in both sexes; caudal seta V with inflated proximal region inflated . . . . . *N. parvipilis* (Kim, Choi & Yoon, 2017)
- P2 exp-2 without inner seta; inner seta on P3 enp-2 extremely slender, very small and naked; distal seta on P4 endopod small and naked; caudal seta V distinctly cylindrical at its base; female unknown . . . . . *N. robustus* sp. nov.
- 5) P5 exopod and baseoendopod fused in females . . . . . 6
- P5 exopod and baseoendopod distinct in females . . . . . 8
- 6) Second segment of A1 with normal setae only; A2 with one abexopodal seta, exopod with three elements; mandibular palp with three setae; inner subdistal element on exopod of P4 strongly pectinate; endopod of P4 with one seta; endopodal lobe of P5 with three setae; male unknown . . . . . *N. perplexus* (Sars, 1909)
- Second segment of A1 with two unique pinnate setae (leaf-shaped) in both sexes; A2 with two abexopodal setae, exopod with four elements in both sexes; mandibular palp with five setae in both sexes; inner subdistal element on exopod of P4 weakly pectinate in both sexes; endopod of P4 with two setae in both sexes; endopodal lobe of P5 with four setae in both sexes . . . . . 7
- 7) P2–P4 exp-3 with 5:6:6 elements, respectively, in both sexes . . . . . *N. parvus* Vakati & Lee, 2017
- P2–P4 exp-3 with 4:5:5 elements, respectively, in both sexes . . . . . *N. bulbiseta* Vakati & Lee, 2017
- 8) P4 exp-3 with six elements in both sexes; female caudal seta V with, male caudal seta V without notch-like process at proximal third . . . . . *N. procerus* Fiers & Kotwicki, 2013
- P4 exp-3 with seven elements in both sexes; caudal seta V without notch-like process at proximal third in both sexes . . . . . 9
- 9) Lateral margins of urosomites densely hirsute; caudal seta V long, inflated, semi-cylindrical, pinnate, densely hirsute proximally; male unknown . . . . . *N. hirsutus* Fiers & Kotwicki, 2013



- Lateral margins of urosomites not densely hirsute; caudal seta V long, with or without inflation, with or without globular expansion at base, pinnate, without hairs proximally in both sexes. . . . . **10**
- 10) Caudal seta IV naked in females, but pinnate in males; male P3 enp-2 with short triangular apophysis . . . . . *N. flexibilis* (Lilljeborg, 1902)
- Caudal seta IV pinnate in both sexes; male P3 enp-2 with relatively long apophysis . . . . . **11**
- 11) Caudal seta III pinnate in both sexes . . . . . **12**
- Caudal seta III naked in both sexes . . . . . **13**
- 12) Caudal seta IV leaf-shaped in both sexes; caudal seta V normal and wide proximally in both sexes; P2–P3 exp-3 with three outer spines in both sexes; distal seta on P4 endopod small and naked in both sexes . . . . . *N. minutus* Vakati & Lee, 2017
- Caudal seta IV with globular expansion at its base in females, but normal in males; caudal seta V heavily inflated and bulbous proximally in females, but normal in males; P2–P3 exp-3 with three spines in females and four in males; distal seta on P4 endopod small, pinnate in females and naked in males . . . . . *N. dimorphicus* Vakati & Lee, 2017
- 13) Innermost seta and outer spines on P2 enp-2 subequal in females, but 0.5 times as long as the outer spine in males; innermost seta on P2 enp-2 pinnate in females, but naked in males; P2 exp-2 with pinnate inner seta in females, but without inner seta in males; caudal seta V with a spur and globular inflated base in females, but without spur not inflated at base in males; males with two spermaducts and symmetrical P6, distal margin of P6 with a small notch-like process . . . . . *N. didelphis* Fiers & Kotwicki, 2013
- Innermost seta of P2 enp-2 1.7 times as long as outer spine in females, and 0.7 times as long in males; innermost distal seta on P2 enp-2 pinnate in both sexes; P2 exp-2 with inner pinnate seta in both sexes; caudal seta V only inflated at base in both sexes; males with one spermaduct and asymmetrical P6, and P6 distal margin without notch-like process in males . . . . . *N. ganghwaensis* Vakati, Kihara & Lee, 2016
- Innermost seta of P2 enp-2 1.7 times as long as outer spine in females; innermost distal seta on P2 enp-2 pinnate in females; P2 exp-2 with inner pinnate seta; caudal seta V inflated and distinctly cylindrical at its base; male unknown . . . . . *N. cylindricus* **sp. nov.**

## Acknowledgements

This study was supported by a grant entitled “Discovery project of endemic species in Korea” from the National Institute of Biological Resources and funded by the Ministry of Environment, Korea (NIBR 201902106), as well as a grant from the National Research Foundation of Korea (NRF, grant no. 2018R1D1A1B07050117). We would also like to express our gratitude to Jeongho Kim for his help in collecting sediments from the type localities. We are also very grateful to editor, Prof. Rony Huys and the two anonymous reviewers for their help in greatly improving this manuscript.

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