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Copepods of the genus *Asterocheres* Boeck, 1859 (Siphonostomatoida: Asterocheridae) from Korean waters

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Sixteen species of *Asterocheres* collected from the southern and eastern coasts of Korea are recorded. Two species are redescriptions—*Asterocheres* aesthetes Ho, 1984 and *A. siphonatus* Giesbrecht, 1897. The remaining 14 new species described are *A. geminus* n. sp., *A. processus* n. sp., *A. culicis* n. sp., *A. eurychelatus* n. sp., *A. scutellatus* n. sp., *A. spiniventer* n. sp., *A. fici* n. sp., *A. serratus* n. sp., *A. tridentatus* n. sp., *A. nodulosus* n. sp., *A. tetraodontis* n. sp., *A. dokdoicus* n. sp., *A. exilis* n. sp., and *A. zodius* n. sp. These new species are compared with other known species of the genus mainly based on the character states of 17 selected characters. These characters include the length/width ratios of the caudal ramus and genital double-somite, the number of postgenital lateral setules or spinules on the genital double-somite of the female, the number of segments of the antennule of both sexes, the position of aesthetasc on antennular segments in the female, the relative length of terminal claw of the antenna, the relative length of the oral siphon, the number of segments and the relative length of the mandibular palp, the presence or absence of inner coxal seta on legs 1 and 4, the relative lengths of setae on the exopod of female leg 5, the presence or absence of sexual dimorphisms of swimming legs, and the presence or absence of a secondary aesthetasc on the male antennule. A key to 22 species of *Asterocheres* known in Korea waters is provided.

Keywords: 14 new species, invertebrate hosts, symbiotic copepods, taxonomy

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Introduction

Asterocheres Boeck, 1859 is the largest genus in the family Asterocheridae and has been known to be symbionts associated with marine invertebrates such as sponges, echinoderms, and corals. The genus currently includes 91 known species (WoRMS Editorial Board, 2023) and many of them were imperfectly described (Ho, 1984; Kim, 2010; Bandera & Conradi, 2016). In Korea, Kim (1998) recorded *A. aesthetes* Ho, 1984, which was described originally in Japan as the first record of the genus in the Pacific (Ho, 1984, p. 24). Subsequently, Kim (2016) redescribed *A. lilljeborgi* Boeck, 1859 and *A. simulans* Scott T., 1898, both formerly reported only from European waters, based on newly collected Korean samples, and described three new species, *A. cuspis* Kim, 2016; *A. horridus* Kim, 2016; and *A. quadridens* Kim, 2016. Recently, Kim & Lee (2023) described the seventh species of Korean fauna, *A. banderaae*, as a new species. Recent field surveys performed using SCUBA diving have made a discovery of a number of additional species of the genus. In the present paper we report 15 additional species of *Asterocheres*, including 14 new species and a new record of Korean fauna, *A. siphonatus* Giesbrecht, 1897.

Materials and Methods

Most species of *Asterocheres* described in the present paper were collected during SCUBA diving, with some of them from washings of sponge hosts caught as fishery bycatch. All collected copepods were preserved in 70–80% ethanol. For microscopic observation, the copepods were immersed in lactic acid for at least 10 minutes and dissected. Dissected appendages were observed using the reverse slide method of Humes & Gooding (1964). Drawings were made with the aid of a microscope equipped with a drawing apparatus. The lengths of the appendage segments are the average of the longest and shortest margins measured after dissections. The termi-

nology adopted in this paper follows Huys & Boxshall (1991). Type specimens have been deposited in three institutes in Korea: National Institute of Biological Resources (NIBR), Incheon, Marine Biodiversity Institute of Korea (MABIK), Seocheon, and Honam National Institute of Biological Resources (HNIBR), Mokpo.

For the primary comparison of each new species with their congeners, 17 characters and their character states are selected (Tables 1 & 2), from which the similarity values between species are calculated. Many of the character states were taken from original illustrations of existing species (usually represented by "=" in Table 2, meaning "approximately"). The formula by which the similarity value between species was calculated is $S_{AB} = a/b$, where S_{AB} = similarity value between species A and B, a = character states shared by species A and B, and b = characters with known character states in both species.

Results and Discussion

Class Copepoda Milne Edwards, 1840
Order Siphonostomatoida Burmeister, 1835
Family Asterocheridae Giesbrecht, 1899
Genus *Asterocheres* Boeck, 1859

Remarks on the valid species. WoRMS (WoRMS Editorial Board, 2023) has recognized 91 species as valid in the genus *Asterocheres*. We accept 88 of those 91 species as valid, except the following three species: *A. berniciensis* (Brady, 1899); *A. carausi* Marcus & Por, 1960; and *A. ornatus* (Brady & Robertson, 1876). *Asterocheres berniciensis* was described under the name of *Cyclopicera berniciensis* based on the male. The description and illustration of *A. berniciensis* exhibit no diagnostic feature of *Asterocheres* and we recognize it here as a *species inquirenda*. We follow Stock (1969) who treated *A. carausi* to be a synonym of *A. uncinatus* (Krichagin, 1873). *Asterocheres ornatus* (originally as *Ascomyzon ornatum*) is currently recognized as a species of the genus *Acontiophorus* Brady, 1880 (Brady, 1880; Giesbrecht, 1899). WoRMS has recognized *A. siphonatus* Giesbrecht, 1897 as a synonym of *Dermatomyzon nigripes* (Brady & Robertson, 1876), but we treat it a distinct species of *Asterocheres*, as redescribed by Conradi & Bandera (2011) and in the present paper. Therefore, a total of 89 species in

Table 1. Characters and character states applied in Table 2.

Characters	Character states
1. Length/width ratio of caudal ramus of female	1, less than 1; 2, approximately 1; 3, distinctly more than 1 but less than 1.5; 4, 1.5 to 2.0; 5, more than 2.
2. Length/width ratio of female genital double-somite	1, less than 1; 2, approximately 1; 3, more than 1.
3. Setules (or spinules) on postgenital lateral margin of genital double-somite of female	1, lacking; 2, less than 10; 3, 10 to 20; 4, more than 20.
4. Segments of female antennule	18, 19, 20, or 21 segments.
5. Female antennular segment bearing major aesthetasc	−2 to −4: second to fourth segments, respectively, from the distal.
6. Length ratio of terminal claw to first endopodal segment of antenna	1, less than 1; 2, about 1; 3, distinctly more than 1.
7. Place of distal tip of oral siphon reach	1, before maxilliped; 2, maxilliped; 3, between maxilliped and leg 1; 4, leg 1; 5, between legs 1 and 4; 6, beyond leg 4.
8. Segments of mandibular palp	1 or 2 segments.
9. Length ratio of mandibular palp (including longer distal seta) to stylet	1, less than 0.8; 2, 0.8 to 1; 3, between 1.01 and 1.5; 4, more than 1.5.
10. Inner seta on coxa of leg 1	+, present; X, absent.
11. Elongate distal process on third endopodal segment of leg 1	+, present; X, absent.
12. Inner seta on coxa of leg 4	+, present; X, absent.
13. Longest seta of exopod of female leg 5	1, outer seta; 2, middle seta; 3, inner seta; =, equal to.
14. Shortest seta of exopod of female leg 5	1, outer seta; 2, middle seta; 3, inner seta; =, equal to.
15. Sexual dimorphism of legs	X, absent; 1 to 3, present in legs 1 to 3, respectively.
16. Segments of male antennule	17 or 18 segments.
17. Aesthetasc on 13th (or 12th) segment of male antennule	+, present; X, absent.

Table 2. A character matrix of *Asterocheres* species ("−" indicates missing data).

Species	Characters (1−17)																	Data source
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
A. aesthetes Ho, 1984	1	1	3	21	−4	1	2	2	3	+	X	+	1	3	2, 3	18	+	Present study
A. alter Eiselt, 1965	4	−	−	−	−	3	1	2	3	+	X	X	−	−	1	17	X	Eiselt (1965)
A. antillensis Varela, 2010	1	3	2	19	−2	2	3	2	4	+	X	+	2	3	−	−	−	Varela (2010b)
A. astroidicola Conradi, Bendera & Lopez-Gonzalex, 2006	3	3	2	21	−4	2	5	2	1	+	X	+	1	3	X	18	X	Conradi *et al.* (2006)
A. bacescui Marcus, 1965	3	1	−	21	−4	3	2	1	2	+	X	−	2	3	X	18	−	Marcus (1965)
A. bahamensis Kim, 2010	1	1	3	19	−3	1	2	2	4	+	X	+	1	3	1, 3	17	X	Kim (2010)
A. banderaae Kim & Lee, 2023	1	1	3	20	−3	1	2	1	2	X	X	X	2	3	3	17	X	Kim & Lee (2023)
A. bimbarrensis Bispo, Johnsson & Neves, 2006	3	2	3	20	−3	3	3	2	−	+	X	+	2	3	X	18	X	Bispo *et al.* (2006)
A. boecki (Brady, 1880)	1	1	3	21	−4	3	4	2	2	+	X	+	2	3	−	−	−	Bandera & Conradi (2016)
A. brevisurculus Kim, 2005	3	3	3	19	−2	1	1	1	4	+	X	+	1	3	1	18	X	Kim (2005)
A. bulbosus Malt, 1991	1	2	2	20	−3	2	1	1	2	−	X	X	123	123	X	17	X	Malt (1991); Bandera & Mercedes (2009)
A. canui Giesbrecht, 1897	−	−	−	−	−	−	2	2	4	+	X	+	1=2	3	−	17	X	Canu (1892, as *A. lilljeborgi*)
A. complexus Stock, 1960	3	1	2	21	−4	2	2	2	−	+	X	+	2	3	2	18	X	Stock (1960); Bandera & Conradi (2014); Schirl (1973)
A. corneliae Schirl, 1973	2	1	2	21	−4	3	3	1	−	+	X	+	1	3	−	18	X	Schirl (1973); Bandera & Conradi (2016)
A. crenulatus Johnsson, 1999	2	1	2	19	−2	1	2	2	2	+	X	+	1	3	−	−	−	Johnsson (1999)
A. crinoidicola Humes, 2000	1	3	2	20	−3	1	2	2	4	+	+	+	2	3	X	18	X	Kim (2010)
A. cubensis Varela, 2010	3	1	2	19	−3	3	3	2	3	+	X	+	1	3	−	−	−	Varela (2010a)
A. cuspis Kim, 2016	3	1	3	20	−3	1	2	2	3	+	X	X	2	3	2, 3	17	X	Kim (2016)
A. dentatus Giesbrecht, 1897	1	1	X	20	−	−	−	−	−	+	−	−	3	1	−	−	−	Giesbrecht (1899)
A. echinicola (Norman, 1868)	4	1	2	21	−4	2	1	1	−	+	X	+	1	3	1	18	X	Bandera & Conradi (2009b); Bocquet *et al.* (1963, as *A. violaceus*)
A. ellisi Hamond, 1968	3	2	3	21	−4	1	5	2	2	+	X	+	2	3	X	18	X	Hamond (1968); Bandera & Mercedes (2009)
A. espinosai Varela, Ortiz & Lalana, 2007	2	1	2	21	−3	3	2	2	3	+	X	+	1	3	−	−	−	Varela, Ortiz & Lalana (2007)
A. eugenioi Bandera & Conradi, 2014	4	1	3	21	−4	1	4	2	−	X	X	+	1	3	X	18	X	Bandera & Conradi (2014)
A. faroensis Crescenti, Baviera & Zaccone, 2010	4	2	3	21	−4	3	3	1	3	+	X	+	1	3	1	17	X	Crescenti *et al.* (2010)
A. fernandezmilerai Varela, 2010	1	1	2	19	−3	3	3	2	3	+	X	+	3	2	−	−	−	Varela (2010a)
A. flustrae Ivanenko & Smurov, 1997	3	1	3	21	−4	3	2	2	3	+	X	+	1	3	X	18	+	Ivanenko & Smurov (1997)
A. galeatus Kim, 2010	3	1	3	20	−3	3	4	2	3	+	X	X	2	1	X	18	X	Kim (2010)
A. garridoi Varela, Ortiz & Lalana, 2007	2	1	3	20	−	2	3	2	1	+	X	+	1	3	X	17	X	Varela *et al.* (2007)
A. genodon Stock, 1966	3	1	3	20	−3	3	5	2	1	+	X	+	1	3	1, 2	17	X	Kim (2010)

Table 2. Continued.

Species	Characters (1−17)																	Data source
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
A. halichondriae Stock, 1966	2	2	2	20	−3	3	2	2	3	+	X	+	1	3	2	18	X	Stock (1966); Bandera & Conradi (2013)
A. hirsutus Bandera Conradi & Lopez-Gonzalez, 2005	5	2	4	21	−4	3	5	2	−	+	X	+	1	3	X	17	X	Bandera *et al.* (2005)
A. hoi Bandera & Conradi, 2013	2	1	3	21	−4	3	4	2	−	+	X	+	1	3	−	−	−	Bandera & Conradi (2013)
A. hongkongensis Malt, 1991	3	2	2	19	−2	3	1	1	−	+	X	?	2	3	−	−	−	Malt (1991); Bandera & Mercedes (2009)
A. horridus Kim, 2016	3	2	3	21	−4	2	4	2	3	+	X	+	2	3	2, 3	18	+	Kim (2016)
A. humesi Varela, 2012	1	2	2	19	−3	2	−	2	2	+	X	+	1	3	X	17	−	Varela (2012)
A. indicus Sewell, 1949	4	1	−	20	−3	1	2	1	1	+	X	−	2	3	−	−	−	Sewell (1949); Bandera & Mercedes (2009)
A. indivisus Kim, 2010	1	1	2	20	−3	1	2	1	3	+	X	+	2	3	1, 2	18	X	Kim (2010)
A. intermedius (Hansen, 1923)	4	3	−	21	−4	−	5	−	−	−	−	−	−	−	−	−	−	Hansen (1923); Bandera & Conradi (2009a)
A. jeanyeatmanae Yeatman, 1970	2	1	−	21	−4	3	2	2	3	+	X	+	1	3	X	17	X	Yeatman (1970)
A. kimi Varela, 2012	2	3	2	19	−2	3	3	1	2	+	X	+	1	3	−	−	−	Varela (2012)
A. lalanai Verela, 2013	4	3	2	20	−3	1	3	1	3	+	X	+	1	3	−	−	−	Varela (2012, as *A. stocki*)
A. latus (Brady, 1872)	5	1	4	21	−4	3	3	2	−	+	X	+	2	3	−	−	−	Bandera & Conradi (2009b)
A. lilljeborgi Boeck, 1859	5	1	4	20	−3	1	2	2	4	+	X	X	1	3	X	18	X	Kim (2016)
A. longisetosus Nair & Pillai, 1984	1	1	2	20	−2	1	−	1	1	+	X	+	2	3	−	−	−	Nair & Pillai (1984)
A. madeirensis Bandera, Conradi & Lopez-Gonzalez, 2007	2	1	3	21	−4	3	2	1	3	+	X	+	2	3	X	18	X	Bandera *et al.* (2007)
A. major Thompson & A. Scott, 1903	2	3	−	20	−4	3	−	2	4	−	−	X	3	1	−	17	−	Thompson & Scott (1903)
A. manaarensis Thompson & A. Scott, 1903	1	1	−	20	−4	3	−	2	3	+	X	−	1	3	−	−	−	Thompson & Scott (1903)
A. maxillatus Stock, 1987	3	1	1	20	−3	3	2	2	3	+	X	+	2=3	1	−	−	−	Stock (1987)
A. micheli (Gurney, 1927)	1	3	−	18	−	−	4	2	−	−	−	−	−	−	−	−	−	Gurney (1927)
A. minor Thompson & A. Scott, 1903	3	1	−	20	−4	−	−	2	−	−	−	−	3	1	−	17	−	Thompson & Scott (1903)
A. minutus (Claus, 1889)	4	1	1	21	−4	1	2	1	3	−	X	−	3	1	1	17	X	Bocquet *et al.* (1963); Conradi & Bandera (2011)
A. neptunei Johnsson, In: Johnsson, Rocha & Neves, 2002	3	1	3	20	−3	3	4	2	1	+	X	+	1	3	−	17	X	Johnsson *et al.* (2002)
A. nidorellae Reyes-González & Suárez-Morales, 2021	1	1	3	21	−4	2	2	2	3	+	X	+	1=2	3	3	18	X	Reyes-González & Suárez-Morales (2021)
A. nudicoxus Kim, 2010	3	3	3	21	−4	1	2	2	3	+	X	X	2	3	1	18	X	Kim (2010)
A. oricurvus Kim, 2010	1	3	2	20	−3	1	5	2	1	+	X	X	2	3	1, 2	18	X	Kim (2010)
A. orientalis Sewell, 1949	2	1	2	20	−4	−	3	2	−	+	X	+	1	3	−	−	−	Sewell (1949)
A. ovalis Sewell, 1949	−	−	−	−	−2	1	1	2	4	+	X	+	2	3	X	14	X	Sewell (1949); Bandera & Mercedes (2009)
A. parvus Giesbrecht, 1897	4	1	3	−	−	−	−	−	−	−	−	−	1	3	−	−	−	Giesbrecht (1899)

Table 2. Continued.

Species	Characters (1–17)																	Data source
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
A. peniculatus Kim, 2010	1	1	3	21	−4	1	4	2	1	+	X	+	1	3	1, 3	18	X	Kim (2010)
A. pilosus Kim, 2004	1	2	2	19	−2	3	2	2	3	+	+	+	3=2	1	X	17	X	Kim (2004a)
A. planus Kim, 2010	3	2	3	20	−3	1	2	1	3	+	X	+	1	3	X	18	X	Kim (2010)
A. plumosus Kim, 2010	3	3	3	19	−2	1	2	2	3	+	X	+	3	1	3	18	X	Kim (2010)
A. proboscideus Stock, 1966	1	1	2	20	−3	3	6	1	−	+	X	X	1	3	−	−	−	Stock (1966)
A. quadridens Kim, 2016	1	1	3	20	−3	3	4	2	1	+	X	+	2	1	−	−	−	Kim (2016)
A. rai Kim & Min, 2013	3	1	1	20	−3	1	3	2	3	+	+	+	2	3	2, 3	17	X	Kim & Min (2013)
A. reginae Boxshal & Huys, 1994	3	1	3	21	−4	3	2	2	3	+	X	+	2	3	X	18	X	Boxshall & Huys (1994)
A. renaudi Canu, 1892	3	1	1	19	−3	3	?	1	1	−	−	−	2	3	−	−	−	Canu (1892)
A. sarsi Bandera & Conradi, 2009	4	1	3	21	−4	3	4	2	3	X	X	+	2	3	−	−	−	Bandera & Conradi (2014)
A. sensilis Kim, 2010	1	1	2	20	−3	2	2	1	2	+	X	+	2	3	2	17	X	Kim (2010)
A. simplex Schirl, 1973	3	1	4	20	−3	1	2	2	−	−	X	−	2	3	X	17	X	Schirl (1973)
A. simulans (Scott T., 1898)	1	1	4	21	−4	2	2	2	3	+	X	+	2	3	X	18	X	Kim (2016)
A. siphonatus Giesbrecht, 1897	2	3	2	20	−3	1	6	1	1	+	X	X	1	3	−	−	−	Present study
A. siphunculus Bahia, Canario, Neves & Johnsson, 2012	4	1	3	20	−3	1	1	2	4	+	X	+	1	3	X	18	X	Bahia *et al.* (2012)
A. spinosus Kim & Min, 2013	4	2	4	20	−3	1	3	1	3	+	X	+	2	3	1, 2	18	+	Kim & Min (2013)
A. spongus Johnsson, 2002	3	3	3	18	−3	3	3	1	1	+	X	+	1=2	3	X	17	X	Johnsson (2002)
A. stimulans Giesbrecht, 1897	2	1	3	21	−4	−	5	2	1	+	−	−	−	−	−	−	−	Giesbrecht (1899); Bandera & Huys (2008)
A. stocki Nair & Pillai, 1984	1	1	2	20	−2	1	6	1	1	+	X	X	1	3	2	−	−	Nair & Pillai (1984)
A. suberitis Giesbrecht, 1897	4	2	3	21	−4	2	2	2	3	+	X	+	1	3	1	17	X	Giesbrecht (1899); Bandera & Conradi (2009a)
A. tarifensis Conradi & Bandera, 2011	3	1	2	21	−4	1	2	2	3	+	X	+	1	3	−	−	−	Conradi & Bandera (2011)
A. tenerus (Hansen, 1923)	3	3	2	21	−4	3	5	2	1	+	X	+	2	3	−	18	X	Bandera & Conradi (2009a)
A. tenuicornis Brady, 1910	5	2	−	21	−4?	3	2	2	3	−	X	+	1	3	−	18	X	Eiselt (1965)
A. tenuipes Kim, 2010	2	1	2	20	−3	3	4	2	3	+	X	X	2	3	1, 2	18	X	Kim (2010)
A. tetrasetosus Johnsson, 1999	1	1	2	20	−3	3	2	1	3	+	X	+	1	3	−	−	−	Johnsson (1999)
A. tricuspis Kim, 2010	1	1	2	20	−3	3	2	2	4	+	X	+	3	2	1	18	X	Kim (2010)
A. trisetatus Kim, 2010	1	1	3	20	−3	1	2	2	2	X	+	X	2	1	X	17	X	Kim (2010)
A. tubiporae Kim, 2004	1	1	2	21	−4	1	2	2	4	+	X	X	2	1	1	18	X	Kim (2004b)
A. uncinatus (Krichagin, 1873)	4	1	2	21	−4	3	2	2	3	+	X	−	1	3	−	−	−	Marcus & Por (1960, as *A. carausi*)
A. unioviger Kim, 2010	1	1	3	19	−2	3	2	2	3	+	+	+	3	2	X	17	X	Kim (2010)
A. urabensis Kim, 2004	3	1	3	21	−4	3	4	2	1	+	X	+	1=2	3	1, 3	18	+	Kim (2004a)
A. walteri Kim, 2004	3	1	3	19	−2	3	2	2	4	+	X	+	2	3	3	18	+	Kim (2004a)
A. geminus n. sp.	1	3	3	21	−4	3	3	2	2	+	X	+	2	3	3	18	+	Present study

Table 2. Continued.

Species	Characters (1–17)																	Data source
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
A. processus n. sp.	1	1	3	20	−3	1	4	1	1	X	+	X	2	3	–	–	–	Present study
A. culicis n. sp.	4	2	3	21	−4	3	4	2	1	+	X	+	1	3	1, 2	18	X	Present study
A. eurychelaus n. sp.	1	3	3	20	−3	1	2	1	3	+	X	X	2	1=3	–	–	–	Present study
A. scutellatus n. sp.	2	3	3	20	−3	3	2	1	3	+	X	+	2	3	–	–	–	Present study
A. spiniventer n. sp.	4	3	4	21	−4	2	2	1	3	+	X	+	1	3	1	17	X	Present study
A. fici n. sp.	3	1	4	21	−4	3	3	1	3	+	X	+	1	3	2, 3	18	+	Present study
A. serratus n. sp.	1	1	3	21	−4	3	3	1	3	+	X	+	2	3	2, 3	18	X	Present study
A. tridentatus n. sp.	1	2	2	20	−3	3	3	2	3	+	X	X	1	3	1, 2	17	X	Present study
A. nodulosus n. sp.	3	2	3	21	−4	1	3	1	3	+	X	+	1	3	2, 3	18	+	Present study
A. tetraodontus n. sp.	2	2	3	20	−3	1	2	1	3	+	X	+	2	3	–	–	–	Present study
A. dokdoicus n. sp.	2	1	3	21	−4	3	4	2	3	+	X	+	1	3	2, 3	18	+	Present study
A. exilis n. sp.	1	3	3	19	−2	2	4	1	1	X	X	+	3	2=1	–	–	–	Present study
A. zodius n. sp.	3	2	1	19	−2	3	2	1	2	+	X	+	2	1	X	17	X	Present study

the genus *Asterocheres* are to be compared with new species described in this paper (Table 2).

Asterocheres aesthetes Ho, 1984 (Fig. 1–3)

Syn.: *Asterocheres aesthetes* Ho, 1984: 47, figs. 17–20; Boxshall, 1990: 537, fig. 8C–F; Kim, 1998: 628, figs. 292–294.

Material examined. 40 ♀♀, 20 ♂♂ from washings of unidentified sponges, Munseom, Seogwipo, Jeju Island (33°13′39.4″N, 126°33′48.2″E), SCUBA diving, depth 22 m, coll. T. Lee, 06 April 2023; 20 ♀♀, 10 ♂♂ from washings of unidentified sponges, Munseom, Seogwipo, Jeju Island (33°13′30.6″N, 126°34′09.62″E), trimix diving, depth 56 m, coll. T. Lee, 26 April 2023.

Female. Body (Fig. 1A) cyclopiform. Body length of largest described specimen 936 μm. Mean body length 857 μm (763–936 μm), based on 10 specimens. Prosome 659 μm long, occupying 70% of body length. Cephalothorax wider than long (418 × 488 μm). All prosomal somites with rounded lateral corners. Urosome (Fig. 1B) 4-segmented. Fifth pedigerous somite (first urosomal somite) 148 μm wide, bearing minute spinules scattered on lateral surface. Genital double-somite slightly wider than long (123 × 126 μm), gradually narrowing along posterior half; genital apertures positioned dorsolaterally at about 40% region of double-somite length; postgenital lateral margin ornamented with 2 groups of spinules (Fig. 2F), anterior group comprising about 12 longer spinules and posterior group comprising 4 or 5 shorter and thicker spinules; posterodorsal margins of double-somite bearing row of minute spinules. Two free abdominal somites 45 × 70, and 45 × 67 μm, respectively, each with 3 or 4 spiniform scales on each lateral margin. Posteroventral margin of anal somite bearing row of spinules (Fig. 1C). Caudal ramus (Fig. 1C) slightly wider than long (28 × 30 μm), with longer outer margin, shorter inner margin, armed with 6 setae, and ornamented with spinules along oblique posterior margin.

Rostrum (Fig. 1D) as tapering ridge, lacking posterior apex. Antennule (Fig. 1E) 378 μm long, 21-segmented; each segment bearing 2 setae, except 7 setae on 9th segment, 2 setae + aesthetasc on 18th segment, 4 setae on penultimate segment, and 7 setae on terminal segment; 10th segment short, obscure; many setae on anterior segments pinnate, some of them truncated, tipped with small setule; 3 large setae (one on 5th segment and 2 on 9th segment) bearing segments-like annulations. Antenna (Fig. 1F) consisting of coxa, basis, exopod, and 3-segmented endopod; coxa short, bearing patch of spinules on outer margin; basis bearing longitudinal row of needle-like, fine spinules along distal half; exopod small, 2.80 times longer than wide (14 × 5 μm), bearing 1 middle and 2 unequal, terminal setae, larger one of terminal setae with annula-

tion proximally; endopod with armature formula of 0, 1, and 2 + claw; first endopodal segment 68 μm long, with setules on outer margin; second endopodal segment short; third endopodal segment with setules on outer margin; terminal claw spiniform, straight, 65 μm long, slightly shorter than first endopodal segment.

Oral siphon (Fig. 1G) 191 × 74 μm, attenuated distally, extending to insertions of maxillipeds, tipped with translucent, circular material. Mandible (Fig. 1H) consisting of coxal stylet and palp; stylet 184 μm long, slightly curved, distally attenuated, with truncated tip and 12 minute teeth; palp 2-segmented, 49 and 21 μm long, respectively, tipped with 2 unequal, weakly pinnate setae (192 and 75 μm long, respectively); palp plus longer distal seta 262 μm long, 1.42 times longer than stylet. Maxillule (Fig. 1I) bilobed, bearing patch of small spinules on outer margin near base of outer lobe; inner lobe (precoxal endite) about 67 μm long, tipped with 4 longer setae (106, 102, 100, and 63 μm, respectively) and 1 small seta, and ornamented with thin setules on proximal part of inner margin and several thicker setules subdistally; outer lobe (palp) 24 μm long, bearing 2 naked distal setae (87 and 74 μm long, respectively) and 2 pinnate subdistal setae (62 and 33 μm long, respectively). Maxilla (Fig. 1J) 2-segmented; proximal segment (syncoxa) bearing flexible hyaline tube of maxillary gland and row of minute, needle-like spinules at proximal region; distal segment (basis) claw-like, as long as proximal segment, curved in distal region, bearing linguiform process proximally and tuft of setules at 60% region of segment length and row of fine spinules along distal third. Maxilliped (Fig. 1K) consisting of syncoxa, basis, and 4-segmented endopod, with armature formula 1, 1, 2, 1, 1, and 1 + claw; basis with fine spinules along outer margin, seta on inner margin minute, obscure; terminal endopodal segment and terminal claw 41 and 72 μm long, respectively.

Legs 1 (Fig. 2A), 2 (Fig. 2B), 3, and 4 (Fig. 2D) biramous, with 3-segmented rami. Leg 3 similar to leg 2, except bearing different armature on third endopodal segment (Fig. 2C). Intercoxal plate of leg 1–3 bearing spinules on distal surface, that of leg 4 smooth. Outer seta on basis of legs 1–3 large, pinnate along distal region. Inner distal corner of basis of leg 1 with spinules. Second endopodal segment of legs 1–4 with bicuspid outer distal process. Inner coxal seta of leg 4 small and naked. Third endopodal segment of fourth leg 72 μm long, its distal spine 68 μm long, slightly longer than segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III, 2, 2	0-1; 0-2; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 3
Leg 4	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 2

Leg 5 (Fig. 1B) consisting of protopod and exopod; protopod fused with fifth pedigerous somite, bearing 1 pinnate dorsolateral seta; exopodal segment (Fig. 2E) 2.19 times longer than wide (57 × 26 μm), armed with 3 setae; inner and outer margins convex, each bearing about 10 spinules; outer distal seta longest, 61 μm long, weakly pinnate; inner distal seta naked, 45 μm long; inner subdistal seta 27 μm long, pinnate, annulated proximally. Leg 6 (Fig. 2F) represented by 1 pinnate seta and 1 spinule on genital operculum.

Male. Body (Fig. 3A) narrower and smaller than that of female. Body length 698 μm in described specimen. Prosome 465 μm long. Cephalothorax as long as wide (327 × 327 μm). Urosome (Fig. 3B) 5-segmented. Fifth pedigerous somite 95 μm wide. Genital somite wider than long (106 × 130 μm), with many spinules covering lateral surfaces; genital operculum well-developed. Three free abdominal somite 23 × 60, 23 × 55, and 30 × 45 μm, respectively. Caudal ramus 0.83 times longer than wide (20 × 24 μm).

Rostrum as in female. Antennule (Fig. 3C) 18-segmented, geniculate between 15th and 16th segments and between 16th and 17th segments; each segment bearing 2 setae, except 7 setae on 9th segment, 2 setae + aesthetasc on 13th segment, 2 setae + aesthetasc on 17th segment, and 10 setae on terminal segment; aesthetasc on 13th segment thin, setiform.

Antenna, oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 3D) segmented as in female; basis with thick proximal process on inner margin, inner seta absent.

Legs 2 and 3 slightly different from those of female. In leg 2 endopod (Fig. 3E), second segment bearing enlarged bicuspid outer distal process; third segment bearing shortened outer distal seta, 1 small nodule on anterior surface of outer distal process, and several spinule on distal margin. In leg 3, third endopodal segment (Fig. 3F) bearing slightly curved outer distal process.

Exopodal segment of leg 5 (Fig. 3G) nearly rectangular, 2.56 times longer than wide (34 × 13.3 μm), with few spinules on inner and outer margins; 3 setae 42, 36, and 18 μm long, respectively, from outer to inner. Leg 6 (Fig. 3H) represented by outer distal part of genital operculum bearing 2 unequal setae, spinules on outer and inner margin, and 4 or 5 setules on inner margin.

Remarks. This is the first known species of *Asterocheres* in Korea (Kim, 1998). The newly examined material collected in Korea are identifiable as this species by the characteristic, sexually dimorphic features revealed on the third endopodal segment of male leg 2 and by the characteristic ornamentation on the genital operculum of the male, which Ho (1984) described and figured in the original description. Ho (1984) overlooked the presence of an aesthetasc on the thirteenth segment of the

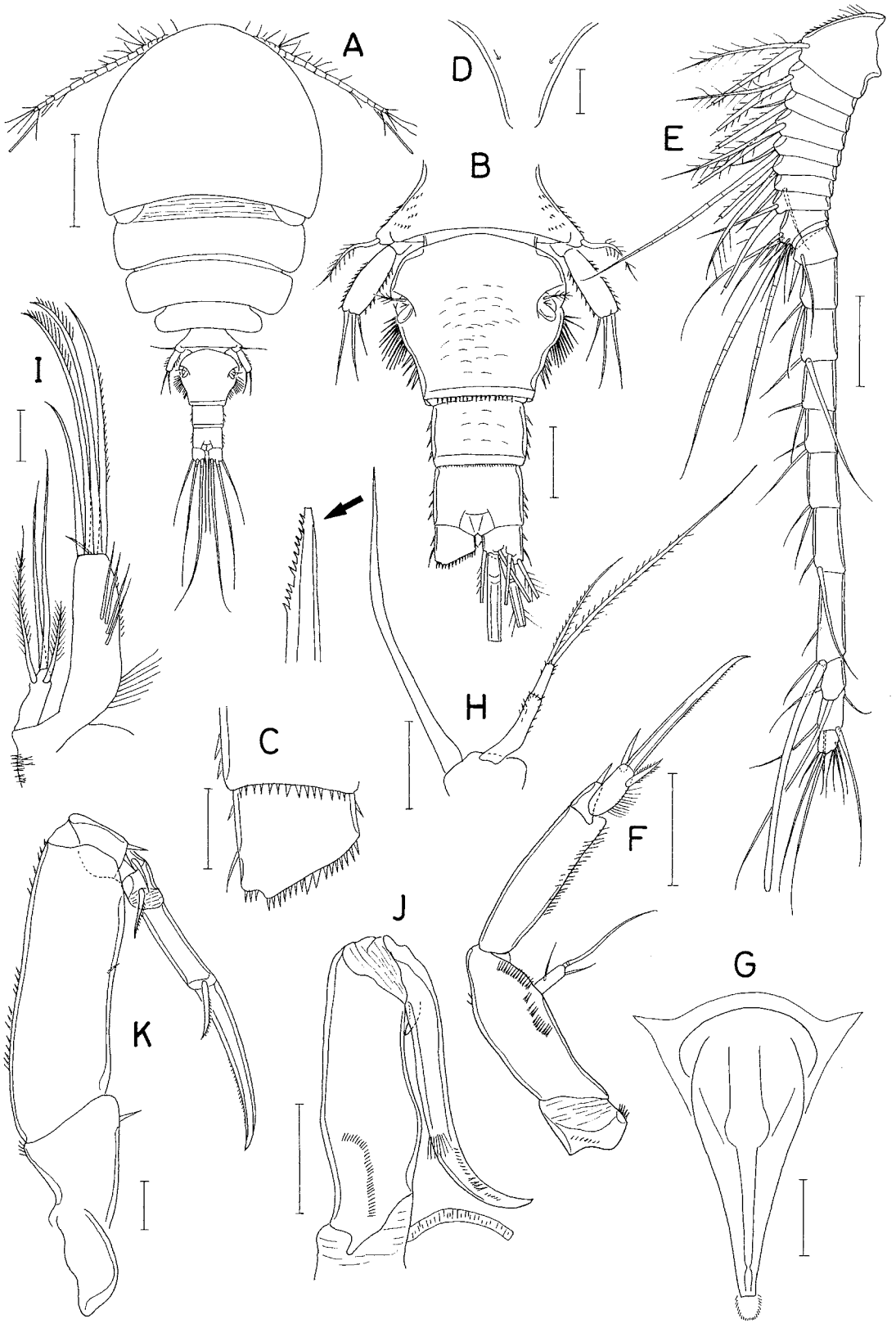

Fig. 1. *Asterocheres aesthetes* Ho, 1984, female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.2 mm; B, E–H, J, 0.05 mm; C, D, I, K, 0.02 mm.

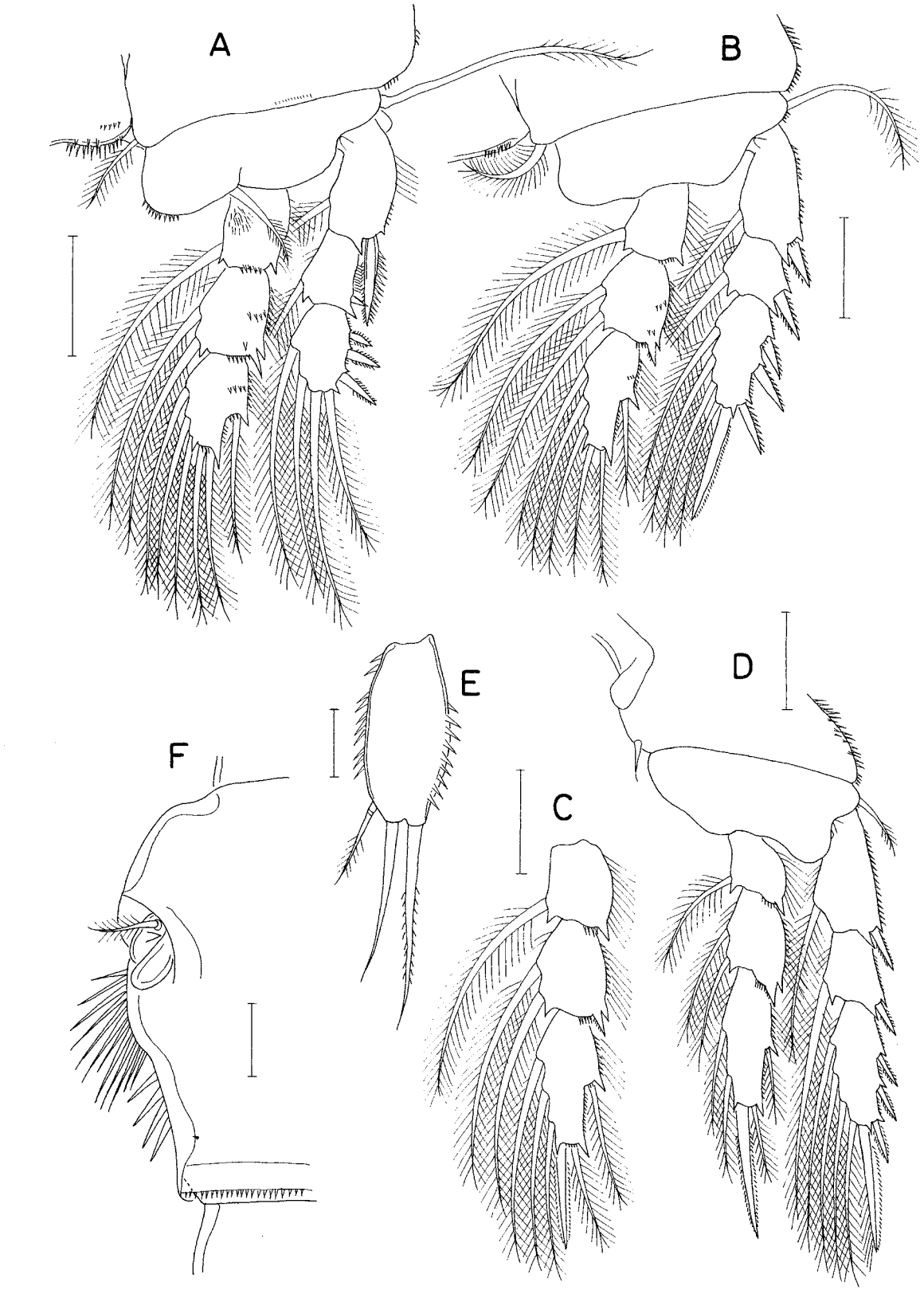

Fig. 2. *Asterocheres aesthetes* Ho, 1984, female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal. Scale bars: A–D, 0.05 mm; E, F, 0.02 mm.

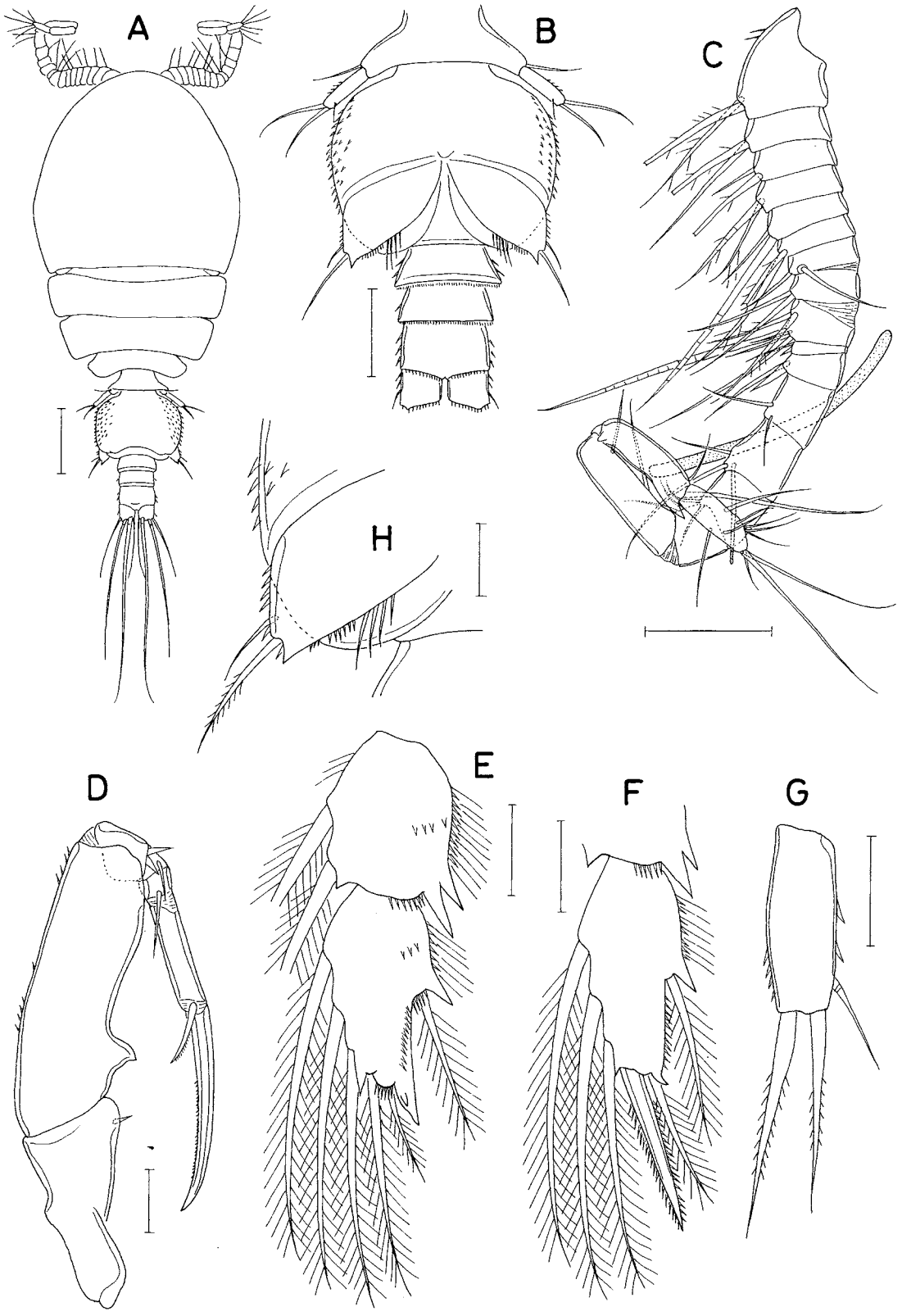

Fig. 3. *Asterocheres aesthetes* Ho, 1984, male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, maxilliped; E, second and third segments of leg 2 endopod; F, third segment of leg 3 endopod; G, exopod of leg 5; H, leg 6. Scale bars: A. 0.1 mm; B, C, 0.05 mm; D–H, 0.02 mm.

male antennule and a slight sexual dimorphism on leg 3, which are considered as useful characters in the present paper.

Asterocheres siphonatus Giesbrecht, 1897 (Figs. 4, 5)

Material examined. Two ♀♀ from washings of mixed species of sponges, Munseom, Seogwipo, Jeju Island (33°13′41.1″N, 126°34′05.9″E), SCUBA diving, depth 28.1 m, coll. T. Lee, 06 April 2023. One ♀ (intact; MABIK CR00254239) has been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon, Korea. One dissected ♀is kept in the collection of I.-H. Kim.

Female. Body (Fig. 4A) moderately broad. Body length 1.24 mm in dissected specimen (1.23 mm in another specimen). Prosome 830 μm long. Cephalothorax semicircular, 509 × 667 μm. Posterolateral corners of second pedigerous somite pointed but rounded in other prosomal somites. Posterodorsal margin of fourth pedigerous somite deeply concave. Urosome (Fig. 4B) 4-segmented. Fifth pedigerous somite 215 μm wide, distinctly wider than genital double-somite, with several spinules (or scales) on lateral regions. Genital double-somite 1.29 times longer than wide (204 × 158 μm), consisting of broader anterior two-thirds and narrower posterior third; broader anterior part with sub-parallel lateral margins; narrower posterior third tapering posteriorly; genital apertures positioned dorsolaterally at midlength of double-somite; postgenital lateral margin bearing 9 spinules (Figs. 4B, 5G). Two free abdominal somites 64 × 95 and 62 × 90 μm, respectively; all urosomal somites covered with scattered scales. Anal somite with pointed scales along posteroventral margin (Fig. 4C). Caudal ramus (Fig. 4C) as long as wide (38 × 38 μm), with 6 setae, longer outer margin, shorter inner margin, and thin spinules along posteroventral margin.

Rostrum (Fig. 4D) as long as wide, tapering, with rounded distal apex. Antennule (Fig. 4E) 585 μm long, 20-segmented, including indistinct 10th segment; 9th, 18th, and terminal segments with 7 setae, 2 setae + aesthetasc, and 9 setae; all other segments each with 2 setae; several setae on proximal segment pinnate. Antenna (Fig. 4F) with short coxa bearing several setules; basis 93 μm long, with longitudinal row of needle-like spinules near exopod, several spinules on inner margin; exopod about 2.2 times longer than wide (16 × 7.3 μm), bearing 3 small setae, largest distal one of them annulated at base; exopod 3-segmented; first endopodal segment 93 μm long, unarmed but ornamented with longitudinal row of thin spinules; short second endopodal segment with 1 seta; third endopodal segment with 3 small setae of subequal lengths, bearing setules, and terminated by slender claw (82 μm long),

Oral siphon (Fig. 4G) slender, flexible, extending to posterior margin of prosome, over intercoxal plate of leg 4, bearing numerous fine transverse striae, 105 μm wide across proximal region, 130 μm wide at proximal box. Mandible (Fig. 4H) consisting of thin coxal stylet and thin palp; stylet curved, 436 μm long, tipped with 4 unequal teeth; palp 1-segmented, 127 μm long, with vestige of articulation at proximal third, tipped with 2 setae (155 and 138 μm long, respectively); palp segment plus longer distal seta 282 μm long, much shorter than stylet. Maxillule (Fig. 3I) bilobed; outer lobe 44 μm long tipped with 3 longer and 1 small setae, 2 longer one of them 159 and 133 μm long; inner lobe 102 μm long, gradually narrowing distally, setulose along inner margin, tipped with 4 setae (lengths 195, 162, 71, and 66 μm, respectively). Maxilla (Fig. 3J) rather stout; proximal segment with 2 groups of spinules at proximal region; distal segment shorter than proximal segment, with several small spinules at subdistal region. Maxilliped (Fig. 5A) 6-segmented; armature formula 1, 1, 2, 1, 1, 1 + claw; second segment (basis) 159 μm long; terminal segment and claw 53 and 82 μm long, respectively.

Legs 1 (Fig. 5B), 2 (Fig. 5C), 3, and 4 (Fig. 5E) biramous, with 3-segmented rami. Intercoxal plate of all swimming legs smooth, unornamented. Inner distal margin of basis spinulose in leg 1, but smooth in legs 2 and 3. Leg 1 with well-developed inner coxal seta, but outer seta on basis smaller than that of other swimming legs. Leg 3 similar to leg 2, except bearing 1 spine and 5 setae on third endopodal segment (Fig. 5D). Leg 4 lacking inner coxal seta; distal spine on third endpodal segment as long as segment. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III, 2, 2	0-1; 0-2; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 3
Leg 4	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 2

Leg 5 represented by 1 dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment (Fig. 5F) 1.94 times longer than wide, tapering distally, armed with 3 naked setae (2 distal and 1 subdistal), ornamented with spinules on lateral margins; lengths of 2 distal setae 83 and 75 μm; smaller subdistal seta 29 μm long. Leg 6 (Fig. 5G) represented by 1 pinnate seta and 1 small spinule on genital operculum. Leg 6 represented by 1 pinnate seta and 1 spinule on genital operculum and accompanied by 1 elongate digitiform process in genital aperture.

Male. Unknown.

Remarks. *Asterocheres siphonatus* Giesbrecht, 1897 has been known from European waters. It was redescribed

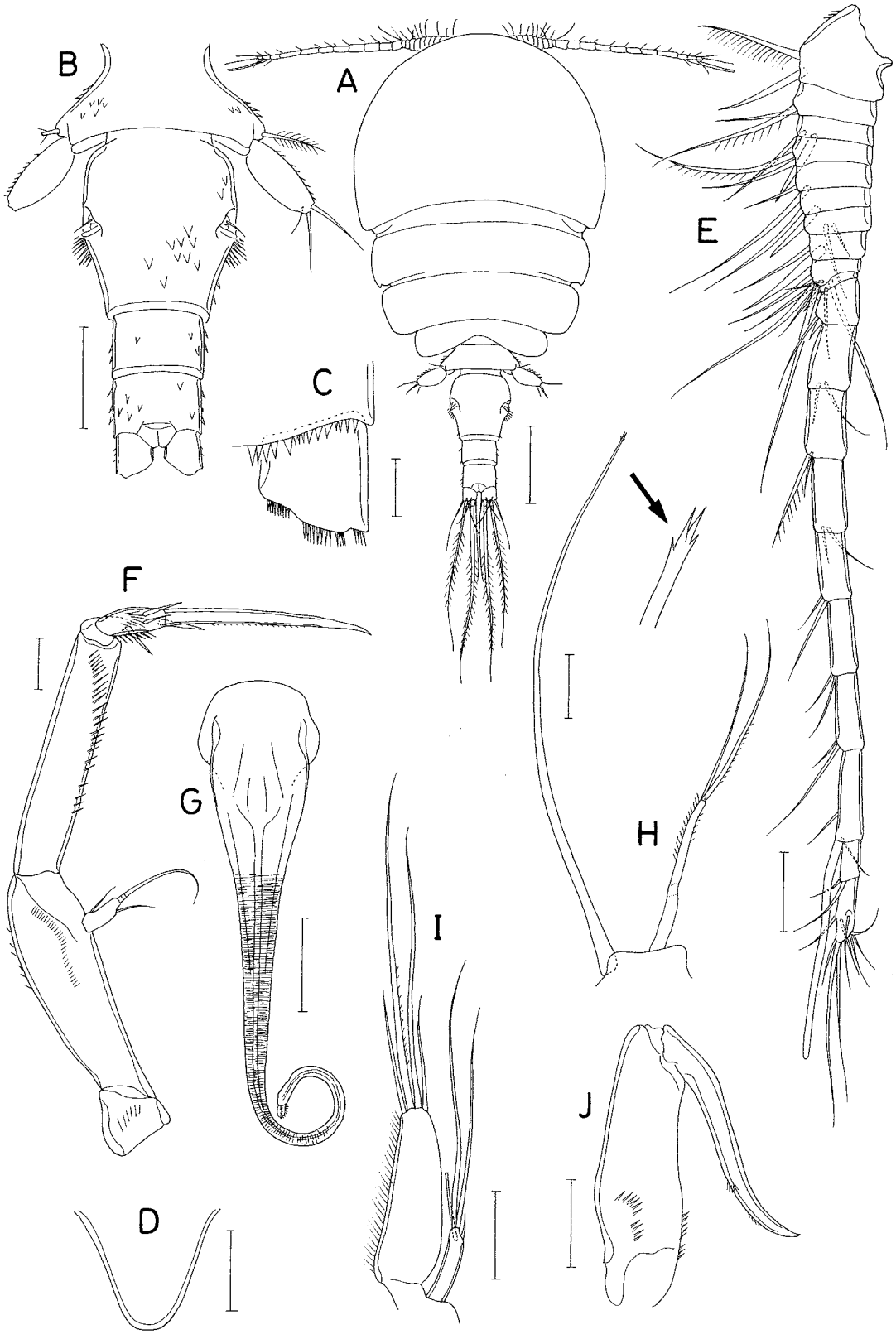

Fig. 4. *Asterocheres siphonatus* Giesbrecht, 1897, female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antennal; G, oral siphon; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.2 mm; B, G, 0.1 mm; C, F, 0.02 mm; D, E, H–J, 0.05 mm.

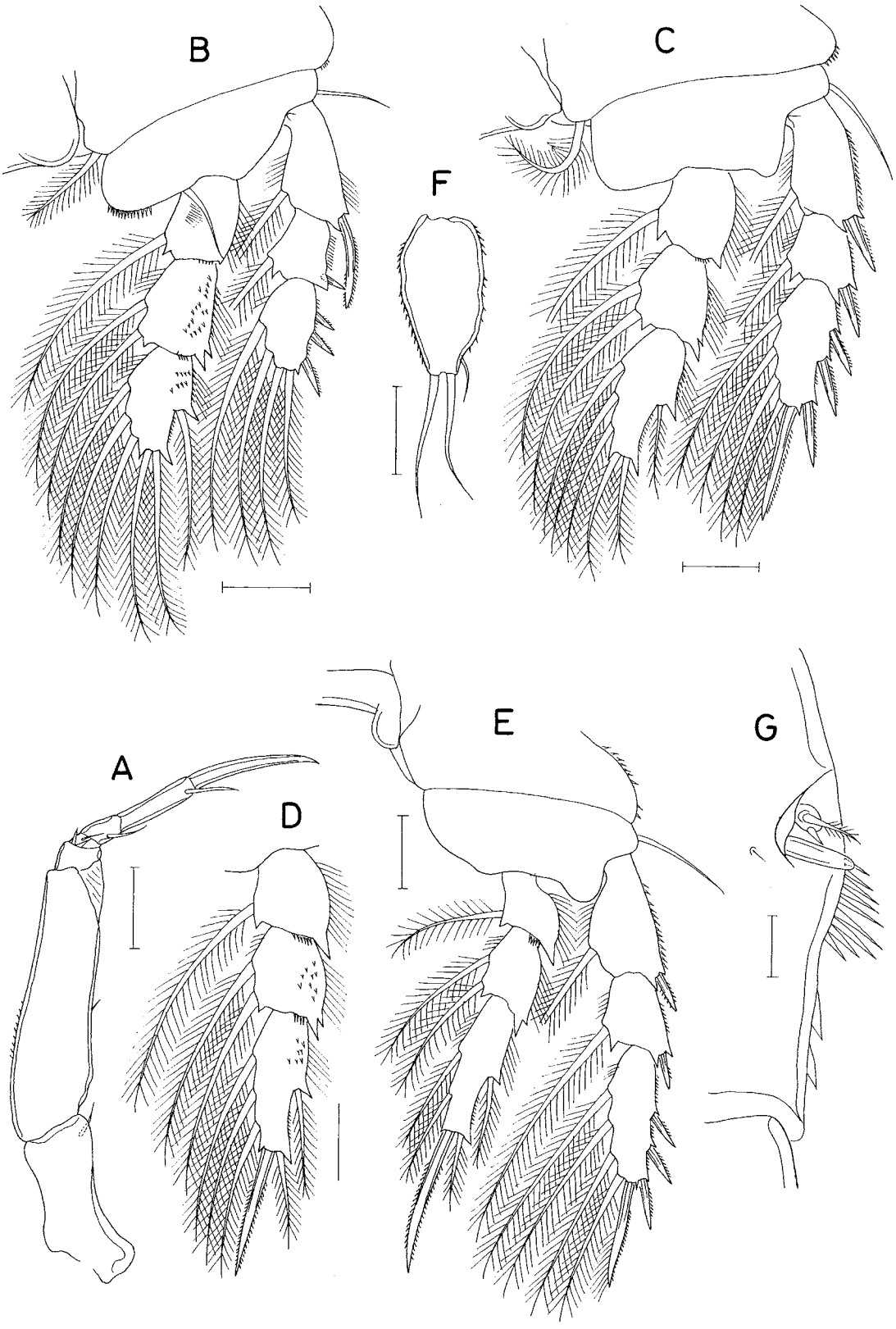

Fig. 5. *Asterocheres siphonatus* Giesbrecht, 1897, female. A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, exopod of leg 5; G, right side of genital double-somite, dorsal. Scale bars: A–F, 0.05 mm; G, 0.02 mm.

by Sars (1915) under the name of *Ascomyzon lilljeborgi* Thorell, 1859 (a name preoccupied by *Asterocheres lilljeborgi* Boeck, 1859) and by Bandera & Conradi (2011) under the name *Asterocheres siphonatus*. This species exhibits several features unusual for the genus, such as the elongated oral siphon which extends over leg 4 and bears numerous horizontal striations, the thin mandibular stylet which is much longer than the palp, the two almost equally long distal setae on the mandibular palp, one of the setae on the inner lobe of the maxillule is much longer than other three setae on the same lobe, one of the setae on the outer lobe of the maxillule is markedly shorter than other three setae, and the rostrum is well-developed with a rounded distal apex. These features were described or illustrated by Sars (1915) and Bandera & Conradi (2011), and Korean material reveals the same features, as well. Some discrepancies between the two geographical forms are noticed, as follows: (1) the body length of the female is 1.24 mm in Korean material, compared to 880−960 μm in the measurement of Bandera & Conradi (2011) for European material; (2) the outer seta on the basis of legs 1 and 2 of Korean material is smaller than those illustrated by Sars (1915) and Bandera & Conradi (2011); (3) the inner coxal seta of leg 1 of Korean material is larger than that illustrated by the European researchers. However, these discrepancies are thought to be minor and zoogeographical variations.

Asterocheres siphonatus is recorded here as a circumpolar species. Kim (2016) already reported *A. lilljeborgi* Boeck, 1859 and *A. simulans* (Scott T., 1898) from Korean waters as other examples of *Asterocheres* species with the circumpolar distribution.

Asterocheres geminus n. sp. (Figs. 6−8)

https://zoobank.org/urn:lsid:zoobank.org:act:24487F34-4F05-4D99-AD6A-0AB6936FCDC4

Type material. Holotype (intact ♀, MABIK CR00254664), intact paratypes (2♀♀, MABIK CR00254665), and dissected paratypes (1♀, 1♂) from washings of unidentified sponges, Seogwipo, Jeju Island (33°13′39.6″N, 126°35′58.9″E), trimix diving, depth 50.1 m, coll. T. Lee, 25 May 2022. Holotype and intact paratypes have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon. Dissected paratypes are retained in the collection of I.-H. Kim.

Etymology. The name is derived from the Latin *gemin* (=twin), referring to the similarity between the new species and *A. boeckii* (Brady, 1880).

Female. Body (Fig. 6A) moderately narrow. Body length 749 μm in dissected and described specimen. Other 3 females 727, 715, and 715 μm long, respectively. Prosome 520 μm long. Cephalothorax slightly wider than long. All prosomal somites with rounded lateral corners. Urosome (Fig. 6B) 4-segmented. Fifth pedigerous somite bearing few spinules on lateral margin. Genital double-somite 1.07 times longer than wide, widest across proximal third, narrowing along distal two-thirds; genital apertures positioned dorsolaterally at 45% region of double-somite length; postgenital lateral margin with about 20 subequal setules (or spinules). Two free abdominal somite 33 × 53 and 34 × 47 μm, respectively. Anal somite with fine spinules arranged along posteroventral margin (Fig. 6C). Caudal ramus (Fig. 6C) slightly wider than long (24 × 25 μm), bearing fine spinules along posteroventral margin.

Rostrum (Fig. 6D) as tapering ridge, without distal apex. Antennule (Fig. 6E) 264 μm long, 21-segmented but articulation indistinct between 2 terminal segments; 18th, 20th, and terminal segments with 2 setae + aesthetasc, 4 setae, and 7 setae, respectively; all other segments each with 2 setae; some of setae on proximal segments pinnate, bearing minute setule at truncated tip. Antenna (Fig. 6F) similar to that of *A. aesthetes*; exopodal segment 9 × 4 μm; first endopodal segment 55 μm long, bearing spinules at proximal third and on inner margin; terminal claw spiniform, 60 μm long, slightly longer than first endopodal segment.

Oral siphon (Fig. 6G) 173 × 54 μm, reaching between maxilliped and leg 1. Mandible (Fig. 6H) consisting of coxal stylet and palp; coxal stylet 160 μm long, bearing 12 teeth (excluding pointed distal tip) on distal part (Fig. 6I); palp indistinctly 2-segmented, proximal segment 32 μm long, distal segment 11 μm long, bearing 2 unequal pinnate setae of 118 and 44 μm long, respectively; palp plus longer terminal seta 161 μm long, almost same in length as coxal stylet. Maxillule (Fig. 6J) as usual for genus; inner lobe about 64 μm long, distally bearing 4 large and 1 small setae (lengths of 4 large setae 95, 90, 86, and 55 μm, respectively); outer lobe 23 μm long, bearing 4 setae (lengths of 2 naked terminal setae 69 and 55 μm, respectively; lengths of 2 pinnate subdistal setae 51 and 29 μm, respectively). Maxilla (Fig. 6K) bearing row of needle-like spinules on proximal region of proximal segment (syncoxa); distal segment (basis) distinctly longer than proximal segment, bearing 1 tubercle at 40% region of outer margin and setules and spinule row along distal half. Maxilliped (Fig. 6L) as in *A. aesthetes*, but with 1 transverse row of small spinules on third endopodal segment; last endopodal segment 33 μm long; terminal claw 70 μm long.

Legs 1 (Fig. 7A), 2 (Fig. 7 B), 3, and 4 (Fig. 7D) similar to those of *A. aesthetes*, but outer seta on basis of these legs smaller than those of latter species. Leg 3 similar to leg 2, except bearing 1 spine and 5 setae on third endopodal segment (Fig. 7C). Third endopodal segment of leg 4 46 μm long; its distal spine 35 μm long, shorter than segment. Armature formula for legs 1−4 as

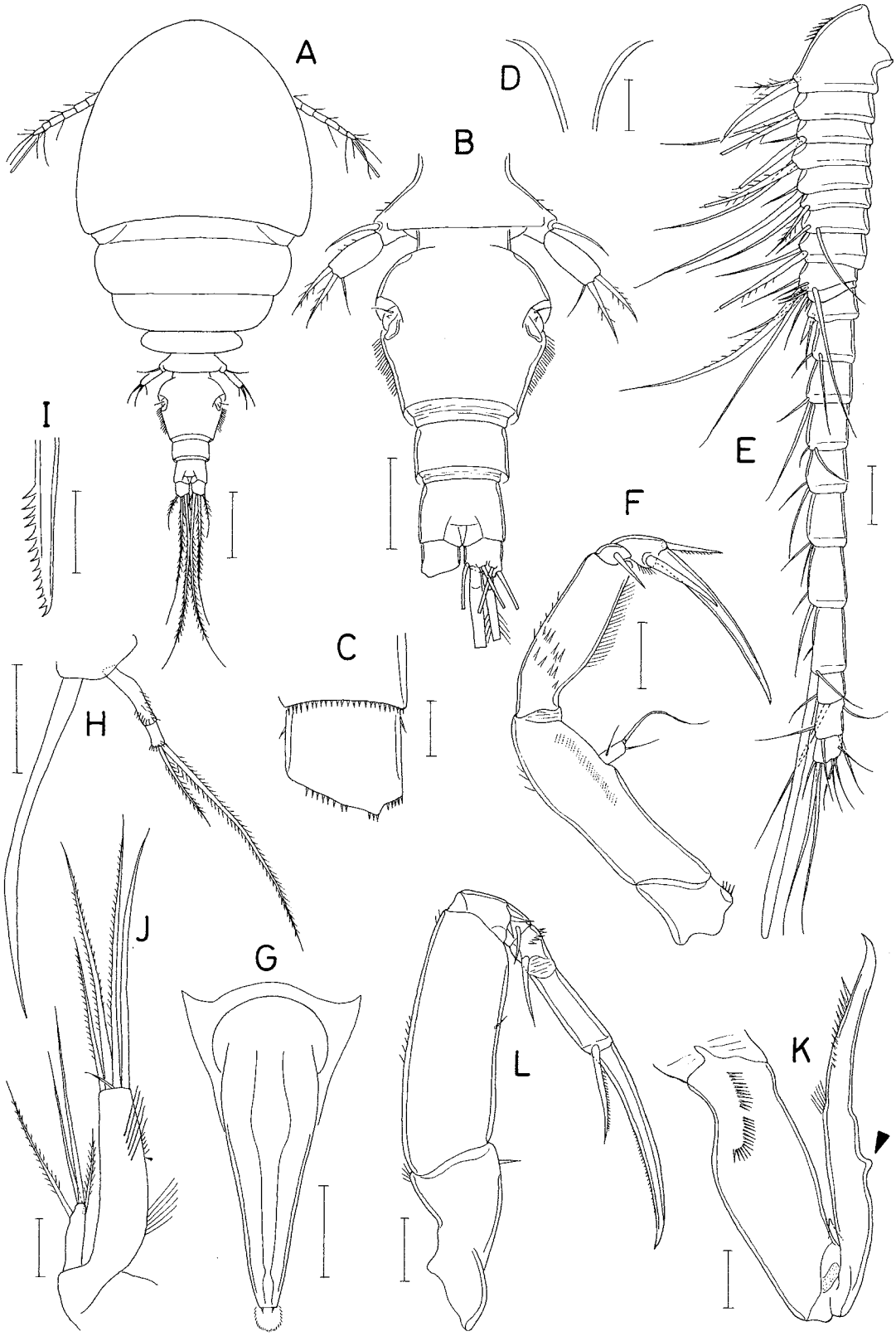

Fig. 6. *Asterocheres geminus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, distal part of mandibular stylet; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, 0.1 mm; B, G, H, 0.05 mm; C, I, 0.01 mm; D–F, J–L, 0.02 mm.

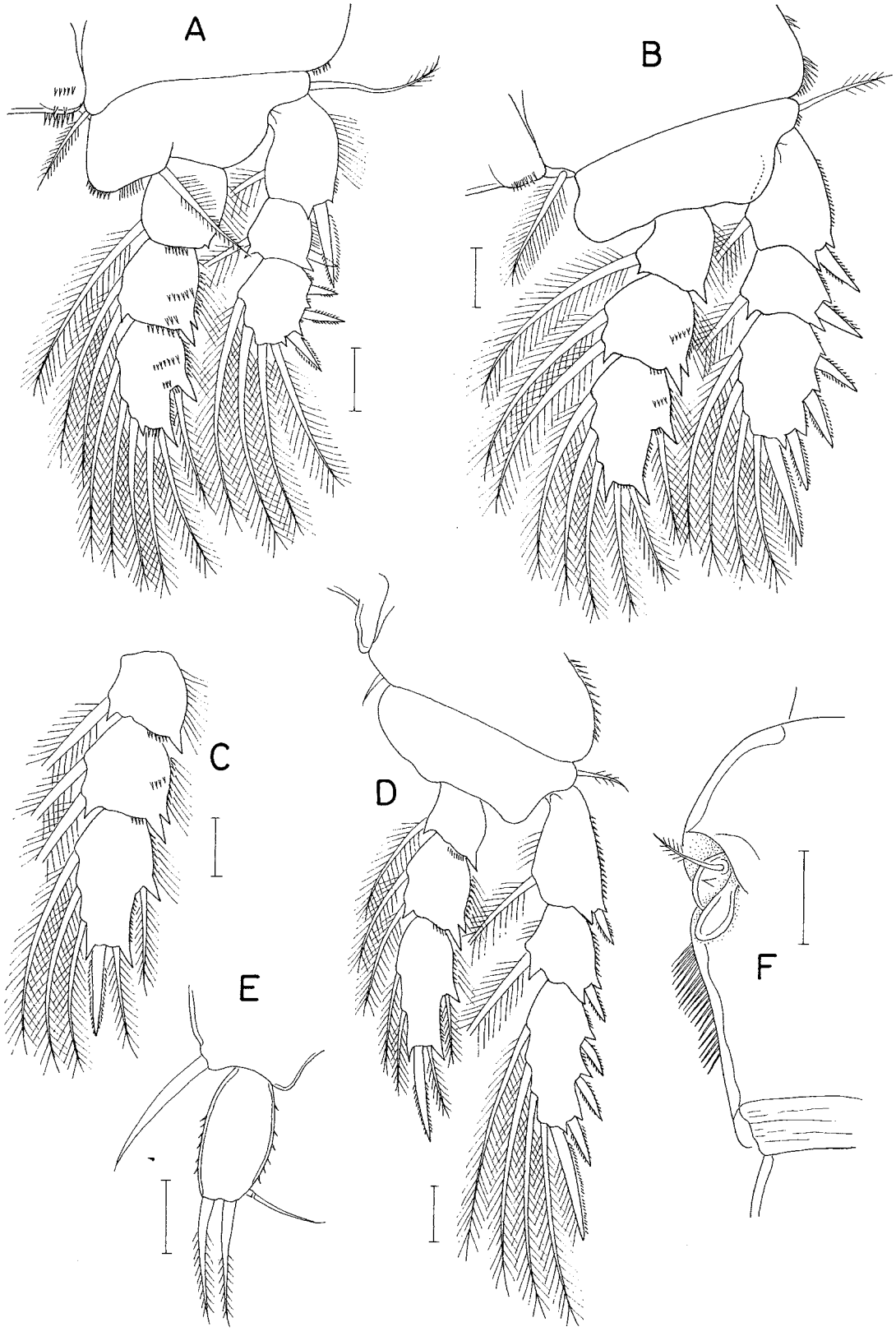

Fig. 7. *Asterocheres geminus* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, leg 5; F, left side of genital double-somite, dorsal. Scale bars: 0.02 mm.

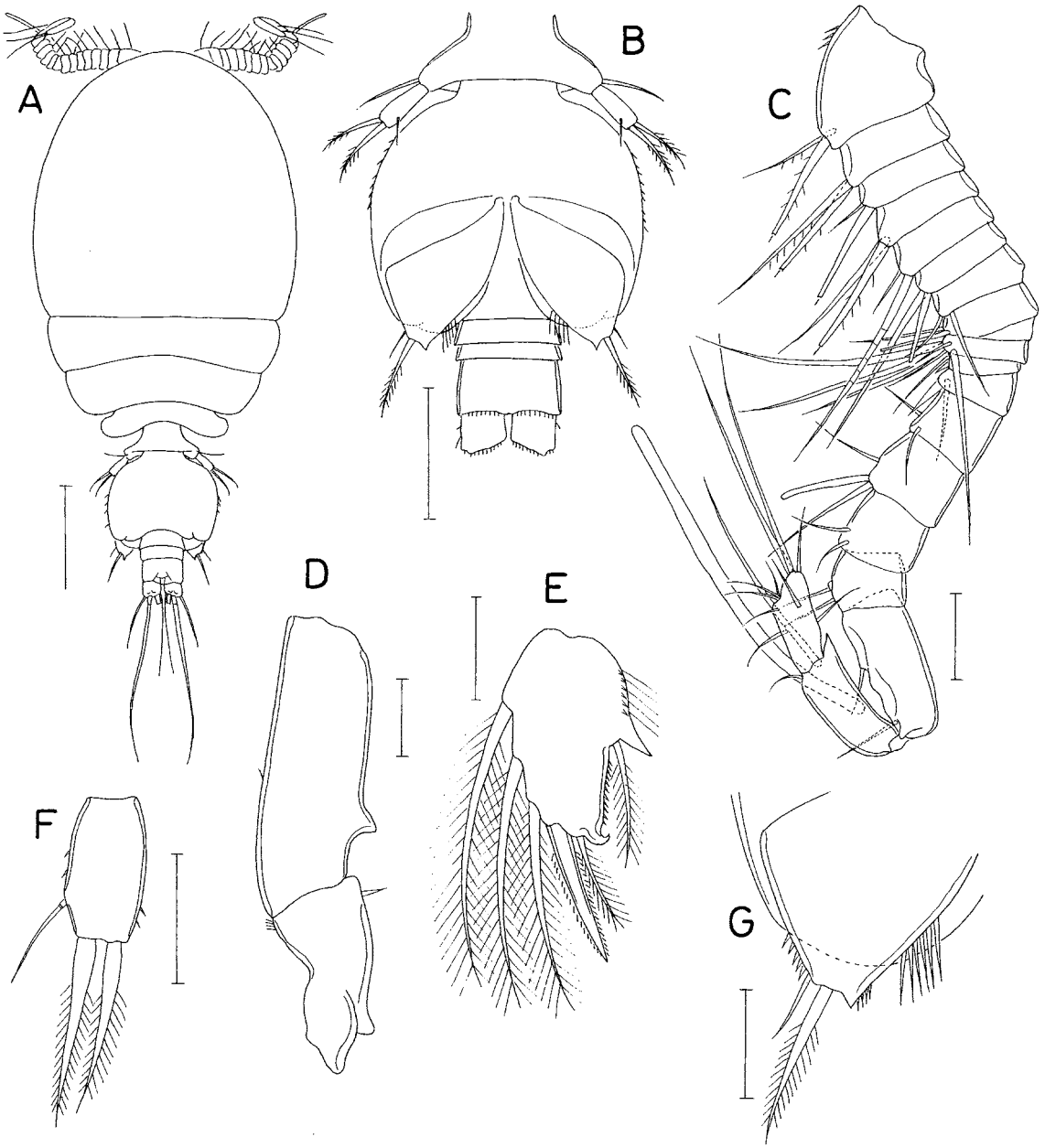

Fig. 8. *Asterocheres geminus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, proximal segments of maxilliped; E, third endopodal segment of leg 3; F, exopod of leg 5; G, leg 6. Scale bars: A, 0.1 mm; B, 0.05 mm; C–G, 0.02 mm.

in *A. aesthetes*.

Leg 5 (Fig. 7E) consisting of 1 naked dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment 1.89 times longer than wide (36 × 19 μm); outer and inner margins coves, each with several small spinules; 2 distal setae pinnate, subequal (outer and inner setae 35 and 36 μm long, respectively); inner subdistal setae naked 28 μm long, annulated proximally. Leg 6 (Fig. 7F) as 1 pinnate seta and 1 spinule on genital operculum.

Male. Body (Fig. 8A) smaller than that of female, 536 μm long. Prosome 367 μm long. Cephalothorax 264 × 260 μm, Urosome (Fig. 8B) 5-segmented. Fifth pedigerous somite 70 μm wide. Genital somite (Fig. 8A, B) nearly circular, 95 × 107 μm, with few minute spinules on lateral margin. First and second abdominal somites characteristically short, each less than half as long as anal somite. Caudal ramus wider than long.

Rostrum as in female. Antennule (Fig. 8C) 18-segmented, geniculate between 16th and 17th segments; 9th seg-

ment with 7 setae; 13th and penultimate segments each with 2 setae + aesthetasc; terminal segment with 10 setae; all other segments each with 2 setae; anterodistal corner of penultimate segment produced, pointed.

Antenna, oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped with 1 proximal process on inner margin, but bearing no seta (Fig. 8D).

Legs 1, 2, and 4 as in female. Outer distal process of third endopodal segment of leg 3 (Fig. 8E) curved as in *A. aesthetes* (endopod of leg 2 same as that of female, unlike in latter species).

Leg 5 exopodal segment of leg 5 (Fig. 8F) 1.69 times longer than wide (22 × 13 μm); its 3 setae 27, 30, and 15 μm long, respectively, from outer to inner. Leg 6 (Fig. 8G) represented by outer distal corner of genital operculum bearing 2 unequal setae at apical region, several spinules on inner and outer margins and 6 or 7 stiff setules on inner margin.

Remarks. A comparison of characters between the new species and its congeners reveals that the new species appears to be most close to *A. boeckii* (Brady, 1880) which was redescribed by Bandera & Conradi (2016). The male is unknown in *A. boeckii*. Based on female characters 1−14 in Table 1, the two species exhibit 86% similarity value, sharing 12 identical character states in 14 characters. As revealed two differences, the genital double-somite of the female is shorter than wide in *A. boeckii* but slightly longer than wide in *A. geminus* n. sp., and the oral siphon extends to the insertions of leg 1 in *A. boeckii* but to the midway between the maxilliped and leg 1 in *A. geminus* n. sp. As additional differences, the new species has (1) a tubercle-like process on the distal segment of the maxilla (vs. the tubercles absent in *A. boeckii* according to the figure of Bandera & Conradi, 2016), (2) the mandibular palp (including the longer distal seta) which is as long as the coxal stylet (vs. the palp is shorter than the stylet in *A. boeckii*), and (3) the setules on the postgenital lateral margins of the genital double-somite are subequal in the shape and length (vs. the setules of *A. boeckii* are grouped into longer anterior and shorter posterior groups, as illustrated by Bandera & Conradi, 2016).

It is noticed that the third endopodal segment of male leg 3 of the new species exhibits the same sexual dimorphism as in *A. aesthetes* and leg 6 of the male is also very similar between the two species. However, unlike *A. aesthetes*, the new species bears no sexual dimorphism in leg 2 and shows other minor differences in the mandible, maxilla, and leg 5.

Asterocheres processus n. sp. (Figs. 9, 10)

https://zoobank.org/urn:lsid:zoobank.org:act:9CC42A9C-B9A6-4961-9AB6-7A23EA804047

Type material. Holotype (intact ♀; MABIK CR00254235), intact paratypes (4 ♀♀; MABIK CR00254236), and dissected paratype (♀) from mixed species of sponges, Munseom, Seogwipo, Jeju Island (33°13′41.1″N, 126°34′05.9″E), SCUBA diving, depth 28.1 m, coll. T. Lee, 06 April 2023. Holotype and intact paratypes have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon, Korea. Dissected paratype is kept in the collection of I.-H. Kim.

Etymology. The specific name alludes to the elongated distal process on the third endopodal segment of leg 1.

Female. Body (Fig. 9A) gradually narrowing posteriorly. Body length 767 μm in figured and described specimen. Prosome 516 μm long. Cephalothorax 335 × 440 μm, somewhat inflated. All prosomal somites with rounded lateral corners. Urosome (Fig. 9B) 4-segmented. Fifth pedigerous somite 109 μm wide. Genital double-somite wider than long (120 × 129 μm), widest at 47% region of double-somite; genital apertures positioned dorsolaterally slightly posterior to widest region; postgenital lateral margins bearing 12−15 spinules including slightly longer several posterior ones (Fig. 10G). Two free abdominal somites 50 × 62 and 30 × 53 μm, respectively; anal somite with row of spinules along posteroventral margin (Fig. 9C). Caudal ramus (Fig. 9C) 0.88 times longer than wide (21 × 24 μm), with 6 setae, short inner and longer outer margins, and unornamented distal margin.

Rostrum not developed. Antennule (Fig. 9D) 338 μm long, 20-segmented; 9th, 18th, and terminal segments armed with 7 setae, 2 setae + aesthetasc, and 11 setae, respectively, all other segments each with 2 setae; several setae on proximal segments feebly pinnate; first segment ornamented with several setules. Antenna (Fig. 9E) consisting of coxa, basis, small exopod, and 3-segmented endopod; coxa short, unarmed; basis 57 μm long, with longitudinal row of minute spinules; exopod twice longer than wide (10 × 5 μm), with 3 setae (2 unequal distal and 1 small proximal); first endopodal segment 49 μm long, unarmed but with row of spinules along outer margin; short second endopodal segment with 1 spiniform seta; third endopodal segment slightly longer than wide with 2 unequal setae distally; terminal claw straight, spiniform, 39 μm long.

Oral siphon (Fig. 9F) narrow, 250 × 56 μm, extending to intercoxal plate of leg 1, widest at proximal 24% region. Mandible (Fig. 9G) consisting of slender stylet and 1-segmented palp; stylet 227 μm long, with 13 minute teeth at distal region (Fig. 9H), proximal one of them broader than others; palp segment 40 μm long, with 2 unequal setae distally, longer pinnate seta 167 μm long, smaller naked seta 64 μm long; palp segment plus longer seta 207 μm long, 0.91 times as long as stylet. Maxillule (Fig. 9I) bilobed; inner lobe (precoxal endite) about 73 μm long, tipped with 4 fragile setae and rows of setules; outer lobe

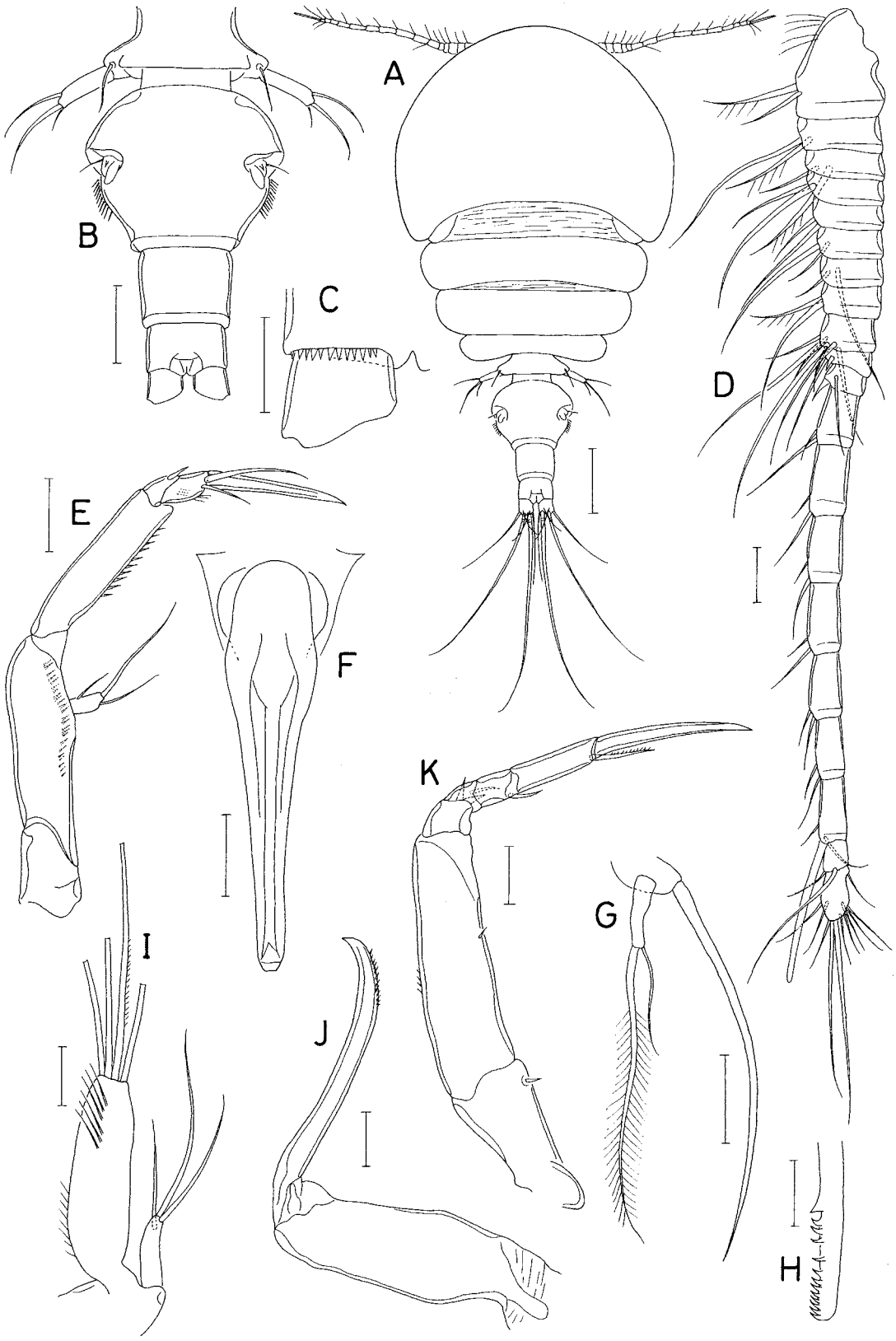

Fig. 9. *Asterocheres processus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, antennule; E, antenna; F, oral siphon; G, mandible; H, distal part of mandibular stylet; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, F, G, 0.05 mm; C–E, I–K, 0.02 mm; H, 0.01 mm.

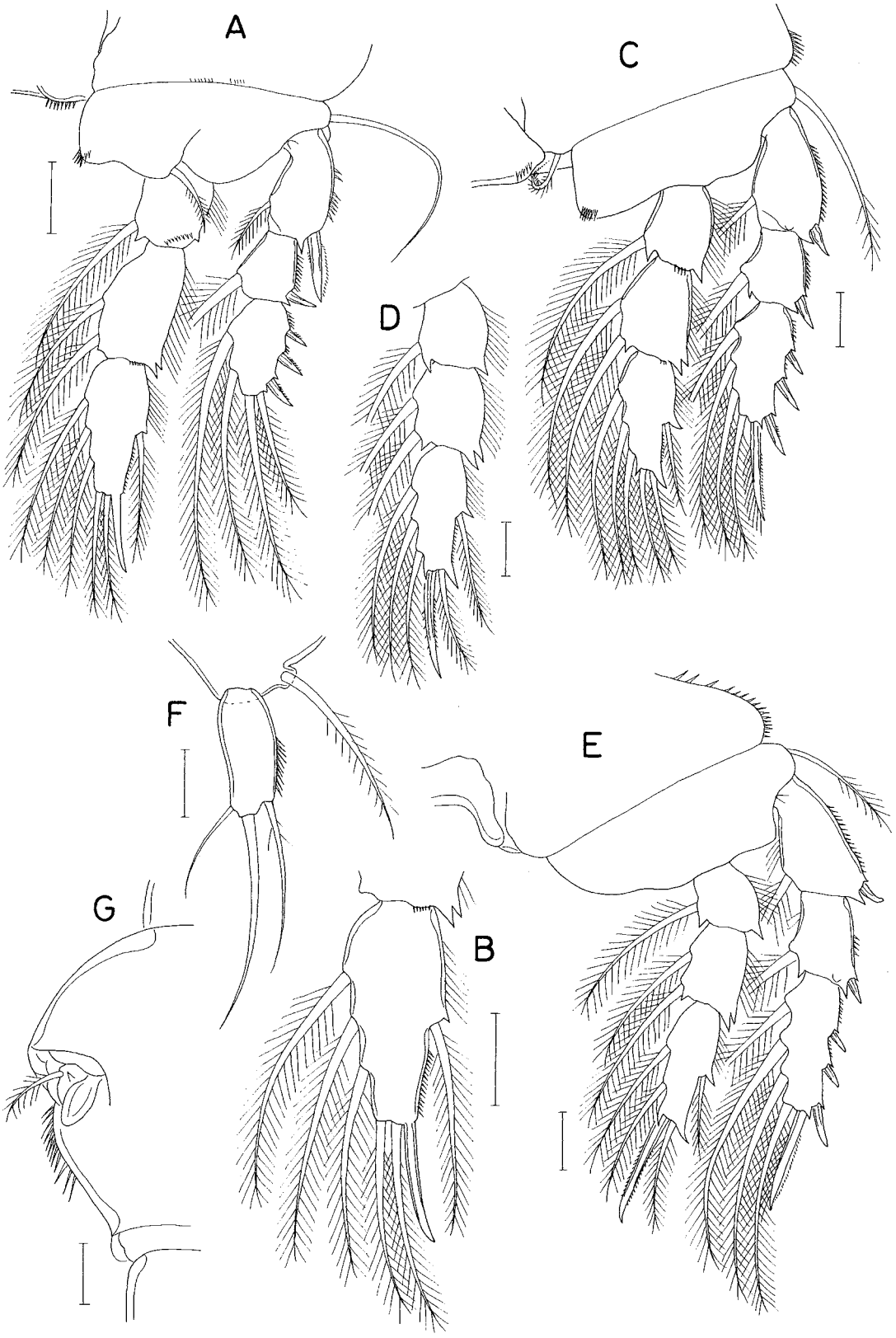

Fig. 10. *Asterocheres processus* n. sp., female. A, leg 1; B, third endopodal segment of leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, leg 5; G, left side of genital double-somite, dorsal. Scale bars: 0.02 mm.

(palp) small, 24 μm long, tipped with 3 naked setae. Maxilla (Fig. 9J) 2-segmented; distal segment (basis) as long as, but much slender than, proximal segment (syncoxa), with row of minute spinules along convex but margin of curved distal part. Maxilliped (Fig. 9K) consisting of coxa, basis, 4-segmented endopod, and terminal claw; coxa with 1 small seta at inner subdistal region; basis with 1 vestigial seta on inner margin and several minute spinules on outer margin; 4 endopodal segments with 2, 1, 1, and 1 setae, respectively; terminal endopodal segment 30 μm long; terminal claw relatively short, 55 μm long, 1.83 times longer than terminal segment.

Legs 1 (Fig. 10A), 2 (Fig. 10C), 3, and 4 (Fig. 10E) biramous, with 3-segmented rami. Leg 1 lacking inner seta on coxa.; third endopodal segment (Fig. 10B) 48 μm long (excluding outer distal process), characteristically bearing elongated, spiniform outer distal process of 27 μm long. Intercoxal plate and inner distal corner of legs 1–3 with several spinules. Outer margin of basis of legs 2–4 with spinules. Outer seta on basis of legs 1–4 well developed. Leg 3 similar to leg 2, except bearing 1 spine and 5 setae on third endopodal segment (Fig. 10D). Leg 4 lacking inner seta on coxa. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-1; III, 2, 2	0-1; 0-2; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 3
Leg 4	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 2

Leg 5 (Fig. 10F) consisting of 1 dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment 2.18 times longer than wide (37 × 17 μm), with sub-parallel lateral margins, 3 unequal setae distally, and row of fine spinules on outer margin; midterminal seta longest, 65 μm long; outer seta second longest. Leg 6 (Fig. 10G) represented by 1 small pinnate seta and 1 small spinule on genital operculum.

Male. Unknown.

Remarks. *Asterocheres processus* n. sp. may be differentiated from its congeners by two diagnostic features revealed in leg 1. Firstly, the coxa lacks an inner seta. Secondly, the third endopodal segment bears a prolonged outer distal process. The first feature is shared with five species in the genus: *A. pilosus* Kim, 2004; *A. eugenioi* Bandera & Conradi, 2014; *A. sarsi* Bandera & Conradi, 2009; *A. trisetatus* Kim, 2010; and *A. banderae* Kim & Lee, 2023. The second feature is shared with four species (*A. crinoidicola* Humes, 2000; *A. mucronipes* Stock, 1960; *A. pilosus*; and *A. unioviger* Kim, 2010). Of the latter four species, *A. mucronipes* has been removed to the genus *Stockmyzon* Bandera & Huys, 2008 by these authors (Bandera & Huys, 2008). Thus, *A. processus* n. sp. is comparable only with *A. pilosus* as only these two species have both the diagnostic features. *Asterocheres pilosus* is associated with the echinoid *Eucidaris thouarsii* (L. Agassiz & Desor, 1846) on the Pacific coast of Panama (Kim, 2004a). In the latter species, the female antennule is 19-segmented, the mandibular palp is 2-segmented, the oral siphon extends to the insertions of the maxillipeds, the distal setae on the inner lobe of the maxillule are shorter than the distal seta of the outer lobe and one of the setae on the outer lobe is specialized with long setules, and the fourth leg has an inner coxal seta. These features of *A. pilosus* are not adjustable to *A. processus* n. sp.

***Asterocheres culicis* n. sp. (Figs. 11–13)**

https://zoobank.org/urn:lsid:zoobank.org:act:C50062C7-3129-4D86-8636-26E654F08E84

Type material. Holotype (intact ♀; MABIK CR0025 4231), intact paratypes (6 ♀♀, 2 ♂♂; MABIK CR0025 4232), and dissected paratypes (1 ♀, 1 ♂) from washings of unidentified sponges, Munseom, Seogwipo, Jeju Island (33°20′17″N, 126°33′48″E), trimix diving, depth 56 m, coll. T. Lee, 25 April 2023. Holotype and intact paratypes have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon, Korea. Dissected paratypes are kept in the collection of I.-H. Kim.

Etymology. The specific name is derived from the Latin *culex* (= mosquito), referring to the type locality, meaning "mosquito-laden" in Korean.

Female. Body (Fig. 11A) moderately broad. Body length 727 μm. Prosome 490 μm long. Cephalothorax 309 × 387 μm, wider than long, distinctly wider than second pedigerous somite. All prosomal somites with rounded or blunt lateral corners. Urosome (Fig. 11B) 4-segmented. Fifth pedigerous somite 100 μm wide, as wide as genital double-somite, with row of spinules along posterodorsal margin. Genital double-somite as long as wide (100 × 98 μm), with convex lateral margins bearing 11 postgenital spinules (7 longer anterior and 4 shorter posterior as in Fig. 12G), and row of spinules (or scales) along posterodorsal margin; genital apertures positioned dorsolaterally at midlength of double-somite. Two free abdominal somite 31 × 54 and 36 × 49 μm, respectively. First free abdominal somite with row of spinules along posterodorsal margin. Anal somite with row of spinules along posteroventral margin (Fig. 11C). Caudal ramus (Fig. 11C) 1.57 times longer than wide (36 × 23 μm), nearly rectangular, armed with 6 setae and ornamented with spinules along posteroventral margin and at proximal part of inner margin.

Rostrum (Fig. 12A) strongly tapering, becoming faint distally, lacking distal apex. Antennule (Fig. 11D) slender, 347 μm long, 21-segmented; 9th, 18th, 20th, and

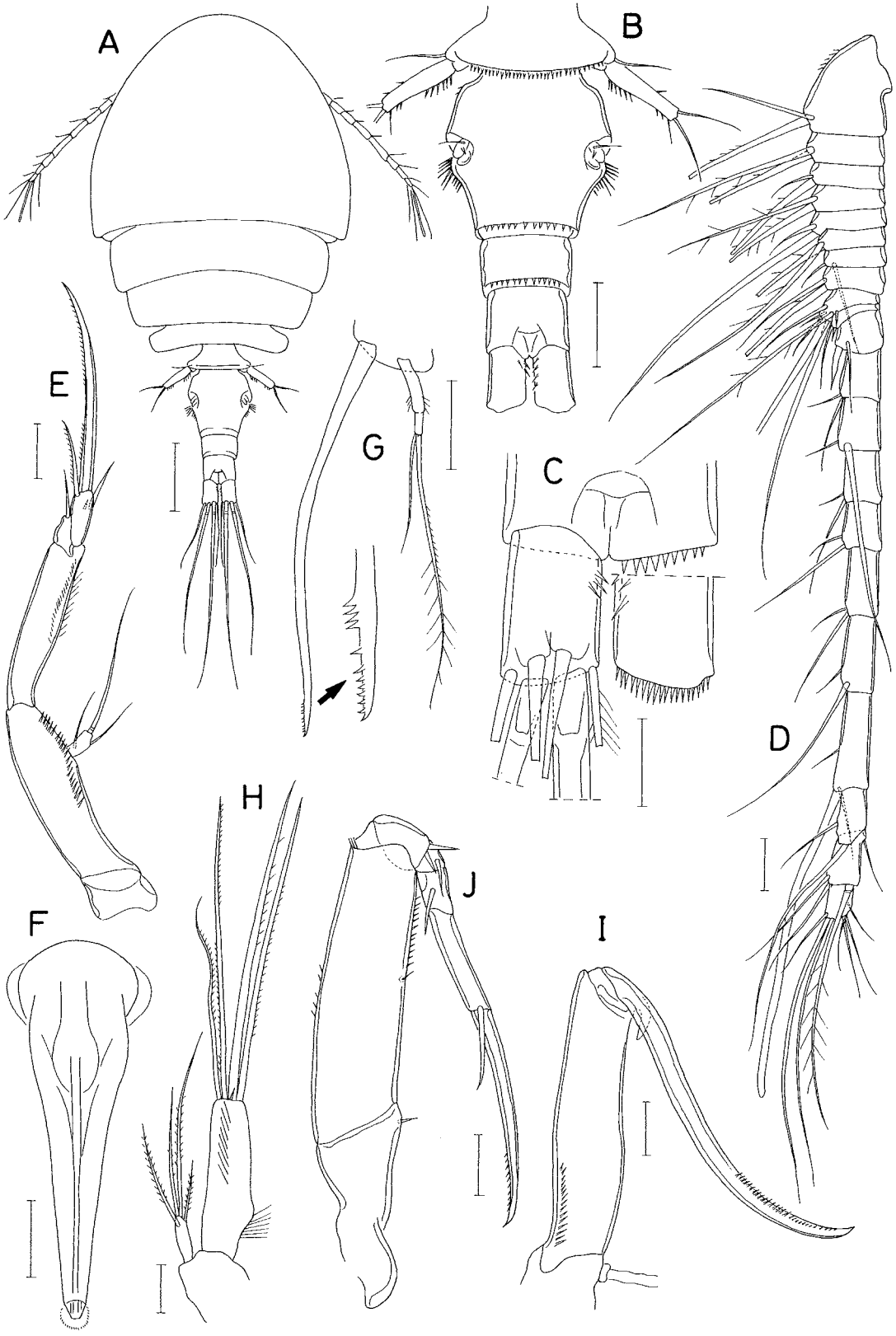

Fig. 11. *Asterocheres culicis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, dorsal; D, antennule; E, antenna; F, oral siphon; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars: A, 0.1 mm; B, F, G, 0.05 mm; C−E, H−J, 0.02 mm.

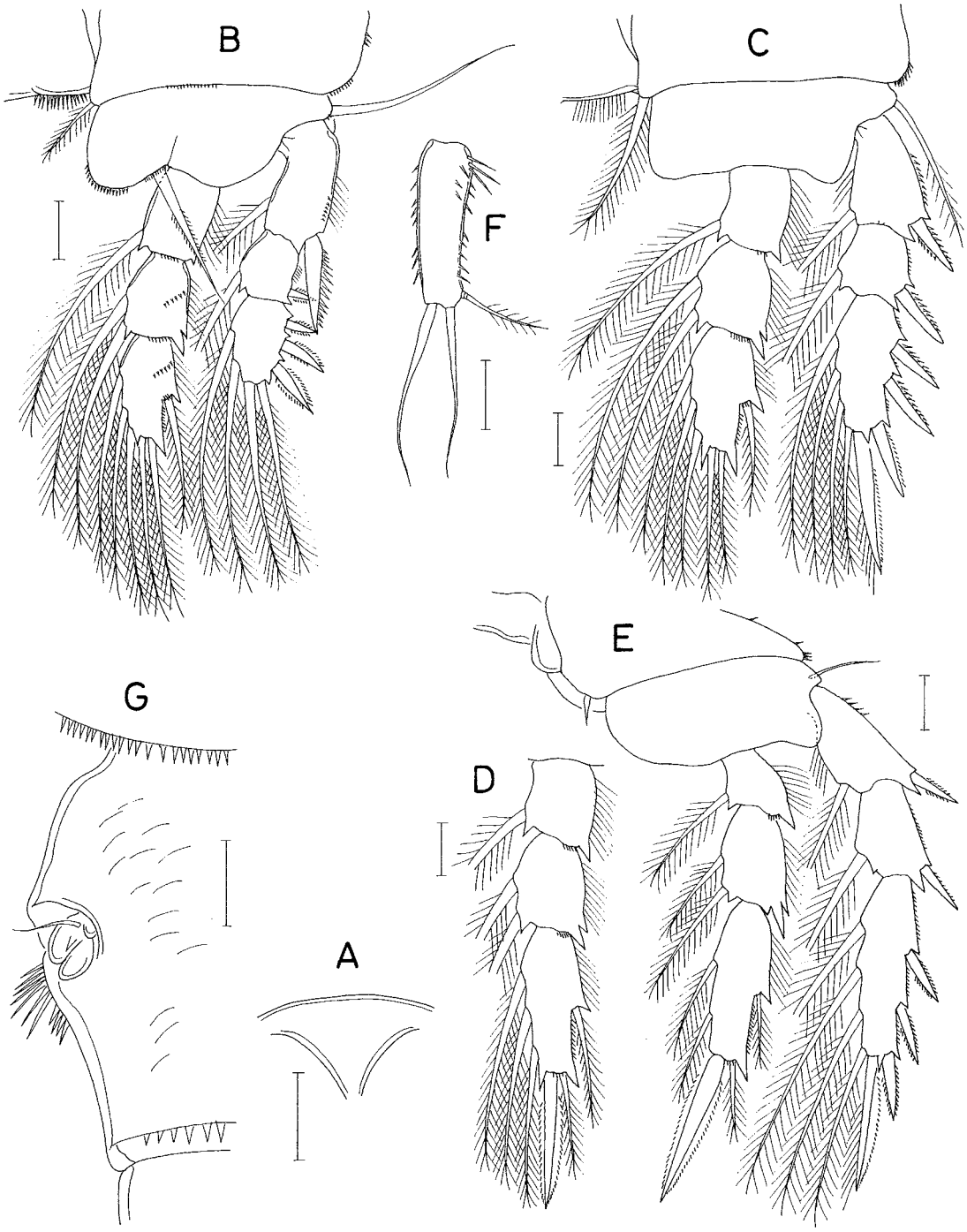

Fig. 12. *Asterocheres culicis* n. sp., female. A, rostrum; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, leg 5; G, left side of genital double-somite, dorsal. Scale bars: A, 0.05 mm; B–G, 0.02 mm.

21st segments with 7 setae, 2 setae + aesthetasc, 4 setae, and 7 setae, respectively; all other segments each with 2 setae; several setae on proximal segments and 1 seta on 20th segments feebly pinnate. Antenna (Fig. 11E) with short, unarmed coxa; basis 71 μm long, unarmed but with longitudinal row of spinules near base of exopod; exopod 10 × 5 μm, bearing 3 setae; first endopodal segment 63 μm long, with fine spinules and setules along outer margin; small second endopodal segment with 1 seta distally; third endopodal segment with 3 unequal setae in distal region and terminated in slender claw of 79 μm long.

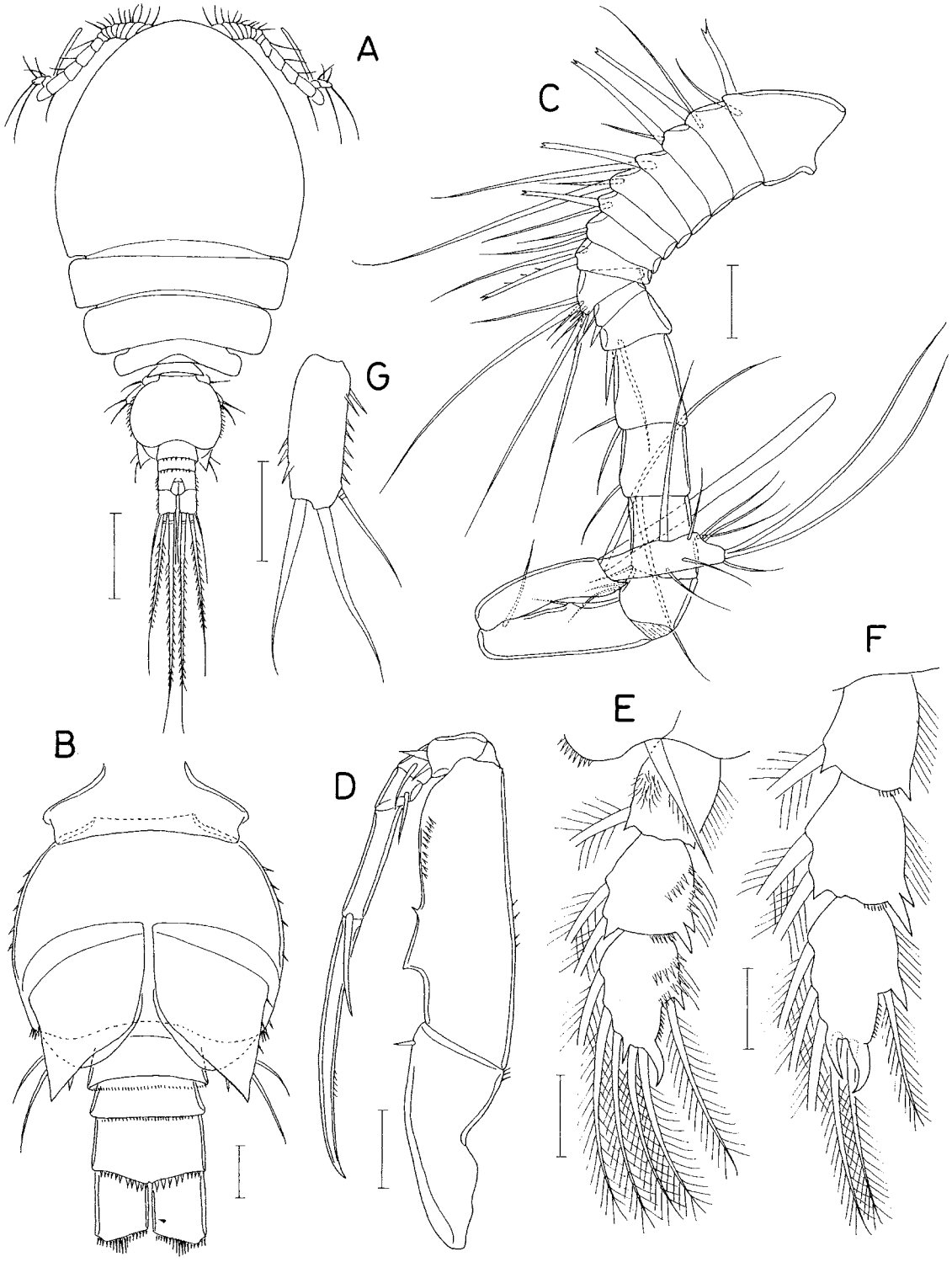

Fig. 13. *Asterocheres culicis* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, maxilliped; E, endopod of leg 1; F, endopod of leg 2; G, exopod of leg 5. Scale bars: A, 0.1 mm; B–G, 0.02 mm.

Oral siphon (Fig. 11F) narrow, 255 μm long, 67 μm wide at proximal widest region, extending to intercoxal plate of leg 1. Mandible (Fig. 11G) consisting of stylet and palp; stylet 227 μm long, bearing 12 denticles at distal region (arranged as 4, 1, and 7 from proximal to distal); palp 2-segmented, 30 and 12 μm long, respectively,

tipped with 2 unequal setae, longer seta 155 μm long, feebly pinnate; smaller seta 68 μm long, naked; palp segments plus longer distal seta 197 μm long, 0.87 times as long as stylet. Maxillule (Fig. 11H), small outer lobe 20 μm long, with 4 setae (86, 59, 50, and 27 μm long, respectively); inner lobe 69 μm long, tipped with 4 large and 1 minute setae (4 large setae 145, 139, 136, and 93 μm long, respectively). Maxilla (Fig. 11I) slender; proximal segment bearing longitudinal row fine spinules at proximal region; distal segment longer than proximal segment, arched, with fine spinules along concave margin of distal third. Maxilliped (Fig. 11J) 6-segmented; armature formula 1, 1, 2, 1, 1, and 1 + claw; second segment (basis) with parallel inner and outer margins, row of fine spinules on distal two-fifths of inner margin, several fine spinules on outer margin; terminal segment and claw 35 and 74 μm long, respectively.

Legs 1 (Fig. 12B), 2 (Fig. 12C), 3, and 4 (Fig. 12E) biramous, with 3-segmented rami. Intercoxal plate spinulose in leg 1, setulose in leg 2, and naked in legs 3 and 4. Outer seta of basis large in legs 1−3, but small in leg 4. Inner distal corner of basis spinulose in leg 1, but naked in legs 2−4. Leg 3 similar to leg 2, except bearing 1 spine plus 5 setae on third endopodal segment (Fig. 12D). Leg 4 with small inner coxal seta; distal spine on third endopodal segment as long as segment. Armature formula for legs 1−4 as in *A. aesthetes*:

Leg 5 consisting of dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 12F) 3.13 times longer than wide (50 × 16 μm), gradually narrowing distally, armed with 3 setae and ornamented with spinules on both inner and outer margins (3 proximal spinules on inner margin longer than other spinules); two distal setae naked, 56 (outer) and 50 μm (middle) long, respectively; inner subdistal seta 28 μm long, feebly pinnate. Leg 6 (Fig. 12G) represented by 1 small seta and 1 small spinule on genital operculum.

Male. Body (Fig. 13A) narrower than that of female. Body length 592 μm. Prosome 412 μm long. Cephalothorax 265 × 301 μm. Urosome (Fig. 13B) 5-segmented. Fifth pedigerous somite 79 μm wide. Genital somite 79 × 13 μm, with well-developed, distally acutely pointed genital opercula and spinules on lateral margins. Three abdominal somites 15 × 47, 14 × 45, and 24 × 45 μm, respectively. Caudal ramus 1.43 times longer than wide (30 × 21 μm).

Rostrum as in female. Antennule (Fig. 13C) 18-segmented, with strong geniculation between 16th and 17th segments, and week geniculation between 15th and 16th segments; 9th, 14th, 17th, and last segments armed with 7 setae, 1 seta, 1 seta + aesthetasc, and 10 setae, respectively; all other segment each bearing 2 setae; several setae on proximal segment with bifurcate tip. Antenna as in female.

Oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 13D) bearing 1 beak-like protuberance on proximal fourth of inner margin, otherwise as in female.

Leg 1−4 with same armature formula as in female, but sexual dimorphisms present in legs 1 and 2. Third endopodal segment of leg 1 (Fig. 13E) with enlarged, claw-like outer distal process. Third endopodal segment of leg 2 (Fig. 13F) with enlarged, claw-like outer and inner distal processes. Exopodal segment of leg 5 (Fig. 13G) nearly rectangular, 2.73 times longer than wide (30 × 11 μm), sparsely spinulose on both margins; all 3 setae naked, midterminal one longest. Leg 6 (Fig. 13B) represented by 2 naked setae on genital operculum.

Remarks. The comparison of *A. culicis* n. sp. with its congeners on the basis of the characters listed in Table 2 reveals that five species (*A. ellisi* Hamond, 1968; *A. parvus* Giesbrecht, 1897; *A. peniculatus* Kim, 2010; *A. suberitis* Giesbrecht, 1897; and *A. urabensis* Kim, 2004) show closeness to the new species, with similarity values more than 75%. These five species are distinguished from the new species by their different features, as follows: *A. ellisi* has a shorter terminal claw of the antenna, which is shorter than the first endopodal segment, a longer oral siphon which extends beyond leg 1, and no sexual dimorphism in the swimming legs (Bandera & Mercedes, 2009). *Asterocheres peniculatus* has shorter caudal rami which are wider than long, a short terminal claw of the antenna, which is shorter than the first endopodal segment, and a rudimentary outer distal seta on the third endopodal segment of male leg 3. *Asterocheres suberitis* has a shorter oral siphon which reaches the insertions of the maxilliped, a longer mandibular palp which is longer than the stylet, and a 17-segmented male antennule (Giesbrecht, 1899). *Asterocheres urabensis* has shorter caudal rami which are 1.20 times longer than wide, about 15 setules on the postgenital lateral margin of the female genital double-somite, as illustrated in the original description, and an elongated exopodal segment of female leg 5, which is 3.65 times longer than wide (Kim, 2004a).

Asterocheres parvus was very briefly recorded by Giesbrecht (1899) with figures about the body form and urosome of the female. Giesbrecht (1899) recorded the body length of the female as 0.55 mm long and illustrated the body having pointed posterolateral corners of the first three prosomal somites and the genital apertures positioned at the anterior third of the genital double-somite. In contrast, in *A. culicis* n. sp. the body of the female is larger, 727 μm long in dissected specimen, all the prosomal somites have rounded posterolateral corners, and the genital apertures are positioned at the midway of the genital double-somite.

***Asterocheres eurychelatus* n. sp. (Figs. 14, 15)**

https://zoobank.org/urn:lsid:zoobank.org:act:10ECAF07-255F-4726-B1F3-F7EDA13A27DC

Type material. Holotype (intact ♀; MABIK CR00254233), intact paratypes (14 ♀♀; MABIK CR00254234), and dissected paratype (1 ♀) from washings of unidentified sponges, Gapado, Jeju Island (33°10′20″N, 126°17′30″E), trimix diving, depth 36 m, coll. T. Lee, 27 April 2023. Holotype and intact paratypes have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon, Korea. Dissected paratype is kept in the collection of I.-H. Kim.

Etymology. The specific name is a combination of the Greeks *eury* (= broad) and *chel* (= a claw), referring to the broad terminal claw of the antenna and maxilliped.

Female. Body (Fig. 14A) relatively small. Mean body length 624 μm (581–668 μm), based on 10 specimens. Figured and described specimen 655 μm long. Prosome 415 μm long, occupying 63% of body length. Cephalothorax 282 × 312 μm. All prosomal somites bearing rounded lateral corners. Urosome (Fig. 14B) 4-segmented. Fifth pedigerous 91 μm wide, as wide as genital double-somite. Genital double-somite 1.16 times longer than wide (106 × 91 μm) widest at proximal 32% region, evenly narrowing posteriorly from widest region; genital apertures positioned dorsolaterally at proximal 36% region; postgenital lateral margin with 11 or 12 equally small spinules (Fig. 15G). Two free abdominal somites 45 × 52 and 30 × 50 μm, respectively; anal somite with fine spinules along posteroventral margin (Fig. 14C). Caudal ramus (Fig. 14C) wider than long (21 × 22 μm), with 6 setae and row of spinules on posteroventral margin.

Rostrum (Fig. 14D) as tapering ridge, lacking posterior apex. Antennule (Fig. 14E) 223 μm long, 20-segmented; 9th, 18th, and terminal segments with 7 setae, 2 setae + aesthetasc, 11 setae, respectively, all other segments each with 2 setae; all setae naked. Antenna (Fig. 14F, G) with short, unarmed coxa; basis 61 μm long, unarmed but bearing longitudinal row of minute spinules; exopod small, 9 × 4.8 μm, bearing 3 small setae; first endopodal segment 45 μm long, unarmed but bearing longitudinal row of small spinules; second endopodal segment short, with 1 spiniform seta subdistally; third endopodal segment 16 μm long, distally with 1 spine (18 μm long) and 1 small seta and terminated in robust claw of 35 μm long.

Oral siphon (Fig. 14H) 127 × 61 μm, reaching insertions of maxillipeds. Mandibular stylet (Fig. 14I) 120 μm long, bearing 6 denticles arranged longitudinally at distal region; palp slender, 1-segmented, 41 μm long, tipped with 1 long (90 μm long) and 1 short (34 μm long) setae; palp segment plus its longer distal seta 131 μm long, 1.09 times longer than stylet. Maxillule (Fig. 14J) bilobed; small outer lobe 17 μm long, distally with 4 setae (lengths of these setae 54, 49, 43, and 22 μm, respectively); inner lobe about 55 μm long, about 3.2 times longer than outer lobe, tipped with 1 minute and 4 large setae (lengths of 4 large setae 63, 62, 58, and 40 μm, respectively). Maxilla (Fig. 14K) 2-segmentd; proximal segment bearing row of about 10 spinules at proximal region; distal segment (chela) about 1.2 times longer than proximal segment, bearing row of minute spinules along distal third. Maxilliped (Fig. 15A) 6-segmented; armature formula 1, 1, 2, 1, 1, and 1 + claw; second segment (basis) 73 μm long; terminal segment 30 μm long, its distal seta spiniform; terminal claw 47 μm long, robust, 1.57 times longer than terminal segment.

Legs 1 (Fig. 15B), 2 (Fig. 15C), 3, and 4 (Fig. 15E) biramous, with 3-segmented rami. Distal margin of intercoxal plate bearing several spinules in leg 1, setules in leg 2, but smooth in legs 3 and 4. Inner distal seta on basis of leg 1 broad. Second endopodal segment of legs 1–4 with bicuspid outer distal corner. Leg 3 same as leg 2, except bearing 1 spine plus 5 setae on third endopodal segment (Fig. 15D). Leg 4 lacking inner coxal seta. Distal spine on third endopodal segment of leg 3 and 4 fusiform, shorter than segment. Armature formula for legs 1–4 as in *A. processus* n. sp.

Leg 5 (Fig. 14B) consisting of dorsolateral seta on fifth pedigerous somite and exopod. Exopodal segment (Fig. 15F) 1.89 times longer than wide (36 × 19 μm), fusiform, bearing 3 naked setae (31, 36, and 31 μm long, respectively, from outer to inner), and ornamented with few spinules on inner and outer margins. Leg 6 (Fig. 15G) represented by 2 small, unequal setae and 1 small denticle on genital operculum.

Male. Unknown.

Remarks. As a combination of diagnostic features of *A. eurychelatus* n. sp. (1) the caudal ramus is short, not longer than wide; (2) the antennule of the female is 20-segmented; (3) the mandibular palp is 1-segmented; and (4) leg 4 lacks an inner seta on the coxa. The new species shares this combination of the diagnostic features with six congeners: *A. siphonatus*; *A. proboscideus* Stock, 1966; *A. stocki* Nair & Pillai, 1984; *A. banderaae*; *A. processus* n. sp.; and *A. bulbosus* Malt, 1991. The first three species are easily separated from the new species by their unusually long oral siphon, which extends beyond leg 4 in *A. siphonatus* as in the redescription in the present paper, over the caudal rami in *A. proboscideus* (see Stock, 1966), and to leg 5 in *A. stocki* (see Nair & Pillai, 1984). *Asterocheres banderaae* and *A. processus* differ from the new species in lacking an inner coxal seta on leg 1. *Asterocheres bulbosus* also differs from the new species in having only one seta on the first segment of the antennule as described and illustrated by

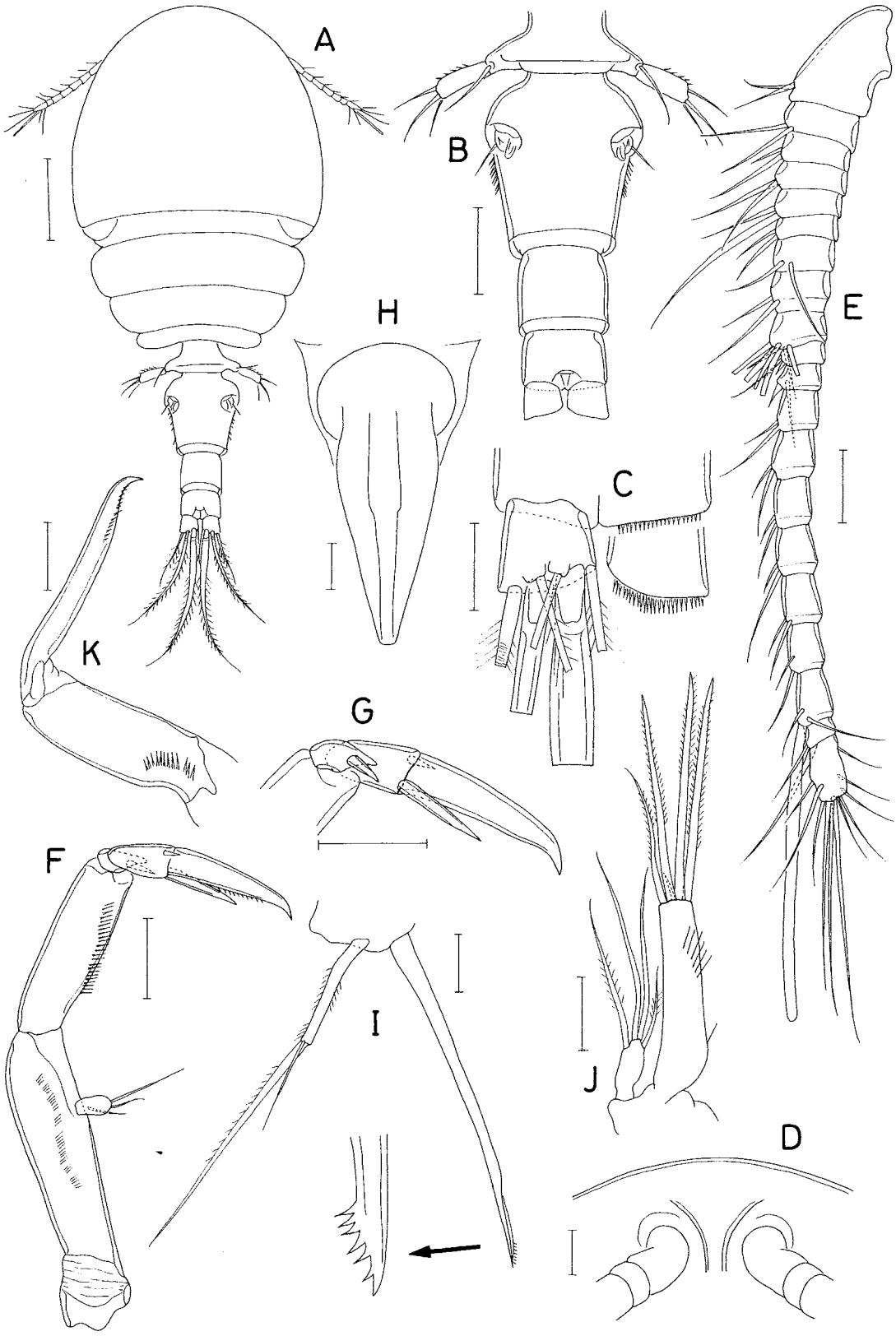

Fig. 14. *Asterocheres eurychelatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, caudal rami, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, distal part of antenna; H, oral siphon; I, mandible; J, maxillule; K, maxilla. Scale bars: A, 0.1 mm; B, 0.05 mm; C–K, 0.02 mm.

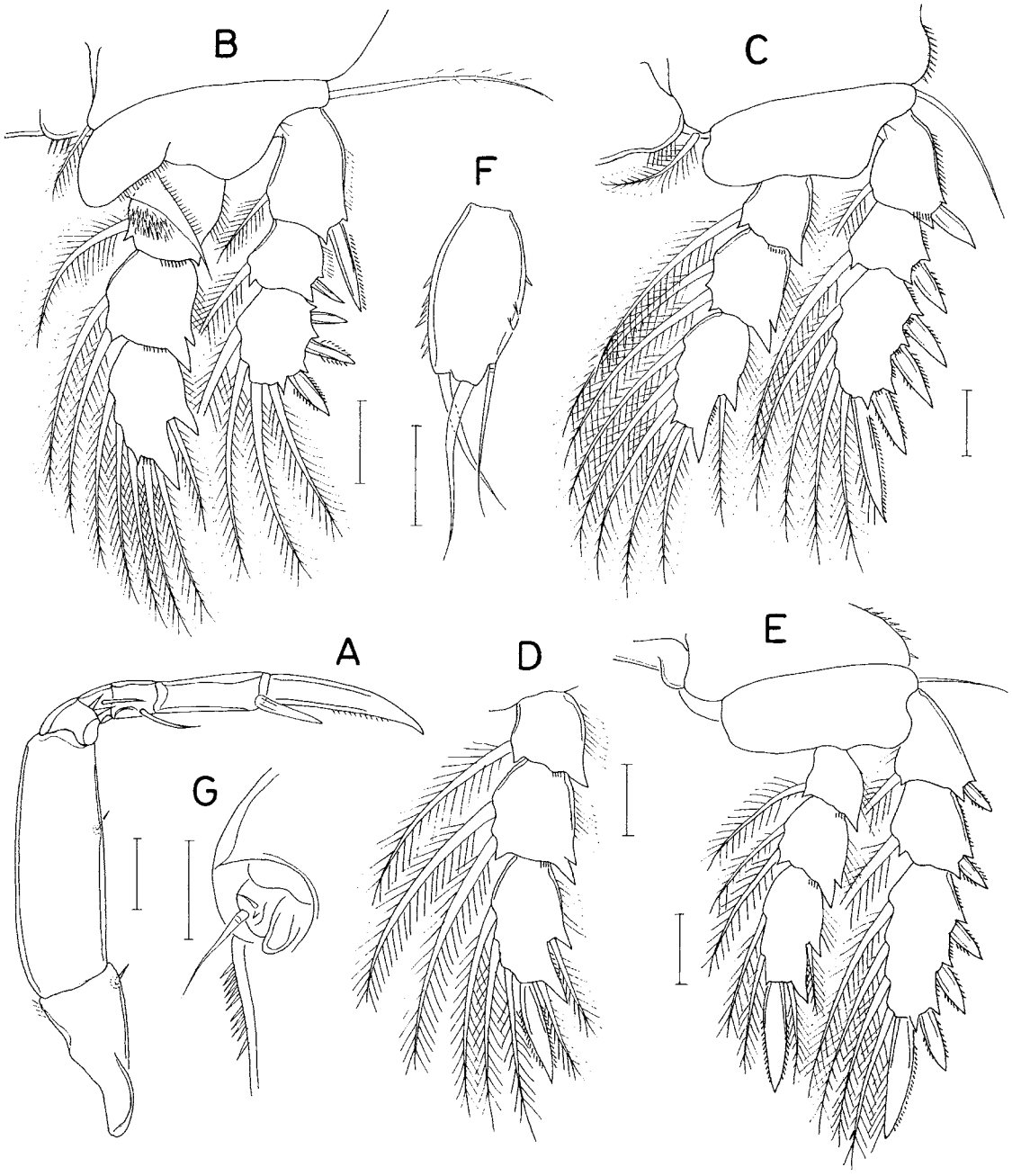

Fig. 15. *Asterocheres eurychelatus* n. sp., female. A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, exopod of leg 5; G, left side of genital double-somite, dorsal. Scale bars: 0.02 mm.

Malt (1991), which was confirmed by Bandera & Conradi (2009b) (vs. two setae in the new species).

At least one of the above four diagnostic features is unknown in *A. corneliae* Schirl, 1973; *A. dentatus* Giesbrecht, 1987; and *A. minor* Thompson & *A. Scott*, 1903. As important differences of these species from the new species, the oral siphon of *A. corneliae* is much thinner than that of the new species and reaches leg 1 (Schirl, 1973), the prosome of *A. minor* is circular and its abdominal somites are longer than wide as illustrated by Thompson & Scott (1903), and the genital double-somite of the female of *A. dentatus* bears a pointed process on the lateral margins (Giesbrecht, 1899).

The form of the terminal claw of the antenna and maxilliped of *A. eurychelatus* n. sp. is remarkable, since it is unusually broadened, a very rare feature within the genus.

***Asterocheres scutellatus* n. sp. (Figs. 16, 17)**

https://zoobank.org/urn:lsid:zoobank.org:act:82C6CBC9-E54A-4D00-825B-88EFCDCA4C1B

Type material. Holotype (intact ♀; MABIK CR00254237), intact paratypes (14 ♀♀; MABIK CR00254238), and dissected paratype (1 ♀) from washings of unidentified sponges, trimix diving, depth 56 m, Munseom, Seogwipo, Jeju Island (33°20′17″N, 126°33′48″E), coll. T. Lee, 25 April 2023. Holotype and intact paratypes have been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon, Korea. Dissected paratype is kept in the collection of I.-H. Kim

Etymology. The name is derived from the Latin *scutell* ("a little shield"), alluding to the small rostrum of the new species.

Female. Body (Fig. 16A) small, relatively narrow. Mean body length 488 μm (455–528 μm), based on 10 specimens. Body length of figured and described specimen 526 μm. Prosome 345 μm long, occupying 66% of body length. Cephalothorax 232 × 243 μm; lateral margins of posterior half parallel. All prosomal somites with rounded lateral corners. Urosome (Fig. 16B) 4-segmented. Fifth pedigerous somite as wide as genital double-somite, bearing spinules on dorsolateral surfaces. Genital double-somite 1.12 times longer than wide (86 × 77 μm) widest at anterior 33% region, gradually narrowing along posterior two-thirds; genital apertures positioned dorsolaterally at about 44% region; postgenital lateral margin with 6–9 spinules (Fig. 17G). Two free abdominal somites 31 × 41 and 23 × 42 μm, respectively. Anal somite with scales of irregular sizes on posteroventral margin. Caudal ramus (Fig. 16C) as long as wide (18 × 18 μm), armed with 6 setae and ornamented with scales on posteroventral margin.

Rostrum (Fig. 17A) small, short, with blunt distal apex. Antennule (Fig. 16D) 210 μm long, 20-segmented; 9th, 18th, and terminal segments with 5 setae, 2 setae + aesthetasc, and 9 setae, respectively; other segments each with 2 setae; setae mostly short. Antenna (Fig. 16E) with short, unarmed coxa; basis 55 μm long, unarmed but ornamented with row of fine spinules along distal half; exopod small, 8 × 3.6 μm, bearing 3 setae; first endopodal segment 39 μm long, with longitudinal row of fine spinules on outer margin; small second endopodal segment with 1 seta; third endopodal segment distally with 2 unequal setae; terminal claw 42 μm long.

Oral siphon (Fig. 16F) 119 μm long, widest at proximal 40% region (38 μm wide at this region); proximal box 47 μm wide. Mandible (Fig. 16G) consisting of stylet and palp; stylet 99 μm long, bearing about 6 teeth arranged longitudinally at distal region; palp slender, 36 μm long, tipped with 2 unequal setae, larger seta 89 μm long, feebly pinnate with short setules, shorter seta naked, 30 μm long; palp segment plus longer distal seta 125 μm long, 1.26 times longer than stylet. Maxillule (Fig. 16H) bilobed; small outer lobe 17 μm long, bearing 4 naked setae, 2 longer distal setae 45 and 42 μm long, respectively; inner lobe about 45 μm long, tipped with 1 minute and 4 distinct setae, longest one of them 54 μm long. Maxilla (Fig. 16I) 2-segmented; proximal segment unarmed and unornamented, bearing excretory tube of maxillary gland; distal segment (basis) slender and much longer than proximal segment, bearing fine spinules and setules on distal half of concave margin. Maxilliped (Fig. 16J) 6-segmented; armature formula 1, 1, 2, 1, 1, and 1 + calw; terminal segment 27 μm long; claw 58 μm long, about 2.1 times longer than terminal segment, spinulose along concave margin.

Legs 1 (Fig. 17B), 2 (Fig. 17C), 3, and 4 (Fig. 17D) biramous with 3-segmented rami. Distal margin of intercoxal plate with minute spinules in legs 1 and 2, but smooth in legs 3 and 4. Inner distal margin of basis of leg 1 spinulose; inner distal seta broadened at proximal region, with setules on outer margin. Inner seta on coxa small but pinnate in leg 1, well-developed in legs 2 and 3, but rudimentary in leg 4. Armature formula for legs 1–4 as in *A. aesthetes*.

Leg 5 (Fig. 16B) consisting of dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 17F) 2.0 times longer than wide (30 × 15 μm), with 3 naked setae, these setae 24, 26, and 22 μm long, respectively, from outer to inner; outer and inner margins bearing several spinules. Leg 6 (Fig. 17G) represented by 1 small seta and 1 denticle on genital operculum.

Male. Unknown.

Remarks. Three species of *Asterocheres* may be comparable with *A. scutellatus* n. sp., because they show relatively high similarity values (over 75%) of characters (Table 2) with the new species: *A. madeirensis* Bandera, Conradi & Lopez-Gonzalez, 2007; *A. eurychelatus* n. sp.; and *A. tetraodontis* n. sp. *Asterocheres scutellatus* n. sp. is differentiated from *A. madeirensis* by the 21-segmented female antennule (cf. 20-segmented in *A. madeirensis*) and by the proximally broadened inner distal seta on the basis of leg 1 (cf. thin in *A. madeirensis*); from *A. eurychelatus* sp. by the long and narrow terminal claw of the antenna (cf. the claw is shorter and broadened in *A. eurychelatus* n. sp.) and by the presence of the inner coxal seta on leg 4 (cf. this seta is absent in *A. eurychelatus* n. sp.); and from *A. tetraodontis* n. sp. by the smaller body (mean body length of females 488 μm; cf. 796 μm in *A. tetraodontis* n. sp.), by having the six teeth on the mandibular stylet (cf. four teeth in *A. tetraodontis* n. sp.), and by the broad inner distal seta on the basis of leg 1 (cf. the seta is thin in *A. tetraodontis* n. sp.).

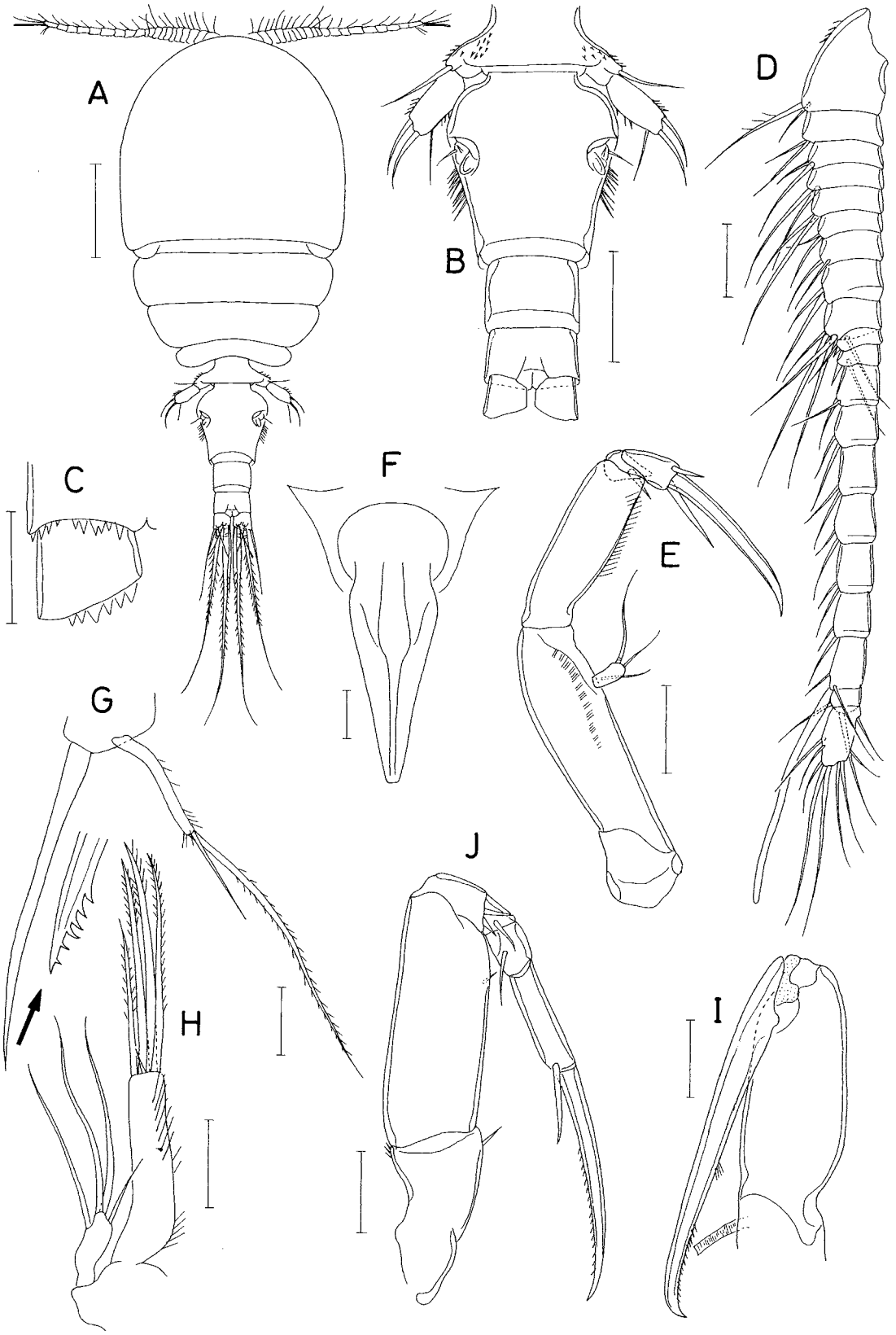

Fig. 16. *Asterocheres scutellatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, antennule; E, antenna; F, oral siphon; G, mandible; H, maxillule; I, maxilla; J, maxilliped. Scale bars: A, 0.1 mm; B, 0.05 mm; C–J, 0.02 mm.

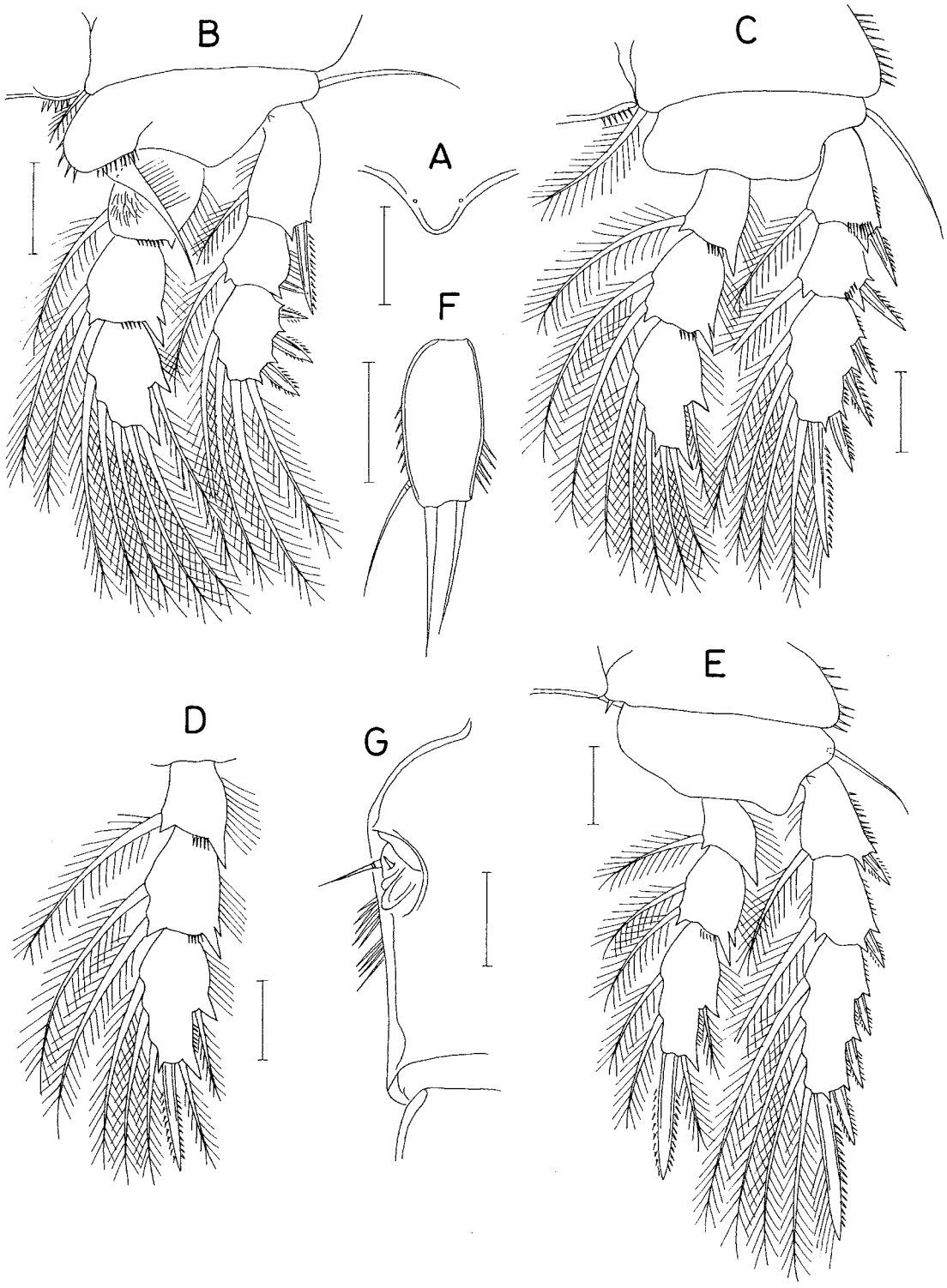

Fig. 17. *Asterocheres scutellatus* n. sp., female. A, rostrum; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, exopod of leg 5; G, left side of genital double-somite, dorsal. Scale bars: 0.02 mm.

***Asterocheres spiniventer* n. sp. (Figs. 18–20)**
https://zoobank.org/urn:lsid:zoobank.org:act:7D4DCC69-1AC4-4F6F-B4D9-563737235A56

Type material. Holotype (intact ♀; HNIBRIV2398), intact paratypes (5♀♀, 3♂♂; HNIBRIV2399), and dissected paratypes (1♀, 1♂) from washings of mixed spe-

cies of sponges. SCUBA diving, depth 20.3 m, Beomseom, Seogwipo, Jeju Island (33°13′28.7″N, 126°30′46.9″E), coll. T. W. Jung, 20 July 2022. Intact type specimens have been deposited in the Honam National Institute of Biological Resources (HNIBR), Mokpo, Korea, Dissected paratypes are kept in the collection of I.-H. Kim

Additional non-type material. 10 ♀♀ and 1 ♂ from washings of an unidentified sponge, SCUBA diving, depth 28.1 m, Munseom, Seogwipo, Jeju Island, 33°13′41.1″N, 126°34′05.9″E, coll. T. Lee, 06 April 2023.

Etymology. The specific name (noun) is a combination of the Latins *spini-* (= spiny) and *venter* (= belly) refers to the presence of many spinules on the lateral margins of the genital double-somite.

Female. Body (Fig. 18A) moderately broad. Body length of figured and described specimen 807 μm. Prosome ovoid, 552 μm long, representing about 68% of body length. Cephalothorax wider than long (356 × 418 μm). All prosomal somite bearing rounded lateral corners. Urosome (Fig. 18B) 4-segmented. Fifth pedigerous somite 114 μm wide. Genital double-somite 1.06 times longer than wide (114 × 108 μm); genital apertures positioned dorsolaterally at widest, 40% region of double-somite; postgenital part tapering posteriorly; postgenital lateral margins each bearing about 27 small spinules grouped as 8, 6−8, 7−8, and 4 from proximal to distal (Fig. 19F). Two free abdominal somites 38 × 56 and 33 × 52 μm, respectively. Anal somite bearing several minute spinules on posteroventral margin (Fig. 18C). Caudal ramus (Fig. 18C) 1.52 times longer than wide (35 × 23 μm), armed with 6 setae, and ornamented with 5 transverse row of minute spinules on both sides; distal margin smooth, lacking any spinule.

Rostrum (Fig. 18D) small, as tapering ridge, without distal apex. Antennule (Fig. 18E) 314 μm long, 21-segmented; 9th, 18th, 20th, and terminal segments bearing 7 setae, 2 setae + aesthetasc, 4 setae, and 7 setae, respectively; all other segments each bearing 2 setae; several setae on proximal segments weakly pinnate. Antenna (Fig. 18F) bearing short, unarmed coxa; basis unarmed but bearing longitudinal row of fine spinules; exopodal segment 11 × 5 μm, bearing 3 setae; first endopodal segment 49 μm long, unarmed but ornamented with fine spinules (or setules) along outer margin; short second endopodal segment tipped with 1 small seta; third endopodal segment bearing 3 unequal setae; terminal claw of 49 μm long.

Oral siphon (Fig. 18G) 139 × 62 μm, reaching insertions of maxillipeds; broader proximal third with parallel lateral margins, distal two-thirds tapering. Mandible (Fig. 18H) with stylet of 137 μm long, bearing longitudinal row of about 6 denticles at distal region; palp 1-segmented, 32 μm long, distally tipped with 2 extremely unequal setae; longer seta 120 μm long, pinnate; shorter seta 20 μm long, naked; palp segment plus longer distal seta 140 μm long, about 1.1 times longer than stylet. Maxillule (Fig. 18I) bilobed; outer lobe 20 μm long, with 4 setae distally, longest one 65 μm long; inner lobe 55 μm long, with 4 large and 1 minute setae distally, longest seta 79 μm long. Maxilla (Fig. 18J) stout; proximal segment bearing row of thin, needle-like spinules at proximal region; distal segment longer than proximal segment, with few spinules and setules in distal region. Maxilliped (Fig. 19G) 6-segmented; armature formula 1, 1, 2, 1, 1, and 1 + claw; second segment with spinules on outer margin; terminal segment and claw 24 and 53 μm long, respectively.

Legs 1 (Fig. 19A), 2 (Fig. 19B), 3, and 4 (Fig. 19D) biramous with 3-segmented rami. Distal margin of intercoxal plate spinulose in legs 1 and 2, but smooth in legs 3 and 4. Inner distal seta on basis of leg 1 thin and naked. Leg 3 similar to leg 2, except bearing 1 spine and 5 setae on third endopodal segment (Fig. 19C). Second endopodal segment of all swimming legs bearing bicuspid outer distal corner. Inner coxal seta of leg 4 small but distinct. Armature formula for legs 1−4 as in *A. aesthetes*.

Leg 5 (Fig. 18B) comprising dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 19E) 1.85 times longer than wide (37 × 20 μm), with 3 setae and spinulose outer and inner margins; lengths of setae 55, 48, and 20 from outer to inner. Leg 6 (Fig. 19F) represented by 1 small pinnate seta and 1 minute spinule on genital operculum.

Male. Body (Fig. 20A) narrower than that of female. Body length 575 μm. Prosome 367 μm long. Cephalothorax 242 × 245 μm, with nearly parallel lateral margins. Urosome (Fig. 20B) 5-segmented. Fifth pedigerous somite 69 μm wide. Genital somite 80 × 109 μm, with numerous fine spinules on lateral surfaces. Three abdominal somites 20 × 45, 20 × 41, and 23 × 39 μm, respectively. Caudal ramus 1.22 times longer than wide (22 × 18 μm).

Rostrum as in female. Antennule (Fig. 20C) 17-segmented, geniculate between 15th and 16th segments; 9th, 12th, 15th, 16th, and terminal segments bearing 5 setae, 4 setae, 4 setae, 2 setae + aesthetasc, and 11 setae, respectively; all other segments each with 2 setae; penultimate segment with pointed anterodistal corner; all setae naked. Antenna as in female.

Oral siphon, mandible, maxillule, maxilla as in female. Maxilliped (Fig. 20D) bearing blunt, beak-like inner process at proximal region of second segment.

Leg 1 (Fig. 20E) segmented and armed as in female, but endopod different from that of female; second endopodal segment bearing unicuspid outer distal corner and thick setules on outer distal region; third endopodal segment distally with 1 strong, spiniform outer pro-

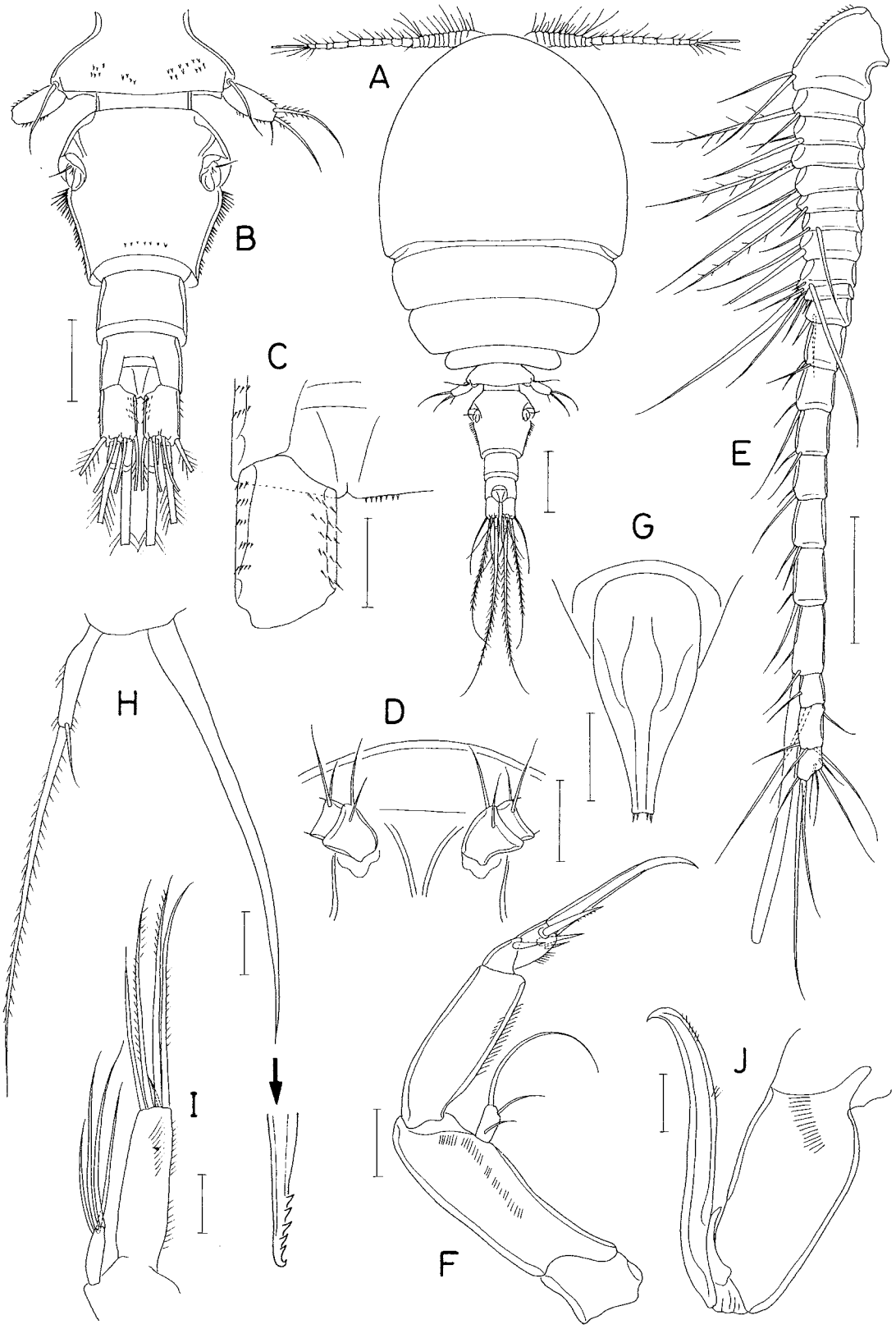

Fig. 18. *Asterocheres spiniventer* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, dorsal; D, rostral area, ventral; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla. Scale bars: A, 0.1 mm; B, D, E, G, 0.05 mm; C, F, H–J, 0.02 mm.

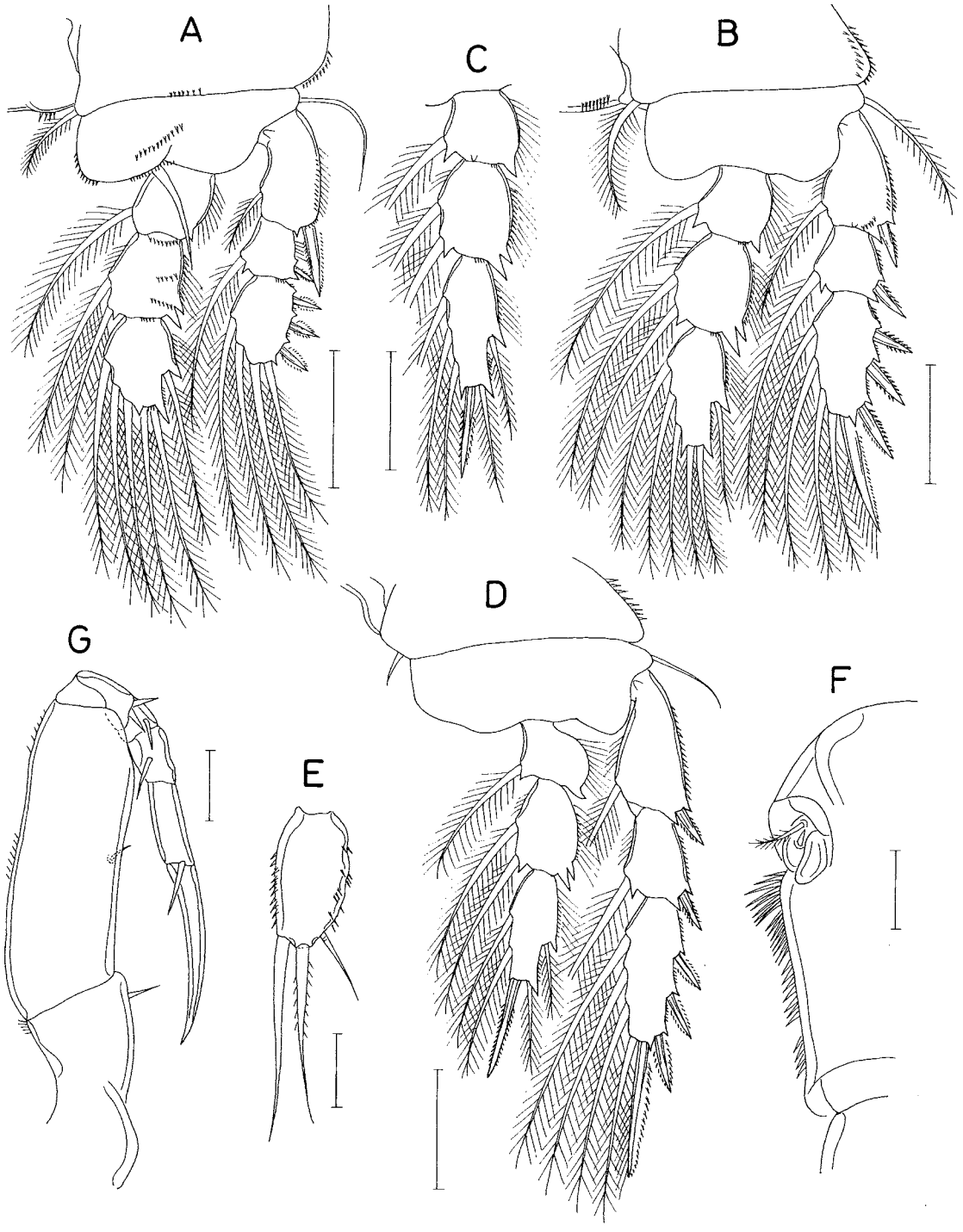

Fig. 19. *Asterocheres spiniventer* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal; G, maxilliped. Scale bars: A–D, 0.05 mm; E–G, 0.02 mm.

cess bearing spinules on its outer margin and 1 smaller, curved inner process bearing truncate tip. Legs 2–4 as in female.

Leg 5 (Fig. 20F) armed as in female; exopodal segment short, 1.33 times longer than wide (16 × 12 μm); 2 larger distal setae 40 μm (pinnate outer seta) and 27 μm (naked inner seta), respectively. Leg 6 (Fig. 20G) represented by 2 unequal naked seta on genital operculum.

Remarks. Five species of *Asterocheres* are selected for a comparison with *A. spiniventer* n. sp., as the new spe-

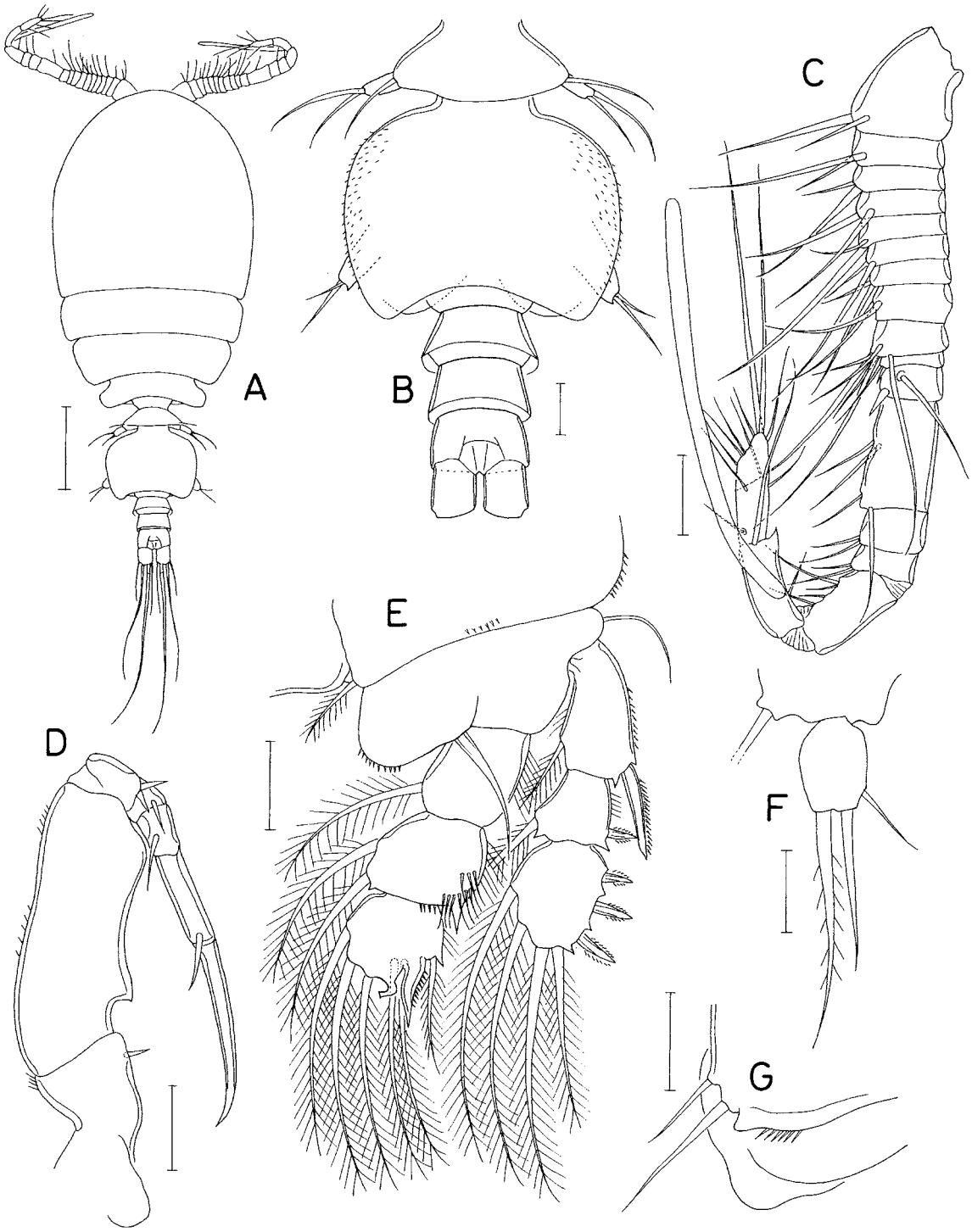

Fig. 20. *Asterocheres spiniventer* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, antenna; D, maxilliped; E, leg 1; F, leg 5; G, leg 6. Scale bars: A, 0.1 mm; B–G, 0.02 mm.

cies exhibits higher similarity values with these species (more than 75% values) than with other species (Table 2). These five species are *A. canui* Giesbrecht, 1897; *A. suberitis*; *A. uncinatus*; *A. faroensis* Crescenti, Baviera & Zaccone, 2010; and *A. intermedius* (Hansen, 1923). However, they are clearly distinguished from the new species by their diagnostic features exhibited in the mandibular palp and oral siphon, since the first three species

have a 2-segmented mandibular palp (vs. 1-segmented in *A. spiniventer* n. sp.) and the remaining two species, *A. faroensis* and *A. intermedius*, have a longer oral siphon that approaches over the insertion of the maxilliped in the former species (Crescenti et al., 2010) or over leg 1 in the latter species (Hansen, 1923) (vs. the oral siphon approaches to the insertion of the maxilliped in *A. spiniventer* n. sp.).

As key characters of *A. spiniventer* n. sp., the caudal ramus is 1.5 times longer than wide, two distal setae on the mandibular palp are extremely unequal in length (longer seta six times longer than shorter one), and the genital double-somite of the female is ornamented with about 25 spinules arranged along the entire postgenital lateral margin. Most of all, the nature of the sexually dimorphic morphological transformation of the endopod of male leg 1 is unique to the new species.

Asterocheres fici n. sp. (Figs. 21–23)

https://zoobank.org/urn:lsid:zoobank.org:act:4F413855-A915-47CE-BB95-0B9D58B8C50F

Type material. Holotype (intact ♀; MABIK CR0025 4668), intact paratypes (12 ♀♀, 2 ♂♂; MABIK CR00 254669), and dissected paratypes (2 ♀♀, 1 ♂) from washing of the sponge, *Suberites ficus* (Johnston, 1842), as a fishery bycatch, at Kisamoon fishing port, Yangyang, Gangwon-do (38°00′44″N, 128°43′48″E), shallow subtidal, coll. I.-H. Kim, 07 October 2011. Holotype and intact paratypes has been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon. Dissected paratypes are kept in the collection of I-H. Kim.

Etymology. The name of the new species is taken from the specific name of the host, *Suberites ficus*.

Female. Body (Fig. 21A) relatively large. Body length of dissected and described specimen 1.07 mm. Prosome broad, 737 × 596 μm. All prosomal somites with rounded lateral corners. Urosome (Fig. 21B) 4-segmented. Fifth pedigerous somite 170 μm wide, bearing minute spinules scattered on lateral and dorsal surfaces. Genital double-somite slightly wider than long (144 × 152 μm), widest at proximal fourth, gradually narrowing posteriorly from widest region; genital apertures positioned dorsolaterally at anterior third; postgenital lateral margin bearing about 26 spinules consisting of 17 longer but thinner anterior spinules and 9 shorter but thicker posterior spinules (Fig. 22F). Genital double-somite and first free abdominal somite bearing fine spinules along posterodorsal and posteroventral margins. Two free abdominal somites 44 × 82 and 56 × 73 μm, respectively. Anal somite bearing spinules along posteroventral margin (Fig. 21C). Caudal ramus (Fig. 21C) 1.10 times longer than wide (34 × 31 μm), armed with 6 setae, and ornamented with 2 long spinules on subdistal outer margin and spinules and 1 small tube pore on posteroventral margin.

Rostrum (Fig. 21D) strongly tapering, with rounded distal apex. Antennule (Fig. 21E) 483 μm long, 21-segmented; segments each bearing 2 setae, except 8 setae on 9th segment, 2 setae + aesthetasc on 18th segment, 4 setae on penultimate segment, and 7 setae on terminal segment; some of setae on proximal segments pinnate or truncated and tipped with minute setule. Antenna (Fig. 21F) as usual for genus; first endopodal segment 85 μm long; terminal claw spiniform, 113 μm long, 1.33 times longer than first endopodal segment.

Oral siphon (Fig. 21G) 259 × 91 μm, evenly tapering, extending between maxilliped and leg 1. Mandible (Fig. 21H) with slightly curved coxal stylet of 273 μm long, distally bearing 12 teeth (not including terminal dentiform point); palp 87 μm long, 1-segmented but with obscure trace of segmentation at distal fourth, tipped with 2 unequal, pinnate setae (220 and 109 μm long, respectively); palp plus longer distal seta 307 μm long, 1.12 times longer than stylet. Maxillule (Fig. 21I) bilobed; inner lobe about 98 μm long, armed distally with 4 long and 1 small setae (lengths of 4 longer setae 167, 159, 152, and 98 μm, respectively); outer lobe small, 33 μm long, armed with 3 long weakly pinnate setae and 1 short naked seta (lengths of these setae 128, 105, 80, and 18 μm, respectively). Maxilla (Fig. 21J) bearing row of spinules proximally on proximal segment; tube of maxillary gland rather distinct; distal segment distinctly longer than proximal segment, bearing tuft of setules and row of spinules. Maxilliped (Fig. 21K) 6-segmented, with armature formula 1, 1, 2, 1, 1, and 1 + claw; inner seta on basis rudimentary; basis and first endopodal segment bearing row of spinules on outer margin; third endopodal segment bearing 1 spinule on outer margin; terminal segment and claw 57 and 117 μm long, respectively.

Legs 1 (Fig. 22A), 2 (Fig. 22B), 3, and 4 (Fig. 22D) segmented and armed as usual for genus. Intercoxal plate of legs 1–3 bearing spinules. Inner coxal seta of leg 1 thin, short, and naked. Inner coxal seta of leg 4 also small and naked. Outer margin of coxa of legs 1–4 covered with spinules. Leg 3 endopod (Fig. 22C) differ from that of leg 2 in having 1 spine and 5 setae on third segment. Distal spine on third endopodal segment of leg 4 68 μm long, slightly shorter than segment (76 μm long). Armature formula for legs 1–4 as in *A. aesthetes*.

Leg 5 (Fig. 21B) consisting of 1 pinnated dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment 2.83 times longer than wide (68 × 24 μm), with 3 setae and nearly parallel outer and inner margins, both margins densely covered with spinules; 3 setae 69, 50, and 28 μm long, respectively, from outer and inner; 2 distal setae pinnate; subdistal inner seta naked, with an-

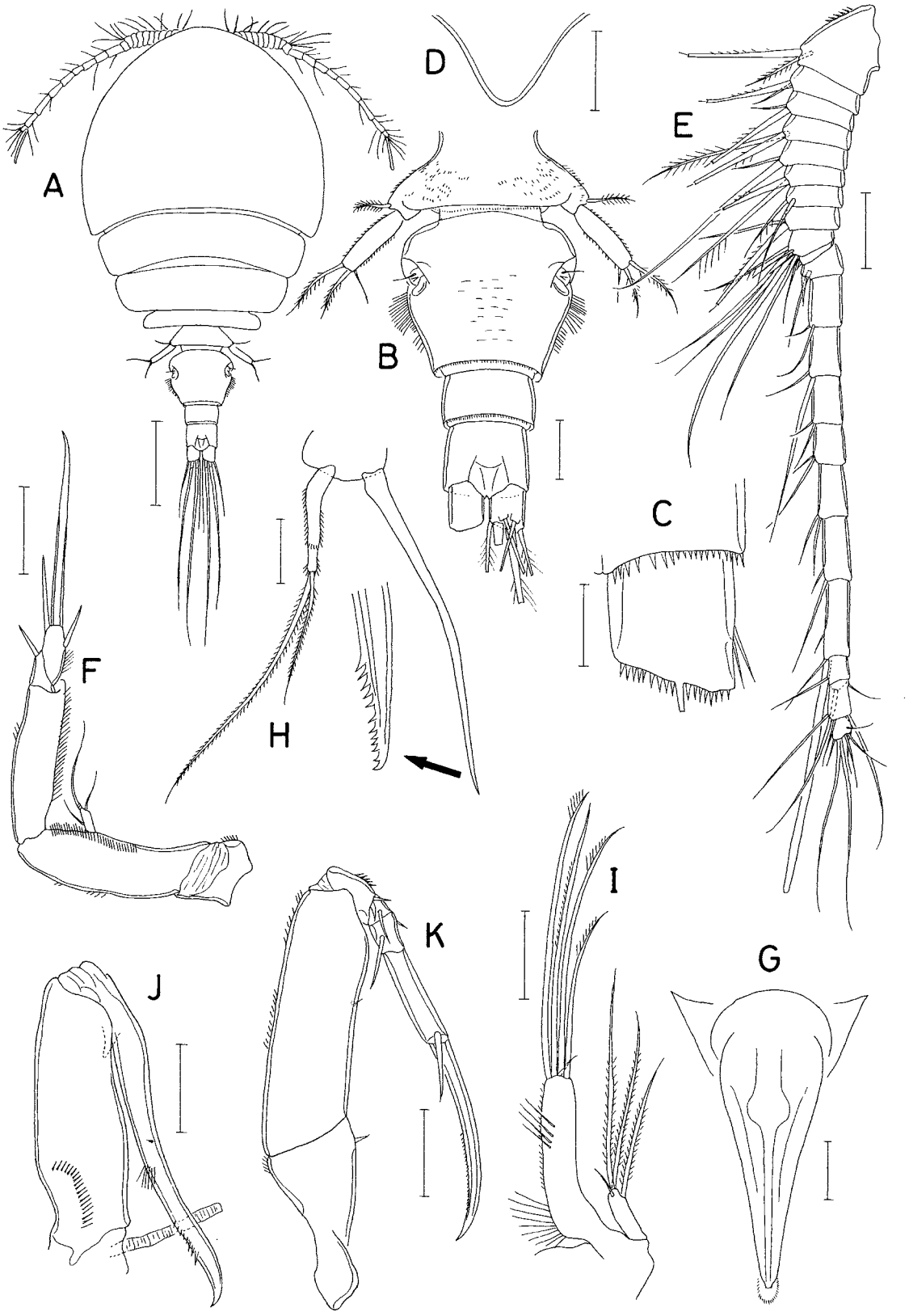

Fig. 21. *Asterocheres fici* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, left caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.2 mm; B, D–K, 0.05 mm; C, 0.02 mm.

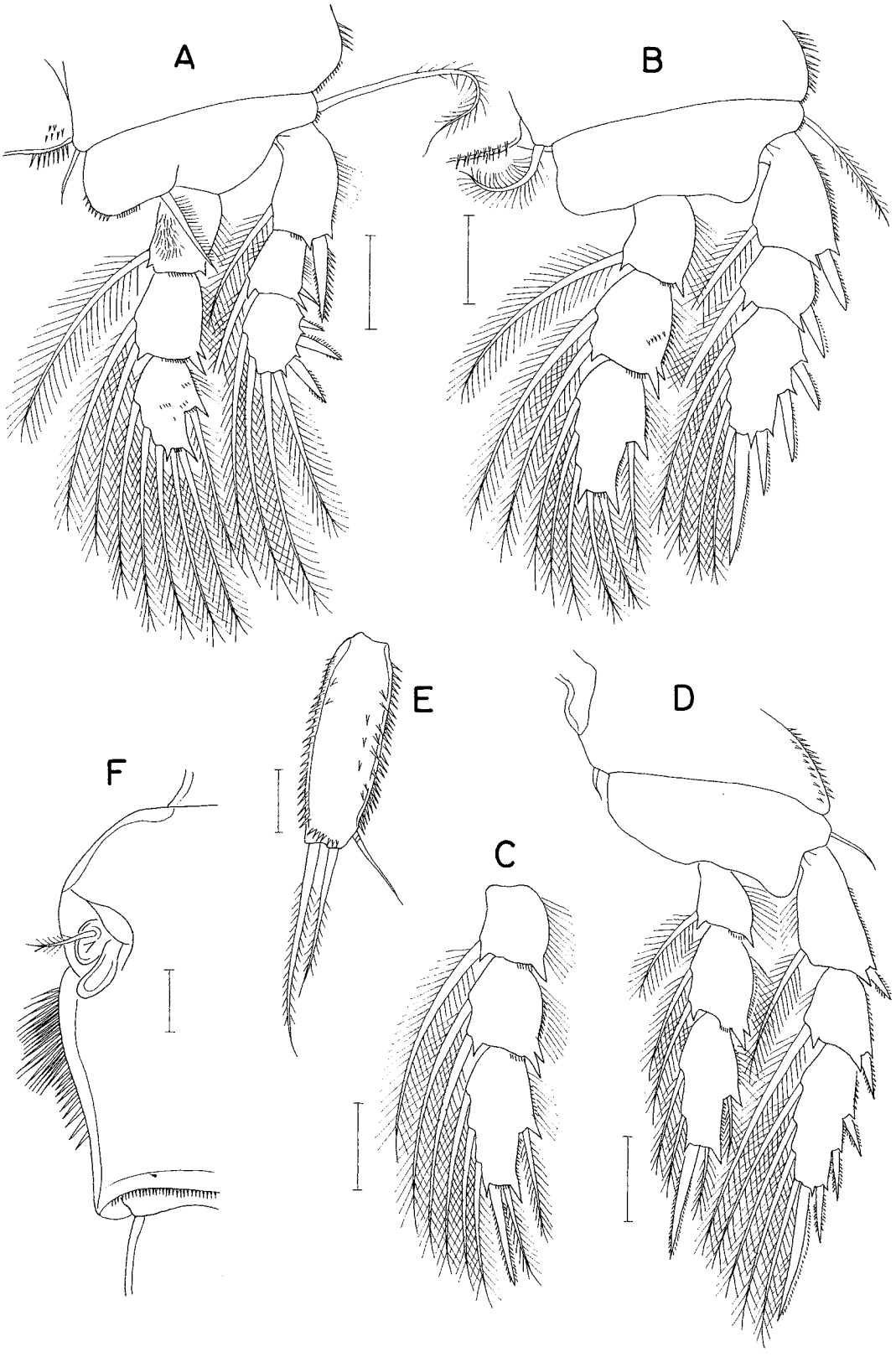

Fig. 22. *Asterocheres fici* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal. Scale bars: A–D, 0.05 mm; E, F, 0.02 mm.

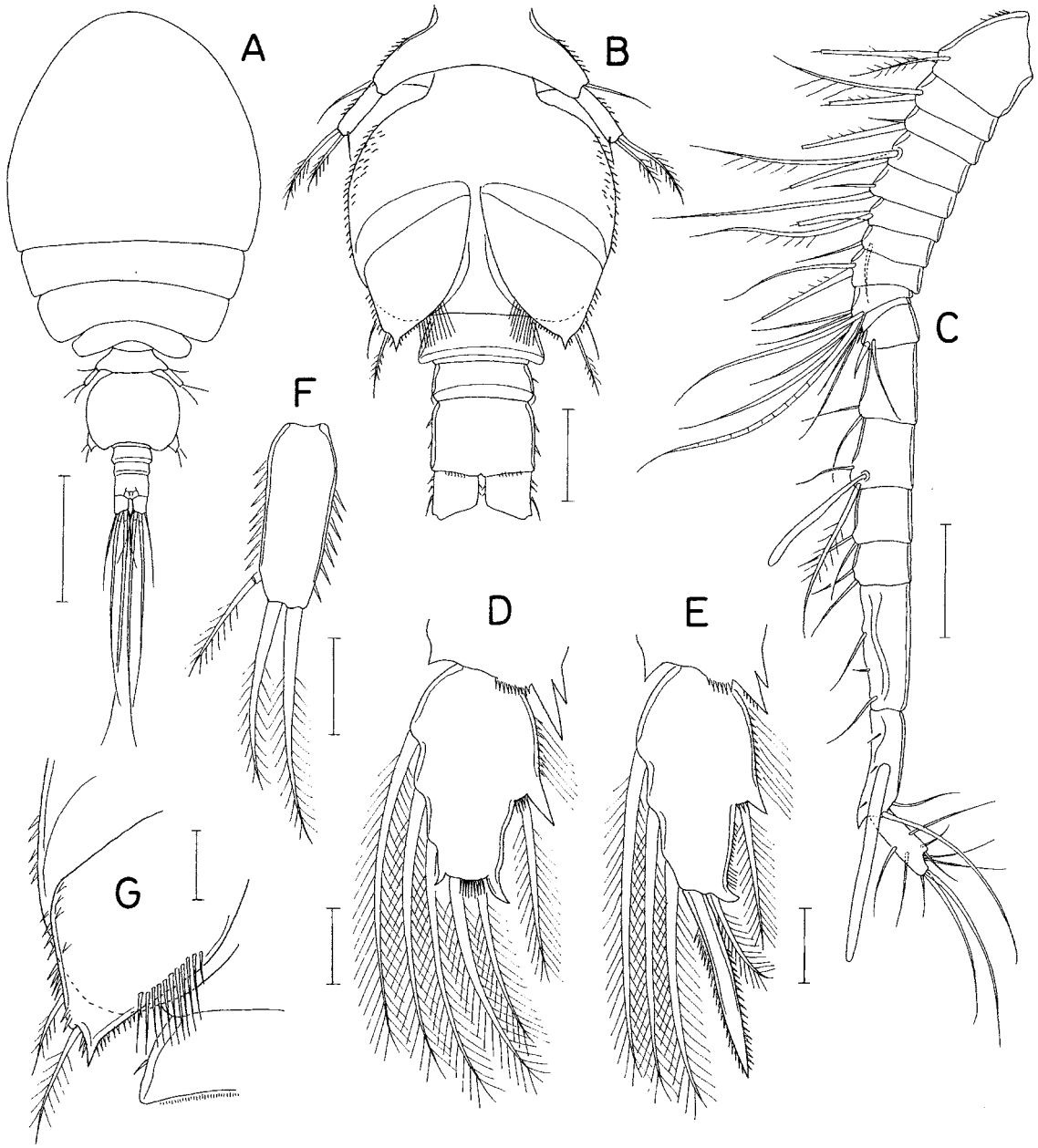

Fig. 23. *Asterocheres fici* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, third endopodal segment of leg 2; E, third endopodal segment of leg 3; F, exopod of leg 3; G, leg 6. Scale bars: A, 0.2 mm; B, C, 0.05 mm; D–G, 0.02 mm.

nulation proximally. Leg 6 (Fig. 22F) represented by 1 pinnate seta and 1 spinules on genital operculum.

Male. Body (Fig. 23A) narrower and smaller than that of female. Body length 800 μm in dissected specimen. Prosome 545 × 409 μm. Urosome (Fig. 23B) 5-segmented. Fifth pedigerous somite 110 μm wide. Genital somite subcircular, wider than long (127 × 144 μm), laterally covered with fine spinules. Genital operculum well-developed, bearing spinules on outer and inner margins and 10–12 setules on inner margin (Fig. 23G). Three abdominal somites 22 × 67, 18 × 58, and 36 × 56 μm, respectively. Caudal ramus as long as wide (25 × 25 μm).

Rostrum as in female. Antennule (Fig. 23C) 18-segmented; 9th, 13th, 16th, 17th, and terminal segments bearing 7 setae, 2 setae + aesthetasc, 3 setae, 5 setae + aesthetasc, and 10 setae, respectively; all other segments each with 2 setae; anterodistal corner of 17th segment produced with pointed tip. Antenna as in female.

Oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped with proximal process on inner margin

of basis, otherwise as in female.

Third endopodal segment leg 2 (Fig. 23D) with slightly curved outer distal process and spinulose distal margin. Third endopodal segment of leg 3 (Fig. 23E) with slightly curved outer distal process; distal seta on same segment small, much shorter than distal spine.

Exopodal segment of leg 5 (Fig. 23F) 2.60 times longer than wide (39 × 15 μm), with 3 pinnate setae; lengths of these setae 49, 41, and 23 μm, respectively, from outer to inner. Leg 6 (Fig. 23G) represented by 2 unequal pinnate seta and pointed process on posterolateral corner of genital operculum.

Remarks. Three species of *Asterocheres* may be compared with *A. fici* n. sp., as they reveal relatively high similarity values with the new species, sharing at least 11 of 15 character states with the new species (Table 2). These three species (*A. corneliae*; *A. flustrae* Ivanenko & Smurov, 1997; and *A. latus* (Brady, 1872)) can be distinguished from the new species by their following differences from the new species:

In *A. corneliae* the oral siphon is slender, as figured in the original description by Schirl (1973), the mandibular stylet bears three thick and several minute teeth, according to Bandera & Conradi (2016) (cf. 12 almost identical teeth in the new species), and the setae of the outer lobe of the maxillule are short, not extend beyond the distal tip of the inner lobe (cf. longer, extends beyond the distal tip of the inner lobe in the new species).

In *A. flustrae* the oral siphon extends to the base of the maxillipeds, the mandibular palp is 2-segmented, and the sexual dimorphisms of the swimming legs are different from those of the new species, as described and illustrated by Ivanenko & Smurov (1997).

In *A. latus*, as redescribed by Bandera & Conradi (2009b), the caudal ramus is 2.6 times longer than wide and the mandibular palp is 2-segmented.

The small, naked inner seta on coxa of leg 1, the elongate exopodal segment of female leg 5 which is densely ornamented on the parallel inner and outer margin, the characteristic forms, and ornamentations of endopods of male legs 2 and 3 and male genital operculum may allow the new species to be easily identified.

Asterocheres serratus n. sp. (Figs. 24–26)

https://zoobank.org/urn:lsid:zoobank.org:act:C5D1EC62-31AF-4D5B-86B4-11A9CCF90842

Type material. Holotype (intact ♀; MABIK CR00254666), intact paratypes (10 ♀♀, 1 ♂; MABIK CR00254667), and dissected paratypes (1 ♀, 1 ♂) from unidentified sponges, at Seopseom, Seogwipo, Jeju Island (33°13′39.6″N, 126°35′58.9″E), trimix diving, depth 50.1 m, coll. T. Lee, 25 May 2022. Holotype and intact paratypes has been deposited in the Marine Biodiversity Institute of Korea (MABIK), Seocheon. Dissected paratypes are kept in the collection of I-H. Kim.

Etymology. The specific name is taken from its key character, the serrate lateral margins of the fourth pedigerous somite.

Female. Body (Fig. 24A) rather small. Body length 603 μm long in dissected and described specimen. Mean body length 601 μm (538–640 μm), based on 9 specimens. Prosome 424 μm long. Cephalothorax wider than long (280 × 327 μm). Posterolateral corner of cephalothorax angular. Second to fourth pedigerous somites with rounded lateral corners. Fourth pedigerous somite characteristically serrate along lateral margins. Urosome (Fig. 24B) 4-segmented. Fifth pedigerous somite 89 μm wide, bearing scattered spinule on lateral and dorsolateral surfaces and row of fine spinules along posterodorsal margin. Genital double-somite wider than long (70 × 83 μm), consisting of expanded anterior three quarters and narrower posterior quarter; genital apertures positioned dorsolaterally near midway of double-somite length; postgenital lateral margin bearing 14 or 15 spinules of unequal lengths (Fig. 25F); posteroventral margin with row of spinules. Two free abdominal somites subequal in length, 26 × 47 and 27 × 39 μm, respectively. Anal somite with row of spinules on posteroventral somite (Fig. 24C). Caudal ramus (Fig. 24C) 0.90 times longer than wide (18 × 20 μm), armed with 6 setae and ornamented with row of spinules along posteroventral margin.

Rostrum (Fig. 24D) as tapering ridge between antennules, without defined distal apex. Antennule (Fig. 24E) 305 μm long, 21-segmented; segments each armed with 2 setae, except 7 setae on 9th segment, 2 setae + aesthetasc on 18th segment, 4 setae on penultimate segment and 7 setae on terminal segment; some of setae on proximal segments weakly pinnate or truncated and tipped with minute setule. Antenna (Fig. 24F) as usual for genus; first endopodal segment 50 μm long; terminal claw 54 μm long, slightly longer than first endopodal segment; spinules near exopod of basis distinct, not needle-like.

Oral siphon (Fig. 24G) 168 × 47 μm, rather slender, its distal tip reaching mid-region between maxilliped and leg 1. Mandible (Fig. 24H) bearing slender coxal stylet and palp; stylet 152 μm long, bearing about 10 minute teeth along distal region; palp 1-segmented, 45 μm long, tipped with 2 naked setae; setae 128 and 55 μm long, respectively; palp plus longer distal seta 173 μm long, 1.14 times longer than stylet. Maxillule (Fig. 24I) bilobed; inner lobe about 50 μm long, tipped with 4 long and 1 small setae (4 long setae 103, 102, 90, and 56 μm long, respectively); outer lobe about 18 μm long, bearing 4 naked setae (lengths of these setae 64, 55, 40, and 23 μm long, respectively). Maxilla (Fig. 24J) slender; proximal segment with row of about 10 spinules proximally; dis-

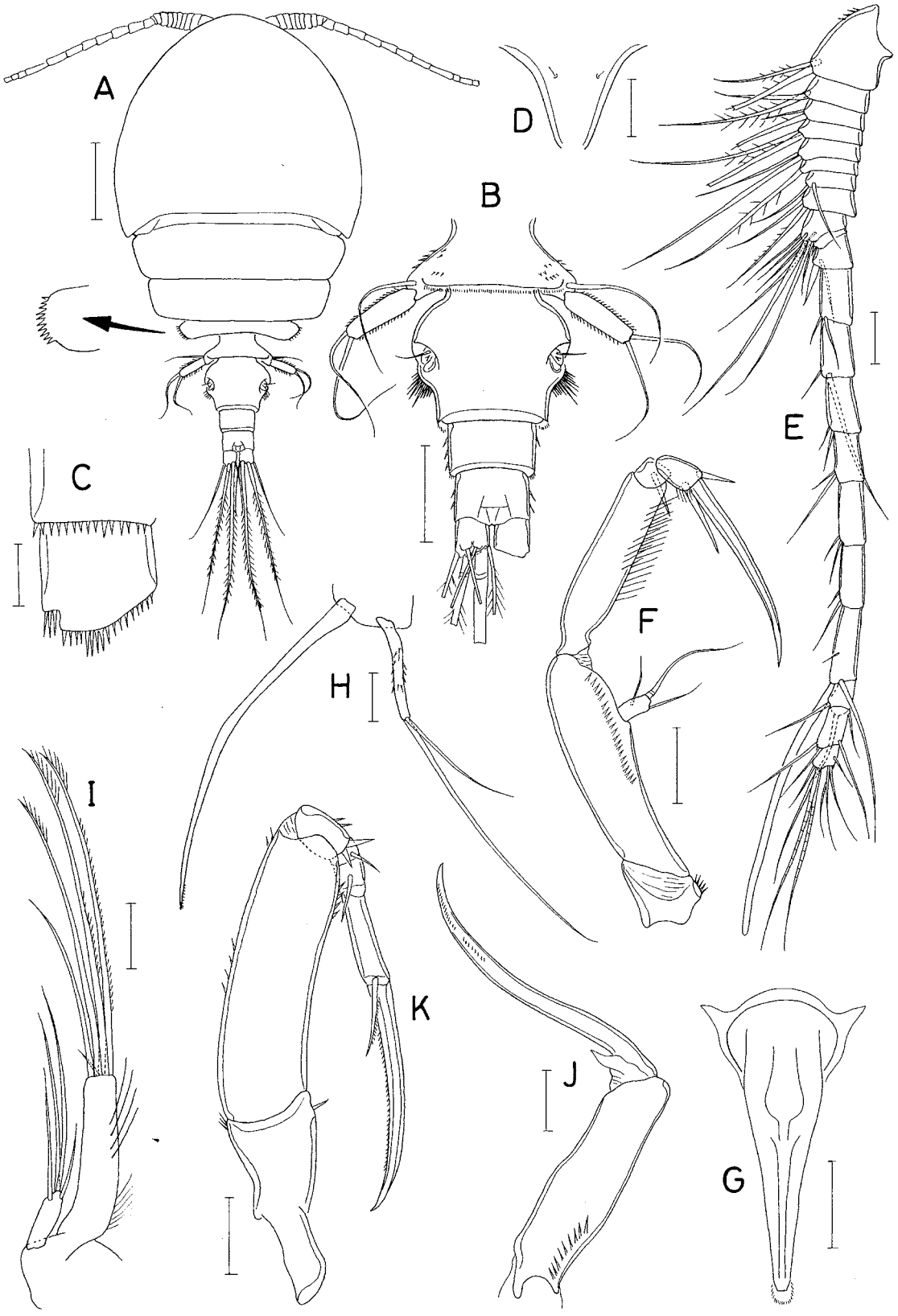

Fig. 24. *Asterocheres serratus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, G, 0.05 mm; C, 0.01 mm; D–F, H–K, 0.02 mm.

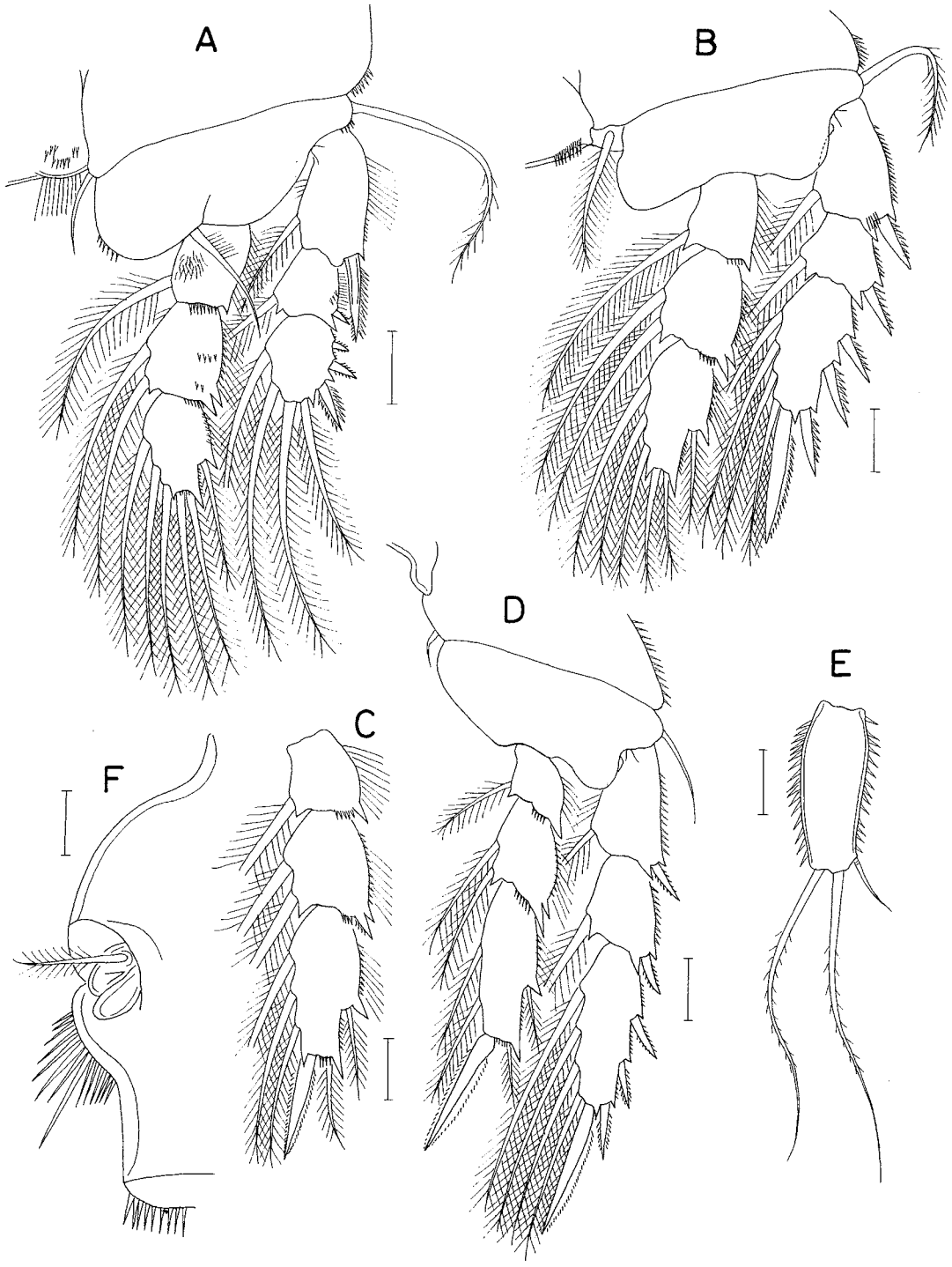

Fig. 25. *Asterocheres serratus* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite. Scale bars: 0.02 mm.

tal segment longer than proximal segment, bearing linguiform process proximally and row of minute spinules along distal third. Maxilliped (Fig. 24K) with armature formula 1, 0, 2, 1, 1, and 1 + claw; basis with several spinules on outer margin and few setae on subdistal part of inner margin; first endopodal segment with 2 spinules on outer margin; terminal segment and claw 25 and 64 μm, respectively.

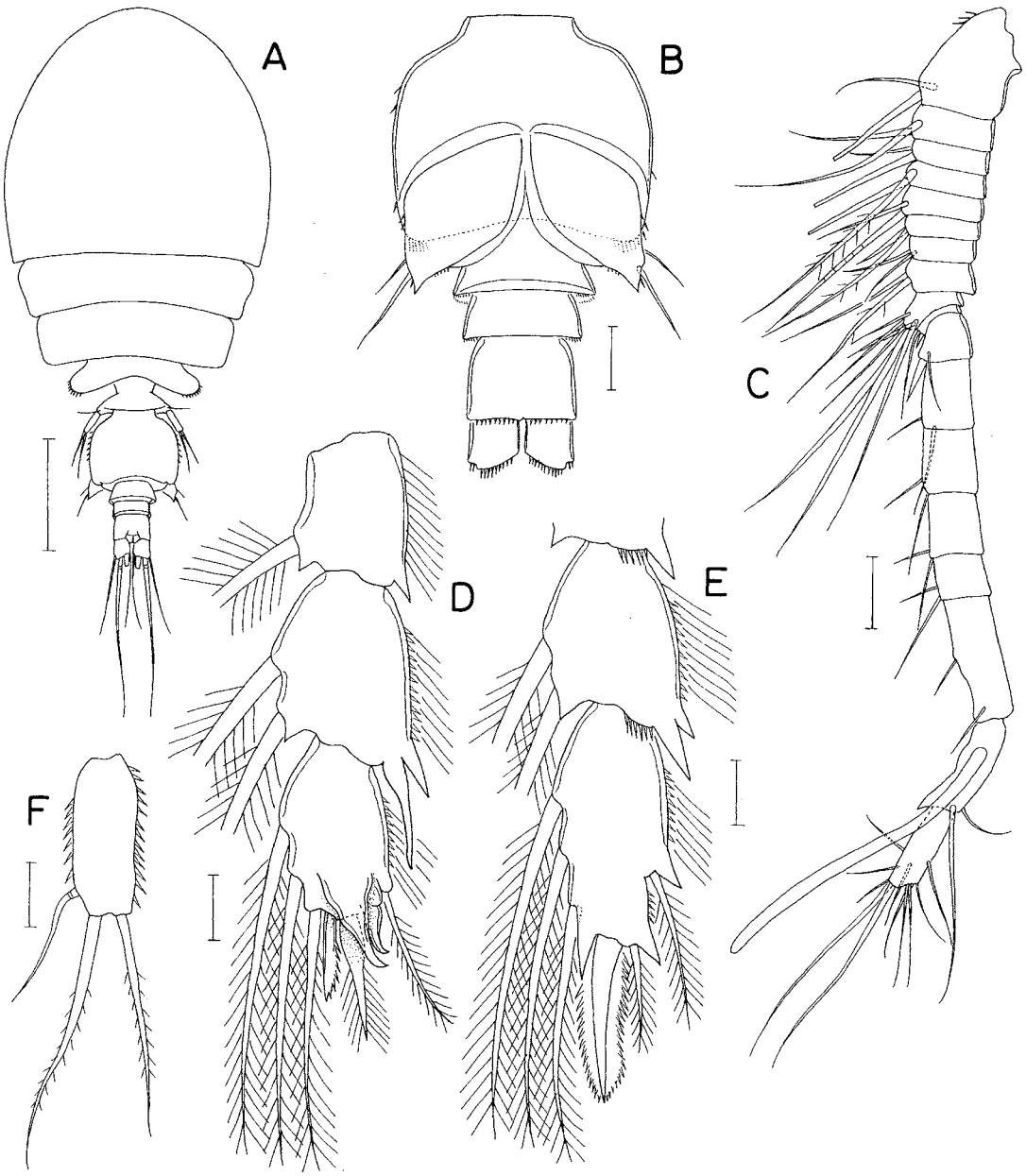

Fig. 26. *Asterocheres serratus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, endopod of leg 2; E, second and third segments of endopod of leg 3; F, exopod of leg 5. Scale bars: A, 0.1 mm; B–F, 0.02 mm.

Legs 1 (Fig. 25A), 2 (Fig. 25B), 3, and 4 (Fig. 25D) armed as usual for genus; inner coxal seta present in all these legs. Leg 3 similar to leg 2, except bearing 1 spine and 5 setae on third endopodal segment. Intercoxal plate bearing spinules and setules in leg 1, spinules only in leg 2, but smooth in legs 3 and 4. Inner coxal seta of leg 1 slender and naked, that of leg 4 rudimentary. Outer margin of coxa spinulose in legs 1–4. Armature formula for legs 1–4 as in *A. aesthetes*.

Leg 5 (Fig. 24B) consisting of 1 long dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 25E) nearly rectangular, 2.60 times longer than wide (52 × 20 μm), bearing many spinules on outer and inner margins, and armed with 2 long, equal setae (outer and inner setae 90 and 92 μm long, respectively), and small, naked inner subdistal seta (21 μm long). Leg 6 as 1 pinnate seta and 1 spinule on genital operculum.

Male. Body (Fig. 26A) smaller and narrower than that of female. Body length 505 μm in figured and dissected specimen. Prosome 340 μm long. Cephalothorax slightly

wider than long (227 × 248 μm). Fourth pedigerous somite with serrated lateral margin as in female. Urosome 5-segmented. Genital somite (Fig. 26B) 73 × 82 μm, with few spinules on lateral margins and dorsal posterolateral corners. Three abdominal somites 15 × 45, 14 × 38, and 26 × 30 μm, respectively. Caudal ramus 16 × 15 μm.

Rostrum as in female. Antennule (Fig. 26C) 18-segmented; segments each with 2 setae, except 7 setae on 9th segment, 2 setae + aesthetasc on penultimate segment, and 11 setae on terminal segment; no aesthetasc present on 13th segment. Antenna as in female. Oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped with proximal process on inner margin of basis.

Legs 1 and 4 as in female. Leg 2 endopod prominently different from that of female: distal one of two dentiform processes on outer distal corner of second segment elongated (Fig. 26D); its third segment armed with 1 seta on outer margin, 2 slightly curved, attenuated distal processes, 1 proximally swollen seta and 1 unilaterally spinulose spine on distal margin, and 3 pinnate setae on inner margin. Third endopodal segment of leg 3 slightly different from that of female in having shortened outer seta on distal margin (Fig. 26E).

Leg 5 armed as in female; exopodal segment (Fig. 26F) with 3 setae, 2.5 times longer than wide (25 × 10 μm), ornamented with spinule on inner and outer margins; lengths of 3 setae 34, 42, and 20 μm, respectively, from outer to inner. Leg 6 (Fig. 26B) represented by 2 unequal setae and pointed distal process on genital operculum.

Remarks. *Asterocheres serratus* n. sp. is readily recognizable by its key character, the serrate lateral margins of the fourth pedigerous somite, which has not been reported until now in *Asterocheres*. The unusually long setae of female leg 5 (except the short inner seta of the exopod) and the typical, sexually dimorphic form of the endopod of male leg 2 are also diagnostic features of the new species.

Asterocheres tridentatus n. sp. (Figs. 27–29)

https://zoobank.org/urn:lsid:zoobank.org:act:46F57BFA-D91F-4342-9733-79E407B8F132

Type material. Holotype (intact ♀; NIBRIV0000909863), intact paratypes (16 ♀♀; NIBRIV0000909864), and dissected paratype (1 ♀) from washings of unidentified sponges, SCUBA diving, depth 24.2 m, Dokdo Island in the Korean east sea (37°14′50.8″N, 131°51′49.28″E), coll. T. Lee, 25 May 2023. Holotype and intact paratypes have been deposited in the National Institute of Biological Resources (NIBR). Incheon, Korea. Dissected paratype is kept in the collection of I.-H. Kim.

Etymology. The name *tridentatus* refers to the presence of three teeth on the mandibular stylet.

Female. Body (Fig. 27A) rather broad. Mean body length 815 μm (797–835 μm), based on 7 specimens. Figured and described specimen 835 μm long. Prosome 585 μm long, 0.70 times as long as body length. Cephalothorax 370 × 476 μm; its posterolateral corners angular. Second to fourth pedigerous somite with rounded lateral corners. Urosome (Fig. 27B) 4-segmented. Fifth pedigerous somite slightly wider than genital double-somite 115 μm wide, bearing several spinules on lateral margins. Genital double-somite as long as wide (106 × 106 μm); genital apertures positioned laterally at middle of double-somite length; posterior region posterior to genital apertures gradually narrowing; postgenital lateral margin bearing 2 groups of spinules, proximal group consisting of 2 or 3 longer spinules and distal group consisting of 2–6 shorter spinules (Fig. 27K, L). Two free abdominal somites 36 × 62 and 33 × 61 μm, respectively; Anal somite with spinules on posteroventral margin (Fig. 27C). Caudal ramus (Fig. 27C) wider than long (25 × 29 μm), armed with 6 setae and ornamented with spinules (or scales) on lateral and posteroventral margins.

Rostrum (Fig. 27D) as tapering ridge, without posterior apex. Antennule (Fig. 27E) 324 μm long, 20-segmented; 9th, 18th, and terminal segments bearing 7 setae, 2 setae + aesthetasc, and 11 setae, respectively; all other segments each with 2 setae; several setae on proximal segment bearing minute spinules on margins; anterior margin of first segment with fine spinules. Antenna (Fig. 27F) with short, unarmed coxa; basis 75 μm long, unarmed ornamented with longitudinal row of fine spinules near exopod and several spinules on inner margin; exopod small, 10 × 5.5 μm, bearing 3 setae; first endopodal segment 53 μm long, unarmed but ornamented with 2 rows of fine spinules on outer surface; small second endopodal segment with 1 seta distally; third endopodal segment with 3 setae (including 1 minute seta); terminal claw 83 μm long, 1.62 times longer than first endopodal segment.

Oral siphon (Fig. 27G) 183 μm long, reaching between maxilliped and leg 1. Mandible (Fig. 27H) consisting of stylet and palp; stylet 190 μm long, bearing 3 teeth (2 distal and 1 subdistal); palp 2-segmented; proximal and distal segments 36 and 21 μm long, respectively, 2 distal setae 135 and 64 μm long, feebly pinnate; palp segments plus longer distal seta 193 μm long, as long as stylet. Maxillule (Fig. 27I) bilobed; smaller outer lobe 25 μm long, with 4 setae, longest one of them 97 μm long; inner lobe about 82 μm long, tipped with 1 small and 4 large setae, longest one of them 105 μm long. Maxilla (Fig. 27J) slender, 2-segmented; proximal segment unornamented; distal segment 1.3 times longer than proximal segment, with 1 group of setules near middle followed distally by row of fine spinules. Maxilliped (Fig. 28A)

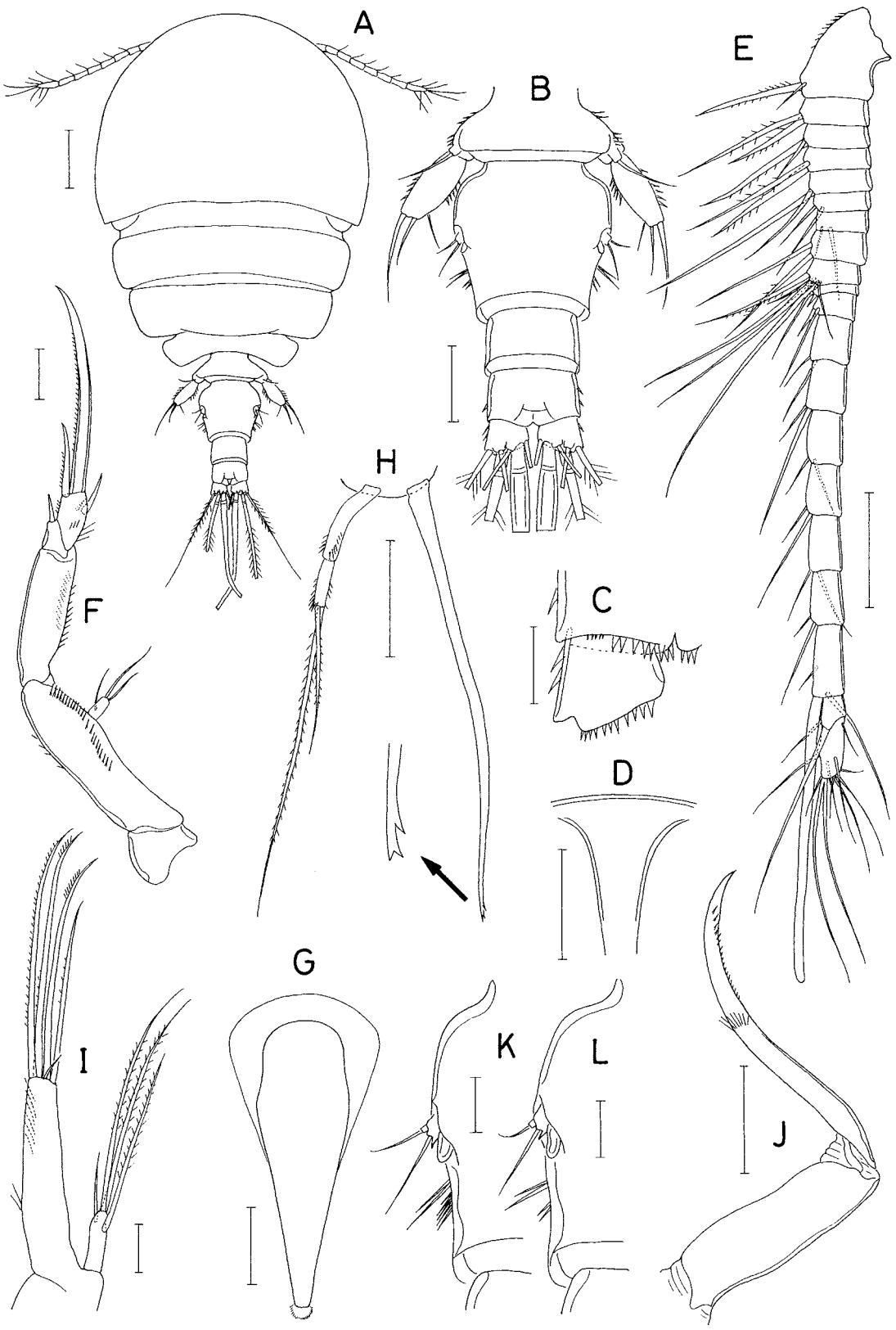

Fig. 27. *Asterocheres tridentatus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, L, left side of genital double-somite, dorsal. Scale bars: A, 0.1 mm; B, D, E, G, H, J, 0.05 mm; C, F, I, K, L, 0.02 mm.

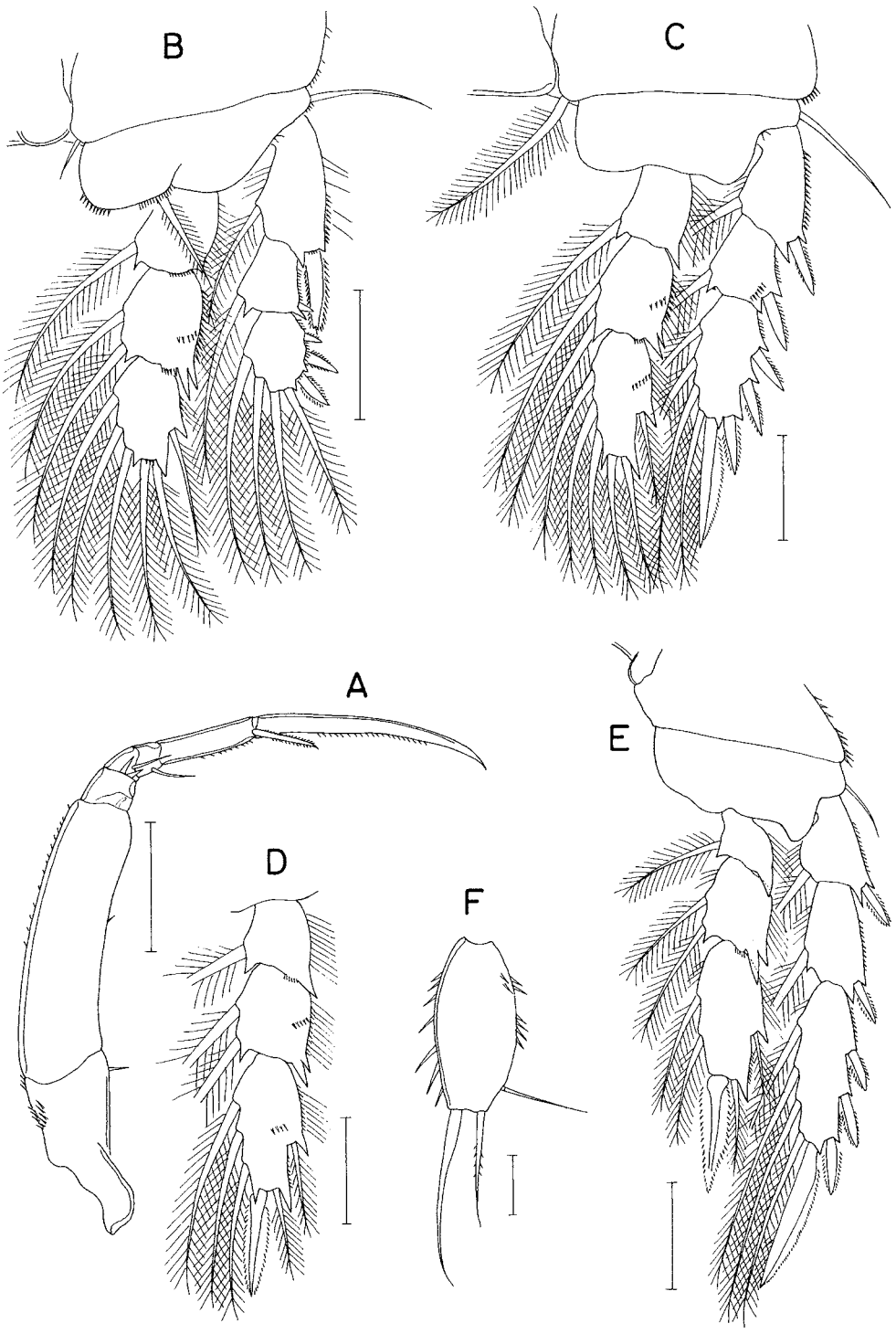

Fig. 28. *Asterocheres tridentatus* n. sp., female. A, maxilliped; B, leg 1; C, leg 2; D, endopod of leg 3; E, leg 4; F, exopod of leg 5. Scale bars: A–E, 0.05 mm; F, 0.02 mm.

slender, 6-segmented; armature formula 1, 1, 2, 1, 1, and 1 + claw; first segment with 1 patch of spinules at outer subdistal region and several spinules at outer distal corner; inner seta on second segment rudimentary; terminal segment 38 μm long; terminal claw 91 μm long, 2.4 times longer than terminal segment.

Leg 1 (Fig. 28B), 2 (Fig. 28C), 3, and 4 (Fig. 28E) biramous with 3-segmented rami. Posterior margin of in-

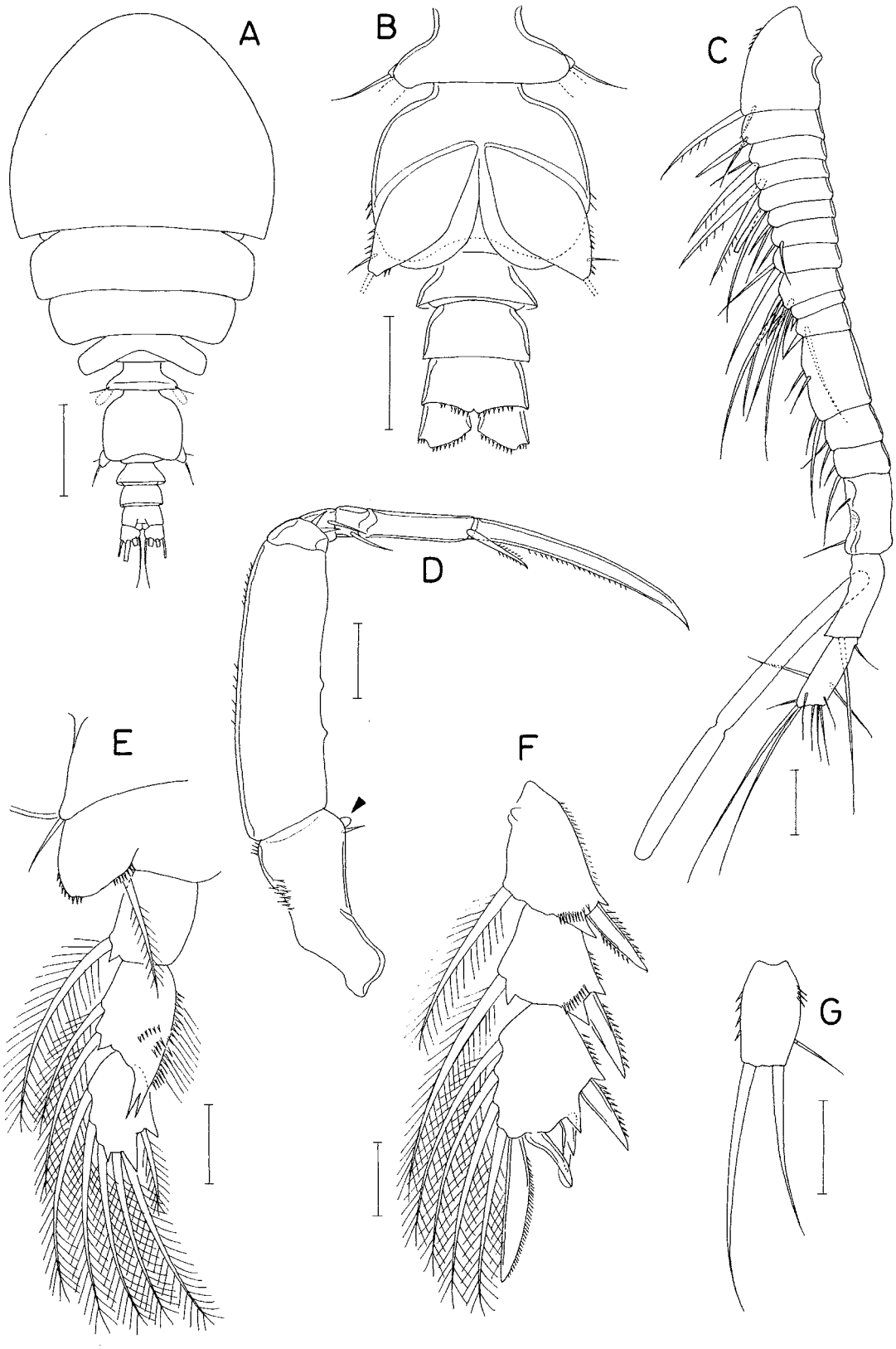

Fig. 29. *Asterocheres tridentatus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, maxilliped; E, medial side of leg 1; F, exopod of leg 2; G, exopod of leg 5. Scale bars: A, 0.1 mm; B, 0.05 mm; C–G, 0.02 mm.

tercoxal plate smooth in all swimming legs. Inner coxal seta small, naked in leg 1, large and pinnate in legs 2 and 3, but absent in leg 4. Leg 3 same as leg 2, except bearing 1 spine plus 5 setae on third endopodal segment (Fig. 28D). Inner distal corner of basis of leg 1 spinulose, but naked in other swimming legs. Inner distal seta on basis of leg 1 slender, not broadened at its proximal region, pinnate along both margins. Second endopodal segment of all swimming legs bearing bicuspid outer distal corner. Armature formula for legs 1–4 as in *A. processus* n. sp.

Leg 5 (Fig. 27B) consisting of dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment (Fig. 28F) fusiform with convex, spinulose outer and inner margins, 2.07 times longer than wide (58 × 28 μm), armed with 3 setae; these setae 59, 38, and 31 μm long, respectively, from outer to inner. Leg 6 (Fig. 27K, L) represented by 2 naked setae and 1 denticle on genital operculum.

Male. Body (Fig. 29A) similar in form to that of female. Body length 582 μm. Prosome 387 μm long. Cephalothorax 237 × 294 μm, bearing angular posterolateral corners. Urosome (Fig. 29B) 5-segmented. Fifth pedigerous somite 77 μm wide. Genital somite 76 × 96 μm; with well-developed genital operculum. Three abdominal somites 22 × 53, 24 × 46, and 22 × 46 μm, respectively. Caudal ramus 18 × 23 μm.

Rostrum as in female. Antennule (Fig. 29C) 17-segmented, slightly geniculate between 15th and 16th segments; 9th, 12th,16th, and terminal segments bearing 6 setae, 4 setae, 1 seta + aesthetasc, and 11 setae, respectively; anterodistal corner of 16th segment pointed; aesthetasc on penultimate segment constricted at 60% region. Antenna as in female.

Oral siphon, mandible, maxillule, and maxilla as in female. Maxilliped (Fig. 29D) with 1 guttiform process near inner distal seta of first segment (indicated by arrowhead); second segment bearing 2 small pronouncements on inner margin.

Legs 1 and 2 showing sexual dimorphisms. Second endopodal segment of leg 1 (Fig. 29E) bearing produced, distally directed outer distal corner and 3 rows of small spinules on outer surface. Third exopodal segment of leg 2 (Fig. 29F) expanded; its second outer spine bearing subsidiary denticle on outer margin; third outer spine bearing membrane on distal part of inner margin; both spines naked, without spinules.

Exopodal segment of leg 5 (Fig. 29G) 1.77 times longer than wide (23 × 13 μm), bearing few spinules on outer and inner margins and 3 unequal naked setae. Leg 6 (Fig. 29B) probably represented by 2 unequal setae on distal region of genital operculum.

Remarks. Nine species of *Asterocheres* are selected as relatives of *A. tridentatus* n. sp. after comparing the new species with its congeners based on the character states of 17 characters (Table 2). These nine species are *A. alter* Eiselt, 1965; *A. canui*; *A. cubensis* Varela, 2010; *A. fernadezmilerai* Varela, 2010; *A. halichondriae* Stock, 1966; *A. manaarensis* Thompson & A. Scott, 1903; *A. proboscideus*; *A. tenuipes* Kim, 2010; and *A. tetrasetosus* Johnsson, 1999 and distinguished from the new species by their different features. The oral siphon extends before the maxilliped in *A. alter*, to the maxilliped in *A. canui*, *A. halichondriae*, and *A. tetrasetosus*, to leg 1 in *A. tenuipes*, and over leg 1 in *A. proboscideus* (vs. the oral siphon extends between the maxilliped and leg 1 in *A. tridentatus* n. sp.). Therefore, these six species are distinguished from the new species by having different lengths of the oral siphon. *Asterocheres cubensis* and *A. fernandezmilerai* both described from the West Indies (Varela, 2010a) have 19-segmented female antennule (vs. 20-segmented in *A. tridentatus* n. sp.) and an inner coxal seta on leg 4 (vs. the seta is absent in *A. tridentatus* n. sp.). Therefore, the latter two species are also distinguished from the new species.

Asterocheres nodulosus n. sp. (Figs. 30–32)

https://zoobank.org/urn:lsid:zoobank.org:act:C3D1431D-8821-4AE6-AF00-F40D8D5787CE

Type material. Holotype (♀, NIBRIV0000909865), intact paratypes (15 ♀♀, 5 ♂♂, NIBRIV0000909866), and dissected paratypes (1 ♀, 1 ♂) from mixed species of sponges, Ulleung Island (approximately 37°32′25″N, 130°50′50″E), depth about 20 m, SCUBA diving, coll. J. Lee. 29 August 2018. Holotype and intact paratypes have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes are kept in the collection of I.-H. Kim.

Etymology. The specific name refers to the nodule-like proximal expansion of the medio-distal seta of the third endopodal segment of male leg 2.

Female. Body form (Fig. 30A) as usual for genus. Body length 793 μm in figured and described specimen. Other 4 measured specimens 695, 730, 755, and 840 μm, respectively. Prosome 549 μm long. Cephalothorax wider than long (364 × 436 μm). All prosomal somites with rounded posterolateral corners. Urosome (Fig. 30B) 4-segmented. Fifth pedigerous somite wider than genital double-somite, with spinules on lateral surfaces. Genital double-somite slightly wider than long (108 × 110 μm); genital apertures positioned dorsolaterally at 47% region of double-somite length; postgenital lateral margin bearing 2 groups of spinules consisting of 13 or 14 thin spinules of anterior group and 4 thicker spinules of posterior group (Fig. 31F). Two free abdominal somites 36 × 66 and 38 × 58 μm, respectively. Genital double-somite and first free abdominal somite bearing row of min-

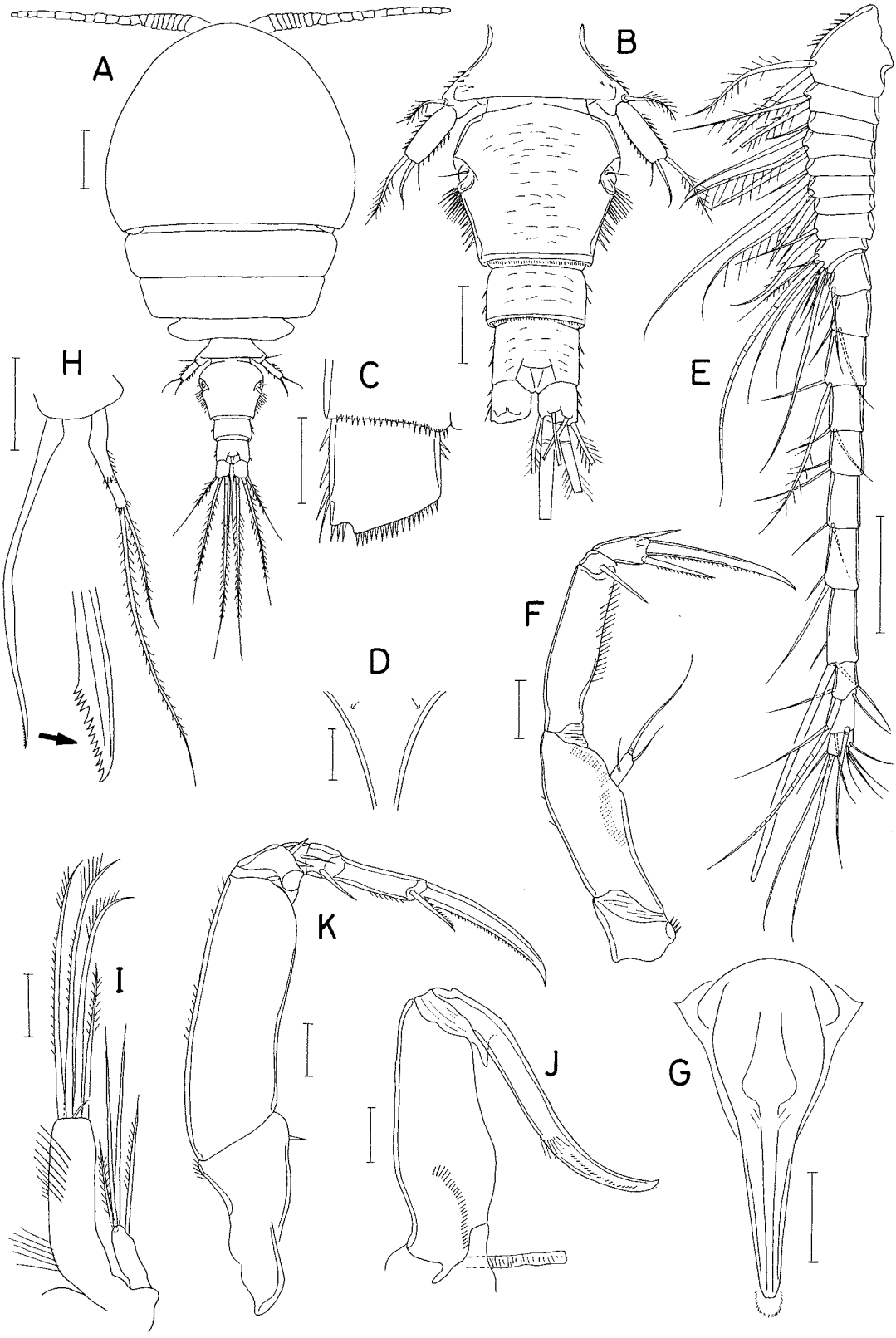

Fig. 30. *Asterocheres nodulosus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, E, G, H, 0.05 mm; C, D, F, I–K, 0.02 mm.

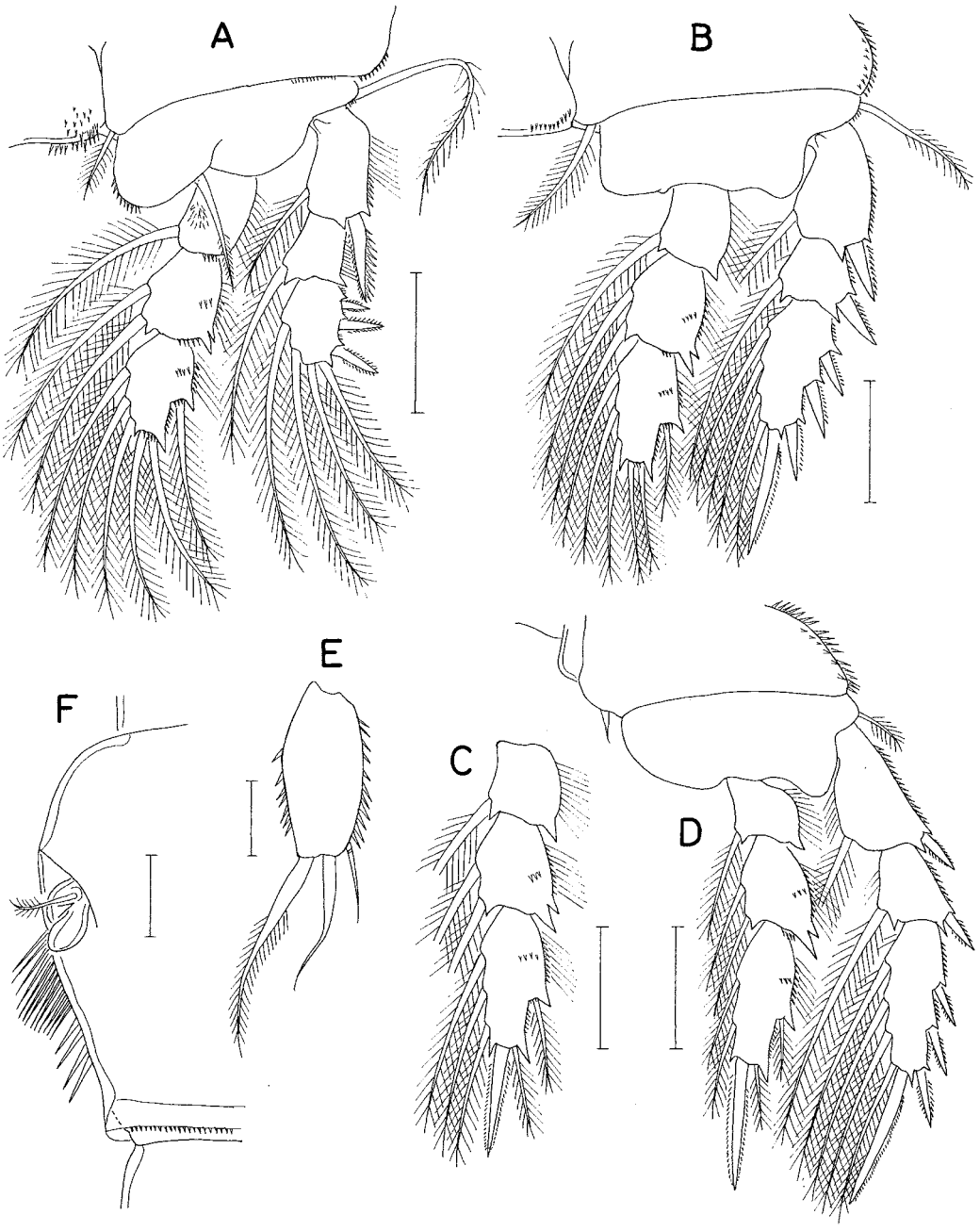

Fig. 31. *Asterocheres nodulosus* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal. Scale bars: A–D, 0.05 mm; E, F, 0.02 mm.

ute spinules along posterodorsal margin. Anal somite with row of spinules along posteroventral margin (Fig. 30C). Caudal ramus 1.08 times longer than wide (28 × 26 μm), armed with 6 setae and ornamented with few scales on outer and inner margins and row of spinules on posteroventral margin.

Rostrum (Fig. 30D) as tapering ridge between antennules, without defined distal apex. Antennule (Fig. 30E) 320 μm long, 21-segmented; 9th, 18th, 20th, and terminal segments with 7 setae, 2 setae + aesthetasc, 4 setae, and 7 setae, respectively; other segments each with 2 setae. First segment with several spinules on anterior margin; some of setae on anterior segments pinnate; one of setae on 9th and 19th segments with crack-like transverse lines; some of setae on proximal segments truncated and tipped with minute setule. Antenna (Fig. 30F) consisting of coxa, basis, small exopod, and 3-segmented endopod; coxa with several spinules on outer

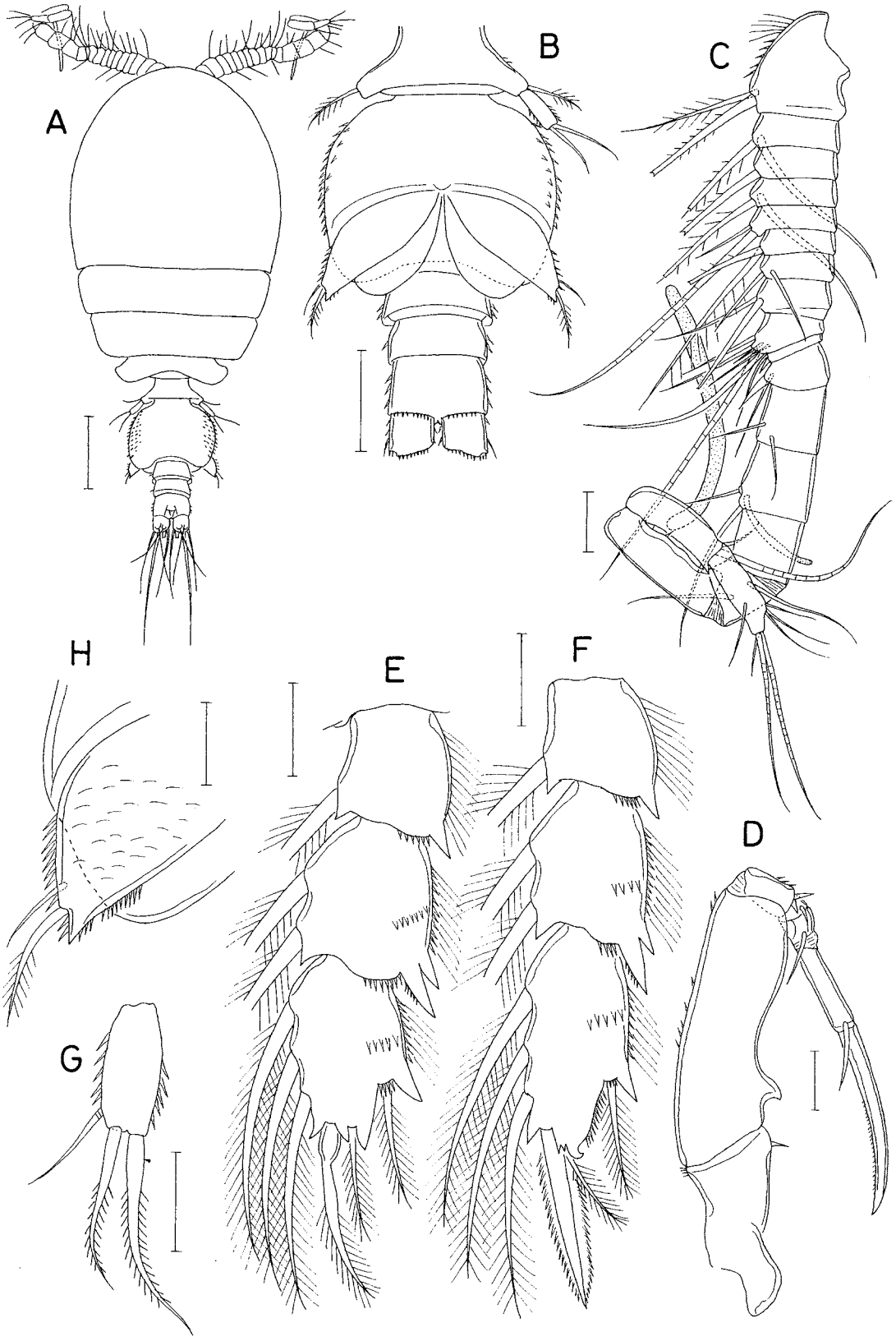

Fig. 32. *Asterocheres nodulosus* n. sp., male. A, habitus, dorsal; B, urosome, ventral; C, antennule; D, maxilliped; E, endopod of leg 2; F, endopod of leg 3; G, exopod of leg 5; H, leg 6. Scale bars: A, 0.1 mm; B, 0.05 mm; C–H, 0.02 mm.

margin; basis with longitudinal row of needle-like minute spinules near outer margin and few spinules on inner margin; first endopodal segment 57 μm long, with setules on outer margin; small second endopodal segment bearing 1 seta; third endopodal segment bearing 2 setae, 1 spinule-like, minute seta; terminal claw spiniform, 54 μm long.

Oral siphon (Fig. 30G) 197 × 65 μm, extending slightly over insertions of maxillipeds. Mandible (Fig. 30H) consisting of coxal stylet and palp; stylet 180 μm long, bearing row of 12 teeth at distal region; palp 1-segmented, 56 μm long, tipped with 1 long (159 μm long) and 1 shorter (68 μm long) setae, both setae weakly pinnate; palp plus longer distal seta 1.19 times longer than stylet. Maxillule (Fig. 30I) bilobed; inner lobe about 59 μm long, tipped with 4 large and 1 rudimentary setae (lengths of 4 large setae 83, 85, 75, and 50 μm, respectively, from inner to outer); outer lobe 21 μm long tipped with 4 setae, lengths of these 4 setae 65, 65, 45, and 25 μm, respectively. Maxilla (Fig. 30J) 2-segmented; proximal segment (syncoxa) bearing excretory tube and row of fine spinules at proximal region; distal segment (basis) as long as proximal segment bearing 1 group of setules at distal third and row of minute spinules along distal third. Maxilliped (Fig. 30K) consisting of coxa, basis, and 4-segmented endopod; coxa with 1 small seta subdistally on inner margin and several minute spinules at outer distal corner; basis unarmed but with minute spinules on outer margin; endopodal segments with 2, 1, 1, and 1 setae, respectively. Terminal segment 35 μm long and terminal claw of 61 μm long.

Legs 1 (Fig. 31A), 2 (Fig. 31B), 3, and 4 (Fig. 31D) with 3-segmented rami. Leg 3 similar to leg 2 except bearing 1 spine and 5 setae on third endopodal segment (Fig. 31C). Intercoxal plate of legs 1−3 with small spinules, but smooth in leg 4. Inner coxal seta of leg 1 small but pinnate, that of leg 4 naked, rudimentary. Outer seta on basis of leg 1 elongated, that of leg 4 short. Inner distal margin of basis of leg 1 bearing spinules. Armature formula for legs 1−4 same as that of *A. processus* n. sp.

Leg 5 (Fig. 30B) represented by 1 dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment (Fig. 31E) 2.14 times longer than wide (47 × 22 μm), bearing spinules on convex inner and outer margins and armed with 3 unequal setae; lengths of these setae 58, 38, and 22 μm, respectively, from outer to inner; longer outermost seta pinnate, other setae naked. Leg 6 (Fig. 31F) represented by 1 pinnate seta and 1 denticle on genital operculum.

Male. Body (Fig. 32A) narrower than that of female. Body length 655 μm. Prosome 430 × 297 μm. Urosome (Fig. 32B) 5-segmented. Fifth pedigerous somite 85 μm wide. Genital somite globular, 91 × 120 μm, bearing spinules on lateral surfaces. Three abdominal somites 22 × 56, 21 × 51, 30 × 50 μm, respectively. Caudal ramus 22 × 23 μm.

Rostrum as in female. Antennule (Fig. 32C) 18-segmented, with weak geniculation between 15th and 16th segments and strong geniculation between 16th and 17th segments; 9th, 13th, 17th, and terminal segments with 7 setae, 2 setae + aesthetasc, 2 setae + aesthetasc, and 10 setae, respectively; other segment with 2 setae each; first segment with setules and spinules on anterior margin. Antenna as in female.

Oral siphon, mandible, maxillule, maxilla as in female. Maxilliped (Fig. 32D) with beak-like proximal process on inner margin of basis.

Legs 1 and 4 as in female. Endopods of legs 2 and 3 different from those of female. Third endopodal segment of leg 2 (Fig. 32E) with mediodistal seta bearing nodule-like proximal expansion and outer distal seta reduced in size. Third endopodal segment of leg 3 (Fig. 32F) with hook-like, curved outer distal process and 2 small denticles medial to outer distal process.

Exopodal segment of leg 5 (Fig. 32G) 2.17 times longer than wide (26 × 12 μm), shaped and ornamented as that of female, bearing 2 pinnate distal setae and 1 naked mediodistal seta; lengths of these setae 43, 34, and 21 μm long, respectively, from outer to inner. Leg 6 (Fig. 32H) consisting of 2 unequal setae on spinulose outer distal region of genital operculum.

Remarks. *Asterocheres nodulosus* n. sp. appears to be most similar to three congeners: *A. fici* n. sp., sharing 14 same character states in 17 characters with the new species, and *A. aesthetes* and *A. horridus* each sharing 13 same character states in 17 characters with the new species (see Table 2). These three species are distinguished from the new species by the following features:

Asterocheres aesthetes has caudal rami of the female which are wider than long and a 2-segmented mandibular palp. *Asterocheres fici* n. sp. has the terminal claw of the female antenna which is distinctly longer than the first endopodal segment and the exopodal segment of female leg 5 which is 2.83 times longer than wide. *Asterocheres horridus* has a longer oral siphon which extends to leg 1, a 2-segmented mandibular palp, and the exopodal segment of female leg 5 which is 2.90 times longer than wide (Kim, 2016).

The distinctiveness of the above three species and *A. nodulosus* n. sp. can be confirmed by their different forms of legs 2 and 3 of the male, as follows: (1) in the third endopod of male leg 2, the outer distal process is expanded with a small tubercle in *A. aesthetes*, thinned in *A. horridus*, and slightly curved in *A. fici* n. sp. and *A. nodulosus* n. sp.; (2) in the third endopodal segment of male leg 3, the outer distal process is slightly curved in *A. aesthetes*, *A. fici* n. sp., and *A. nodulosus* n. sp., but

not modified in *A. horridus*; (3) the outer distal seta of the third endopodal segment of male leg 3 is minimized in *A. fici* n. sp. and *A. nodulosus* n. sp. but normal in *A. aesthetes* and *A. horridus*; and finally, the presence of a nodule-like proximal expansion on the inner distal seta of the third endopodal segment of male leg 2 is a unique feature of *A. nodulosus* n. sp., which is easily observable under the microscope without dissection.

***Asterocheres tetraodontis* n. sp. (Figs. 33, 34)**

https://zoobank.org/urn:lsid:zoobank.org:act:337B5104-1AD3-443C-8AD3-2404EF566717

Type material. Holotype (♀; NIBRIV0000909867), Paratypes (3 ♀♀; NIBRIV0000909868), and dissected paratype (1 ♀) from mixed species of sponges, Ulleung Island (approximately 37°32′25″N, 130°50′50″E), depth about 20 m, SCUBA diving, coll. J. Lee, 29 August 2018. Holotype and intact paratypes have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratype is retained in the collection of I.-H. Kim.

Etymology. The name *tetraodontis* (from Greeks, *tetra* meaning "four" and *odon* meaning "a tooth") refers to the four distal teeth of the mandibular stylet.

Female. Body (Fig. 33A) moderately broad. Body length of figured and described specimen 796 μm. Prosome 513 × 422 μm. Cephalothorax 353 μm long, wider than long. All prosomal somites with rounded posterolateral corners. Urosome (Fig. 33B) 4-segmented. Fifth pedigerous somite wider than genital double-somite, with 1 or 2 spinules on lateral margin. Genital double-somite as long as wide (117 × 118 μm), widest at proximal third, gradually narrowing posteriorly from widest region; genital apertures positioned laterally at 45% region of double-somite length; postgenital lateral margin bearing 2 groups of spinules, anterior group consisting of 4 or 5 shorter spinules and posterior group of 4 longer spinules (Fig. 34F); posterior region of lateral margin with 2 scales. Two free abdominal somites 48 × 70 and 36 × 64 μm, respectively. Anal somite with spinules of irregular sizes along posteroventral margin (Fig. 33C). Caudal ramus (Fig. 33C) as long as wide (27 × 27 μm), bearing longer outer margin and shorter inner margin, armed with 6 setae, and ornamented with spinules along posteroventral margin.

Rostrum (Fig. 33D) represented by ridge bearing concave lateral margins, without posterior apex. Antennule (Fig. 33E) 337 μm long, 20-segmented; 9th, 18th, and terminal segments with 7 setae, 2 setae + aesthetasc, and 9 setae, respectively; all other segments each with 2 setae; several setae on proximal segments pinnate; all setae attenuated, not truncated at tip. Antenna (Fig. 33F) comprising coxa, basis, small exopod, and 3-segmented endopod; coxa short, unarmed; basis unarmed but ornamented with fine spinules near exopod; exopod 9 × 5.5 μm, bearing 1 proximal and 2 distal setae; first endopodal segment 57 μm long, unarmed but ornamented with setules along outer margin; small second endopodal segment with 1 seta; third endopodal segment with 2 setae; terminal claw spiniform, 52 μm long.

Oral siphon (Fig. 33G) rather stout, 147 × 57 μm, reaching maxilliped insertions, constricted near proximal quarter. Mandible (Fig. 33H) consisting of coxal stylet and palp; stylet 133 μm long, bearing 4 teeth distally including hook-like terminal tooth; palp 1-segmented, 46 μm long, tipped with 2 unequal, weakly pinnate setae, longer seta 118 μm long, and shorter seta 47 μm long; palp plus longer distal seta 164 μm long, 1.23 times longer than stylet. Maxillule (Fig. 33I) bilobed; inner lobe about 67 μm long, tipped with 1 rudimentary and 4 distinct setae (lengths 69, 70, 65, and 37 μm, respectively, from inner to outer); outer lobe 18 μm long, tipped with 4 setae (lengths 59, 55, 50, and 18 μm, respectively). Maxilla (Fig. 33J) 2-segmented; both segments smooth, lacking spinules or setules; distal segment slender, distinctly longer than proximal segment. Maxilliped (Fig. 33K) 6-segmented; armature formula 1, 0, 2, 1, 1, and 1 + claw; terminal segment and claw 36 and 58 μm long, respectively.

Legs 1 (Fig. 34A), 2 (Fig. 34B), 3, and 4 (Fig. 34D) segmented and armed as in general for genus. Leg 3 similar to leg 2, but with 1 spine and 5 setae on the third endopodal segment (Fig. 34C). Inner coxal seta pinnate in legs 1–3 but small, naked in leg 4. Intercoxal plate bearing spinules in leg 1, but smooth in legs 2–4. Outer seta on basis of leg 1 subequal in length to that of leg 2. Mediodistal margin of basis of leg 1 bearing spinules. Inner distal seta on basis of leg 1 thin, bearing few setules on proximal part of outer margin. Outer distal process of first endopodal segment of legs 3 and 4 larger than those of legs 1 and 2. Outer distal corner of second endopodal segment of legs 1–4 with bicuspid process. Armature formula for legs 1–4 as in *A. aesthetes*.

Leg 5 (Fig. 33B) consisting of dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 34E) rectangular, 2.50 times longer than wide (55 × 22 μm), armed with 3 setae and ornamented with several scales on inner and outer margins; lengths of setae 51, 62, and 32 μm, respectively, from outer to inner; first and second outer setae pinnate, but innermost seta naked, with proximal annulation. Leg 6 (Fig. 34F) represented on genital operculum by 1 small, naked seta tipped on digitiform process and 1 spinule.

Male. Unknown.

Remarks. *Asterocheres tetraodontis* n. sp. shows relatively high similarity values (more than 75%) with five congeners: *A. indivisus* Kim, 2010; *A. planus* Kim,

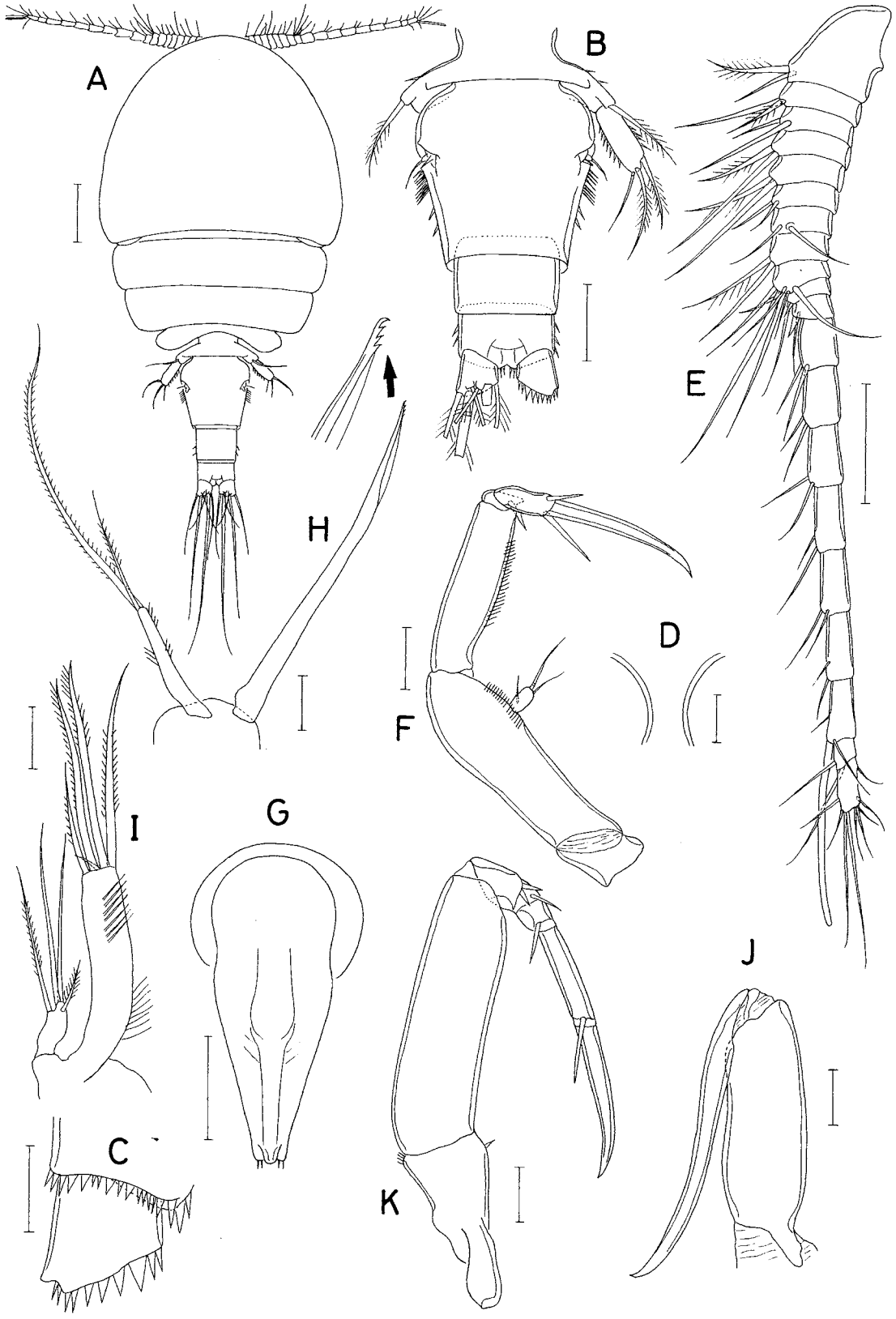

Fig. 33. *Asterocheres tetraodontis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, E, G, 0.05 mm; C, D, F, H–K, 0.02 mm.

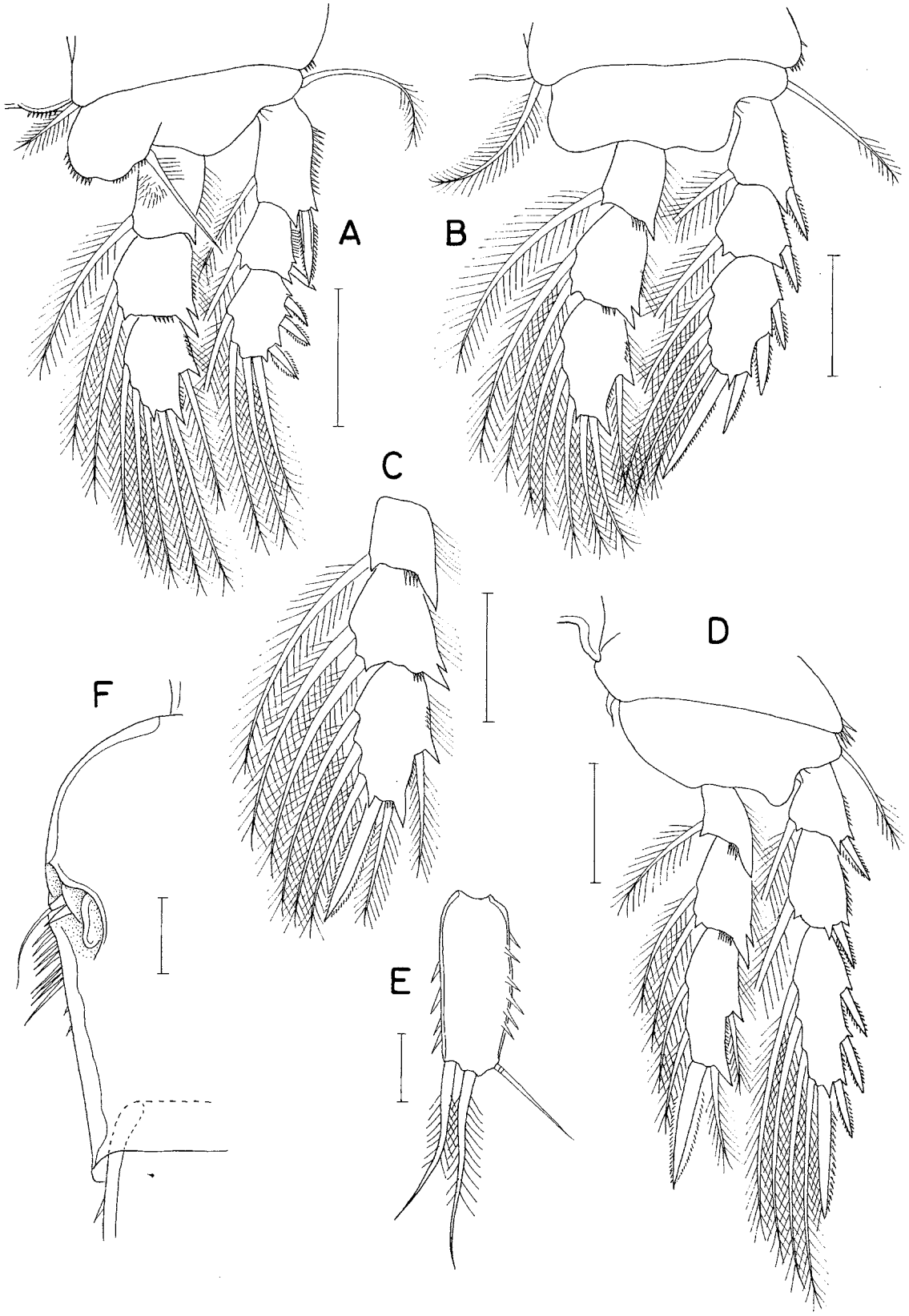

Fig. 34. *Asterocheres tetraodontis* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal. A–D, 0.05 mm; E, F, 0.02 mm.

2010; *A. spinosus* Kim & Min, 2013; *A. eurychelatus* n. sp.; and *A. scutellatus* n. sp. It is noticed that the latter five species have in common a 20-segmented female antennule bearing an aesthetasc on the 18th segment and a 1-segmented mandibular palp which is longer than the stylet. However, these five congeners differ from *A. tetraodontis* n. sp. in having the following different features in the female:

In *A. indivisus*, the caudal rami and genital double-somite are distinctly wider than long (vs. as long as wide in *A. tetraodontis* n. sp.), and the exopodal segment of leg 5 is fusiform (vs. rectangular in *A. tetraodontis* n. sp.) and its outer and middle distal setae are characteristically long, more than twice longer than the segment (vs. the setae are not so long in *A. tetraodontis* n. sp.). In *A. planus*, the caudal ramus is distinctly longer than wide, the mid-terminal seta on the exopod of leg 5 is longer than the other two setae, the cephalothorax is broadened, and the distal segment of the maxilla is stout and strongly curved. In *A. spinosus*, the caudal ramus is 1.88 times longer than wide, the postgenital lateral margin of the genital double-somite is ornamented with numerous setules, and the oral siphon extends over the maxilliped (Kim & Min, 2013). In *A. eurychelatus* n. sp., the genital double-somite is distinctly longer than wide, the terminal claw of the antenna and maxilliped is broadened, and the exopodal segment of leg 5 is fusiform, with three subequal naked setae. In *A. scutellatus* n. sp., the genital double-somite is distinctly longer than wide, the mandibular stylet bears six teeth distally (vs. four teeth in *A. tetraodontis* n. sp.), the exopodal segment of leg 5 is slightly fusiform and its distal setae are all naked and shorter than the exopodal segment (vs. the exopodal segment is rectangular and two of distal setae pinnate and the mid-terminal one is longer than the segment in *A. tetraodontis* n. sp.).

Asterocheres dokdoicus n. sp. (Figs. 35–37)

https://zoobank.org/urn:lsid:zoobank.org:act:BBA11B01-AE1C-4E75-B5FC-5409767A48CB

Type material. Holotype (♀, NIBRIV0000909869), paratypes (6♀♀, 9♂♂, NIBRIV0000909870), and dissected paratypes (1♀, 1♂) from mixed species of sponges, Dokdo Island (37°16′46.7″N, 131°53′11.3″E), depth 45.2 m, trimix diving, coll. T. Lee, 06 July 2022. Holotype and intact paratypes have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes are kept in the collection of I.-H. Kim.

Etymology. The new species is named after its type locality, Dokdo Island.

Female. Body (Fig. 35A) moderately broad. Body length of figured and described specimen 822 μm. Mean body length 774 μm (703–870 μm), based on 8 specimens. Prosome 570 × 436 μm. Cephalothorax 353 μm long, wider than long. All prosomal somite bearing rounded lateral corners. Urosome (Fig. 35B) 4-segmented. Fifth pedigerous somite 123 μm wide, bearing spinules (or scales) on dorsolateral surfaces. Genital double-somite slightly wider than long (110 × 114 μm), widest at proximal third, followed by gradually narrowing distal two-thirds; genital apertures positioned dorsolaterally at about 48% region of double-somite length; postgenital lateral margin ornamented with 2 groups of spinules, anterior group containing 10–13 unequally longer spinules, posterior group containing 4 or 5 shorter but thicker spinules (Fig. 36F). Two free abdominal somite 35 × 65 and 38 × 58 μm, respectively. Genital double-somite and first free abdominal somite bearing minute spinules along posterior margin. Posteroventral margin of anal somite smooth, lacking spinules (Fig. 35C). Caudal ramus (Fig. 35C) as long as wide (26 × 26 μm), ornamented with spinules (or scales) on posteroventral, outer, and inner margins.

Rostrum (Fig. 35D) as tapering ridge between antennules, lacking defined posterior apex. Antennule (Fig. 35E) 360 μm long, 21-segmented; 9th, 18th, 20th, and terminal segments with 7 setae, 2 setae + aesthetasc, 4 setae, and 7 setae, respectively; other segments each with 2 setae; some of setae on proximal segments weakly pinnate, truncated, tipped with small setule. Antenna (Fig. 35F) segmented as in other species of genus; coxa short, unarmed; basis with row of needle-like spinules on outer side; exopod 2.44 times longer than wide (11 × 4.5 μm), bearing 1 proximal and 2 unequal distal setae. First endopodal segment 68 μm long, bearing setules or spinules on both margins; second endopodal segment short, with 1 seta; third endopodal segment bearing 2 setae; terminal claw spiniform, weakly arched, 109 μm long.

Oral siphon (Fig. 35G) 212 × 59 μm, extending to intercoxal plate of leg 1. Mandible (Fig. 35H) consisting of coxal stylet and palp; coxal stylet 205 μm long, bearing 12 teeth at distal region; palp indistinctly 2-segmented, 56 (39 + 17) μm long, tipped with 2 pinnate, unequal setae, longer seta 174 μm long, shorter one 86 μm long; palp plus its larger distal seta 230 μm long, 1.12 times longer than stylet. Maxillule (Fig. 35I) bilobed; inner lobe about 73 μm long, bearing 4 distinct and 1 rudimentary setae (4 distinct setae 120, 1,4, 115, and 70 μm, respectively, from inner to outer); outer lobe 29 μm long, bearing 4 setae (lengths of these setae 118, 91, 86, and 28 μm, respectively); precoxal region near base of outer lobe bearing several spinules. Maxilla (Fig. 35J) slender, 2-segmented; proximal segment bearing excretory tube and row of minute spinules at proximal region; distal segment thin, 1.3 times longer than proximal segment, with tuft of setules in middle and rows of spinules along distal third. Maxil-

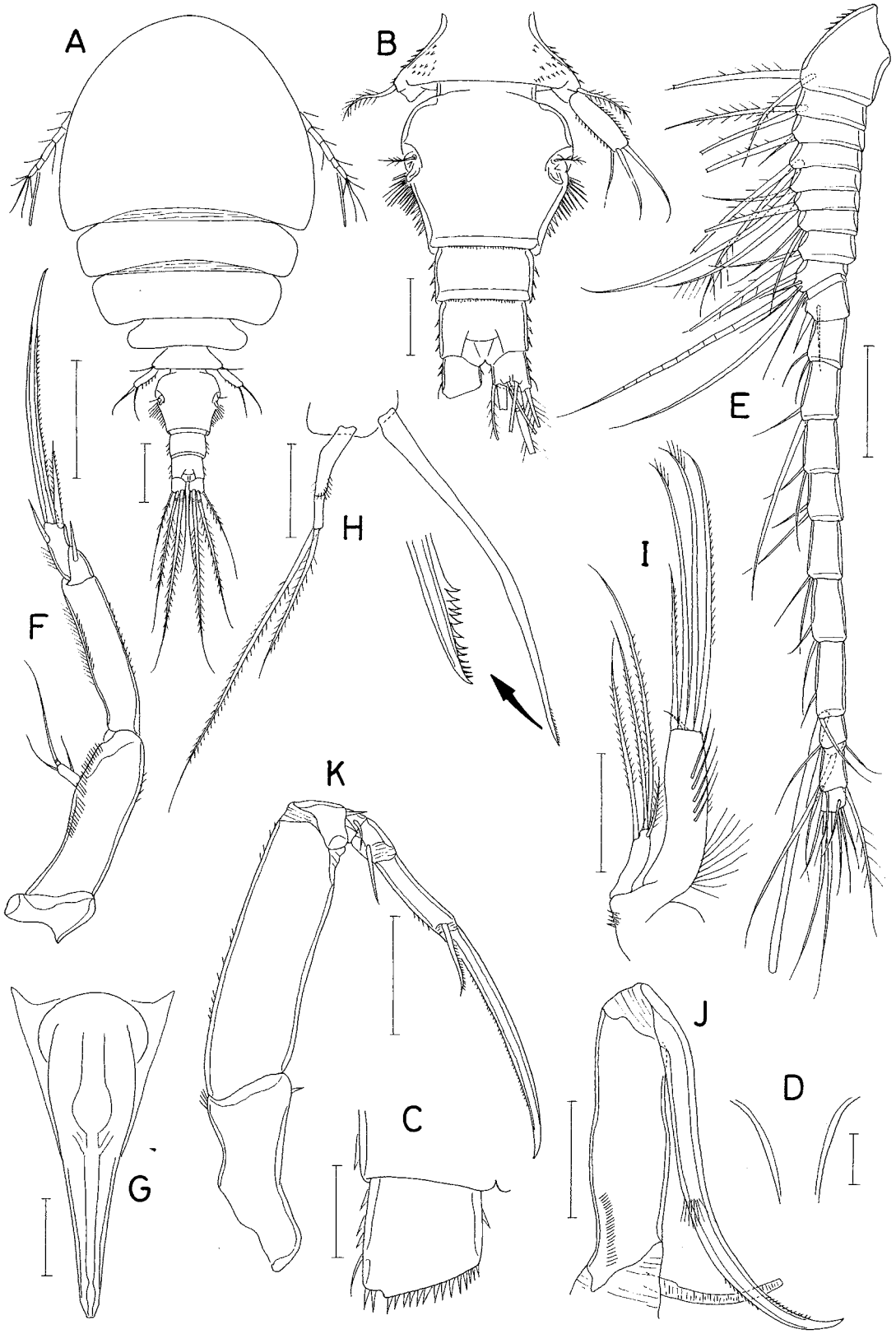

Fig. 35. *Asterocheres dokdoicus* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, E–K, 0.05 mm; C, D, 0.02 mm.

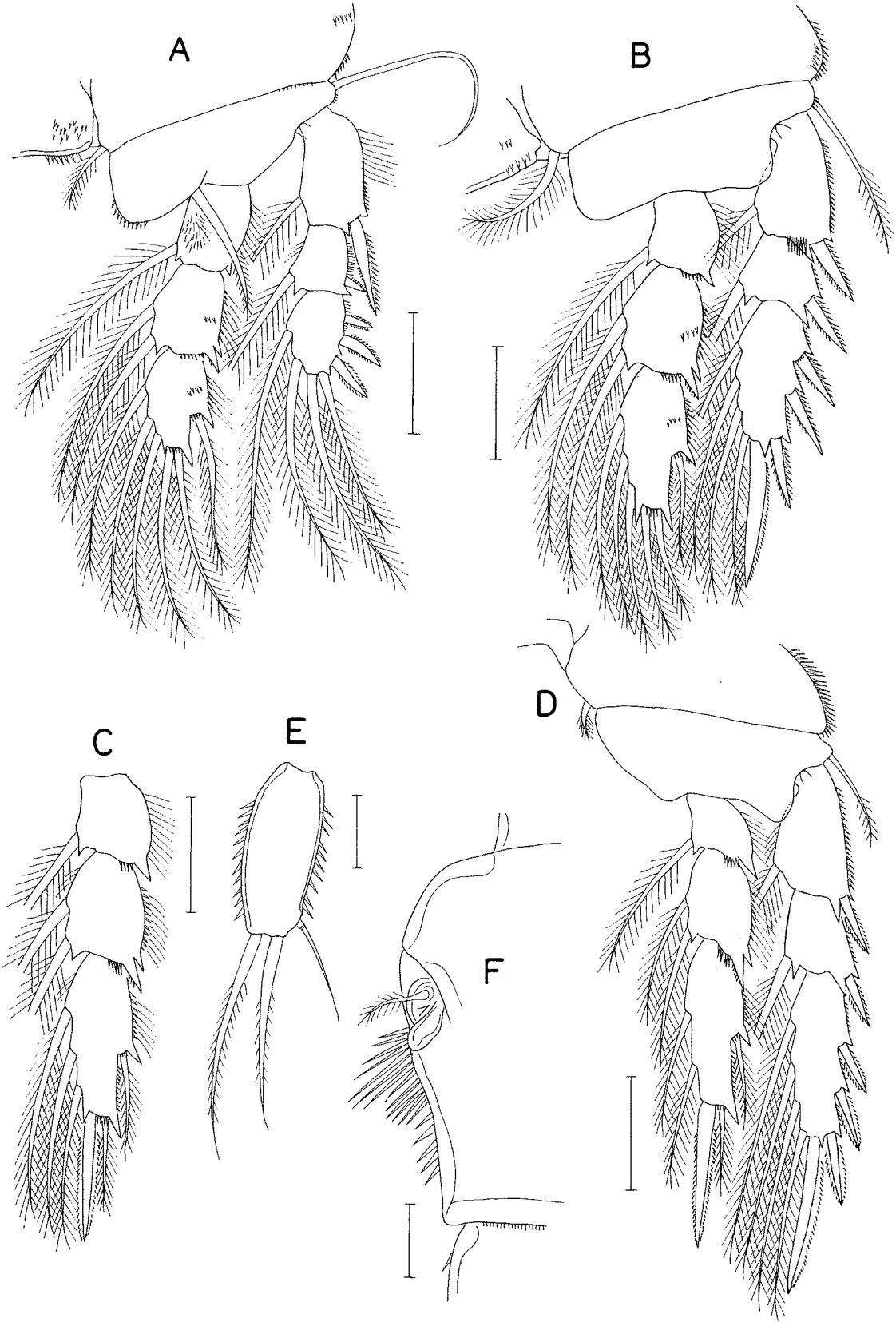

Fig. 36. *Asterocheres dokdoicus* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, exopod of leg 5; F, left side of genital double-somite, dorsal. Scale bars: A–D, 0.05 mm; E, F, 0.02 mm.

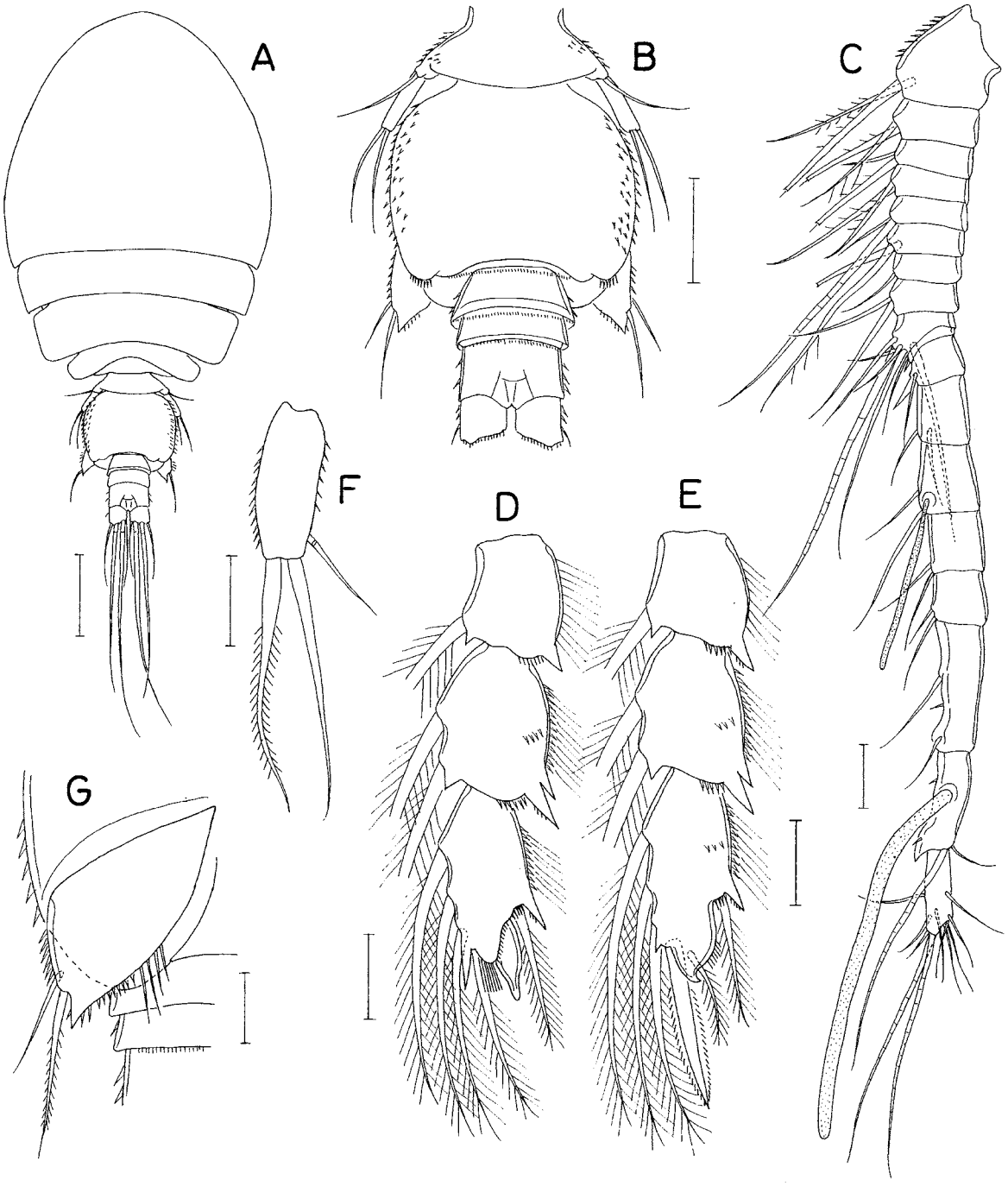

Fig. 37. *Asterocheres dokdoicus* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, antennule; D, endopod of leg 2; E, endopod of leg 3; F, exopod of leg 5; G, leg 6. Scale bars: A, 0.1 mm; B, 0.05 mm; C–G, 0.02 mm.

liped (Fig. 35K) 6-segmented; armature formula 1, 0, 2, 1, 1, and 1 + claw; terminal segment and claw 39 and 105 μm long, respectively.

Legs 1 (Fig. 36A), 2 (Fig. 36B), 3, and 4 (Fig. 36D) segmented as usual for genus. Leg 3 similar to leg 2, but with 1 spine and 5 setae on the third endopodal segment (Fig. 36C). Intercoxal plate bearing spinules in legs 1–3 but smooth in leg 4. Inner coxal seta present, pinnate in all swimming legs. Inner distal margin of basis in leg 1 spinulose but smooth in legs 2–4. Inner distal seta on basis of leg 1 thin, bipinnate along distal half. Second endopodal segment of legs 1–4 with bicuspid outer dis-

tal corner. Armature formula for legs 1–4 as in *A. aesthetes*.

Leg 5 (Fig. 35B) consisting of dorsolateral seta on fifth pedigerous somite and exopod; exopodal segment (Fig. 36E) 2.47 times longer than wide (47 × 19 μm), armed with 3 setae and ornamented with spinules on outer and inner margins; two distal setae pinnate, 70 (outer) and 65 (inner) μm long, respectively; inner subdistal seta naked, 36 μm long, proximally annulated. Leg 6 (Fig. 36F) represented by 1 pinnate seta and 1 spinule on genital operculum.

Male. Body (Fig. 37A) narrower and smaller than that of female. Body length of dissected specimen 633 μm. Prosome 448 × 333 μm. Cephalothorax 294 μm long. Urosome (Fig. 37B) 5-segmented. Fifth pedigerous somite 91 μm wide. Genital somite 91 × 117 μm, with many spinules on lateral surfaces and group of minute spinules at posterodorsal corners; genital operculum bearing 2 setae on subdistal outer margin, spinules on outer and inner margins, 3–5 setules on inner margin, and acutely pointed distal apex. Three abdominal somites 19 × 59, 14 × 53, and 24 × 50 μm, respectively. Caudal ramus as long as wide (23 × 23 μm).

Rostrum as in female. Antennule (Fig. 37C) 18-segmented; 9th, 13th, and 3 terminal segments armed with 7 setae, 2 setae + aesthetasc, 3 setae, 4 setae + aesthetasc, and 11 setae, respectively; anterodistal corner of penultimate segment angularly produced. Antenna as in female.

Oral siphon, mandible, maxillule, and maxilla not different from those of female. Maxilliped with beak-like proximal process on inner margin of second segment.

Legs 1 and 4 as in female. Legs 2 and 3 with endopod (Fig. 37D, E) different from those of female; third endopodal segment of leg 2 bearing strong mammiform spine (transformed from a seta) and group of several, needle-like spinules medial to spine; third endopodal segment of leg 3 with expanded distal region bearing curved, claw-like distal process.

Leg 5 exopodal segment (Fig. 37F) 2.50 times longer than wide (35 × 14 μm). Leg 6 (Fig. 37G) represented by 2 setae on genital operculum.

Remarks. *Asterocheres dokdoicus* n. sp. appears closely related to *A. hoi* which was described by Bandera & Conradi (2013) on the basis of females collected at Curaçao in the Caribbean Sea. The new species and *A. hoi* share all character states in 13 characters (Table 2), thus they cannot be distinguished from each other based on those character states. Differences between the two species are detectable in minor details. According to the original description and illustration of *A. hoi*, in the female of this Caribbean species, (1) the first segment (syncoxa) of the maxilla is slightly expanded proximally (cf. not expanded in *A. dokdoicus* n. sp.), (2) the second segment (basis) of the maxilliped bears row of spinules along the inner margin (cf. the margin is smooth in the new species), (3) the inner coxal seta of leg 1 is naked (cf. pinnate in the new species), (4) the outer seta on the basis of legs 1–4 is naked (cf. the outer seta on the basis of leg 1 is also naked but those of legs 2 and 3 are pinnate in the new species), and (5) the exopodal segment of leg 5 is almost three times longer than wide (cf. the segment is 2.47 times longer than wide in the new species).

The male of *A. dokdoicus* n. sp. has characteristically modified endopods of legs 2 and 3, which are readily observable under the microscope without dissection. Since *A. hoi* is known only by the female, it is expected that the male of the latter species will be discovered in the future and confirm the distinctiveness of both species.

Asterocheres exilis n. sp. (Figs. 38, 39)

https://zoobank.org/urn:lsid:zoobank.org:act:0B8F0C87-8A05-4DE0-AC4E-160A24A9560F

Type material. Holotype (♀; NIBRIV0000909871), intact paratypes (4 ♀♀; NIBRIV0000909872), and dissected paratypes (2 ♀♀) from unidentified species of sponges, Dokdo Island (37°14′17″N, 131°51′59.7″E), SCUBA diving, depth 27 m, coll. T. Lee, 26 August 2023. Holotype and intact paratypes have been deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea. Dissected paratypes are kept in the collection of I.-H. Kim.

Etymology. The name *exilis* (from Latin *exil*, meaning "slender") refers to the narrow body of the new species.

Female. Body (Fig. 38A) narrow. Mean body length 846 μm (818–900 μm), based on 7 specimens. Body length of figured and described specimen 830 μm. Prosome 527 × 349 μm. Cephalothorax 327 μm long, slightly wider than long. All prosomal somites with rounded lateral corners. Urosome (Fig. 38B) 4-segmented. Fifth pedigerous somite 114 μm wide. Genital double-somite 1.16 times longer than wide (136 × 117 μm), widest at proximal third; genital apertures positioned dorsolaterally at 40% region of double-somite length; post-genital lateral margins each bearing tuft of about 20 thin setules (Fig. 39F). Two free abdominal somites 48 × 74 and 38 × 65 μm, respectively. Anal somite bearing scattered spinules along posteroventral margin (Fig. 38C). Caudal ramus (Fig. 38C) much wider than long (21 × 30 μm), broadened distally, armed with 6 setae, and ornamented with small spinules along posteroventral margin; two medial distal setae (setae IV and V) thick, 233 and 265 μm long, respectively, other caudal setae much smaller.

Rostrum (Fig. 38D) as tapering ridge between antennules, with thin sclerotization along lateral margins. Antennule (Fig. 38E) 244 μm long, 19-segmented; 1st, 9th, and 2 terminal segments bearing 1 seta, 5 setae, 2 setae + aesthetasc, and 13 setae, respectively, all other seg-

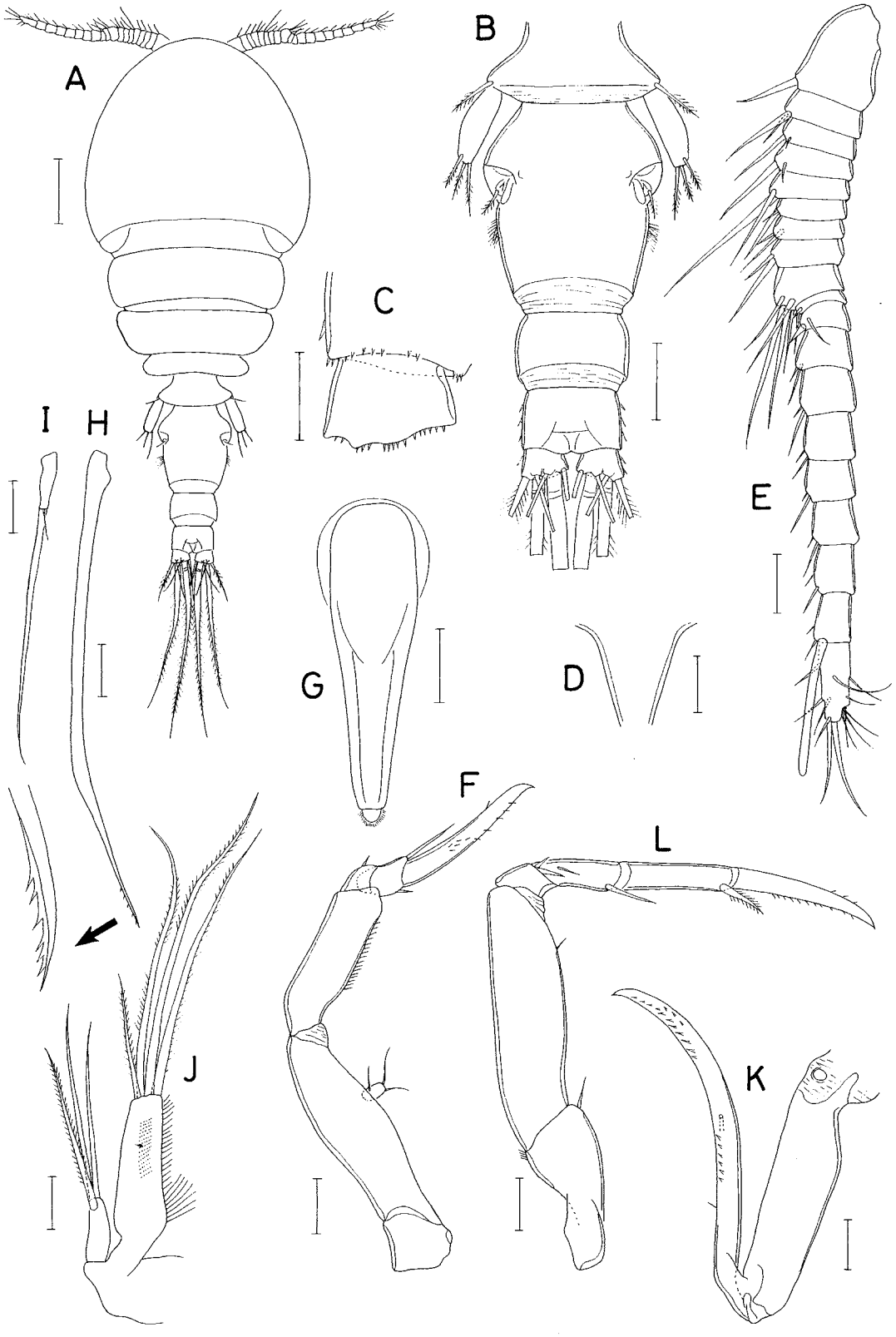

Fig. 38. *Asterocheres exilis* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, ventral; D, rostrum; E, antennule; F, antenna; G, oral siphon; H, mandibular stylet; I, mandibular palp; J, maxillule; K, maxilla; L, maxilliped. Scale bars: A, 0.1 mm; B, G, 0.05 mm; C–F, H–L, 0.02 mm.

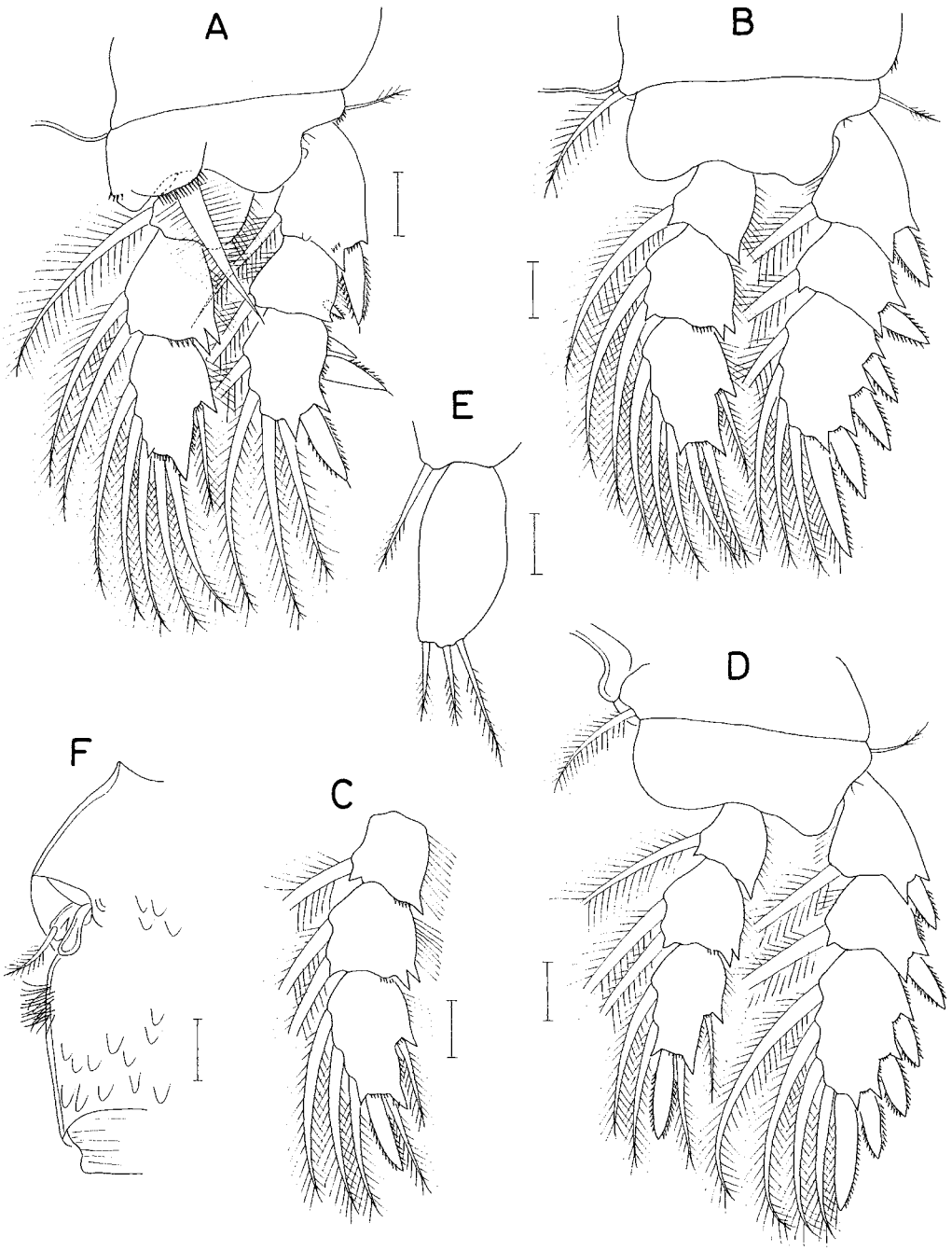

Fig. 39. *Asterocheres exilis* n. sp., female. A, leg 1; B, leg 2; C, endopod of leg 3; D, leg 4; E, leg 5; F, left side of genital double-somite, dorsal. Scale bars: 0.02 mm.

ments each with 2 setae; all setae naked, mostly small. Antenna (Fig. 38F) with short coxa; basis 77 μm long, unarmed, unornamented; exopod 9 × 4.5 μm, bearing 1 proximal and 2 distal small setae; endopodal segments with 0, 1, and 2 setae, respectively; first endopodal segment 55 μm long, with setules along outer margin; terminal claw rather thick, 56 μm long, bearing several minute, scattered spines.

Oral siphon (Fig. 38G) 209 × 60 μm, narrow, extending to proximal margin of intercoxal plate of leg 1; proximal third slightly broadened. Mandibular stylet (Fig. 38H) 188 μm long, curved and broadened at distal third, bearing row of 6 teeth at distal region; palp (Fig. 38I) small, 22 μm long, tipped with 1 rudimentary seta (13 μm long)

and 1 longer seta (104 μm long); palp plus longer distal seta (126 μm) only 0.67 times as long as stylet. Maxillule (Fig. 38J) bilobed; shorter outer lobe 25 μm long, bearing 3 setae, subdistal one of them pinnate, 64 μm long, other 2 setae naked, 77 and 70 μm long, respectively; inner lobe about 70 μm long, bearing 4 weakly pinnate setae distally, lengths of these 4 setae 110, 127, 106, and 50 μm, respectively, from inner to outer. Maxilla (Fig. 38K) 2-segmented; proximal segment bearing excretory pore proximally, unornamented; distal segment 1.35 times longer than proximal segment, slender, arched, with rows of spinules. Maxilliped (Fig. 38L) consisting of syncoxa, basis, and 3-segmented endopod; armature formula 1, 1, 2, 2, and 1 + claw; seta on basis vestigial, hardly visible; terminal segment and claw 44 and 59 μm long, respectively.

Legs 1 (Fig. 39A), 2 (Fig. 39B), 3, and 4 (Fig. 39D) biramous with 3-segmented rami. Leg 3 similar to leg 2, except bearing 1 spine and 3 setae on third endopodal segment (Fig. 39C). Inner coxal seta absent in leg 1, but well-developed and pinnate in legs 2–4. Outer seta on basis small, translucent in all swimming legs. Leg 1 basis with broad inner distal seta, few spinules at inner distal corner, and row of thin spinules on distal margin near base of inner distal seta. Third endopodal segment of leg 3 with 1 spine and 5 setae (Fig. 39C), otherwise leg 3 similar to leg 2. Most of spines on swimming legs broadened, leaf-like. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-0	1-1	I-1; I-1; III, 2, 2	0-1; 0-2; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 3
Leg 4	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 2

Leg 5 (Fig. 39E) consisting of dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment sub-fusiform, 2.03 times longer than wide (63 × 3 μm), armed with 3 pinnate setae distally; lengths of distal setae 26, 27, and 45 μm, respectively, from outer to inner; innermost seta longest. Leg 6 (Fig. 39F) represented by 1 pinnate seta and 1 small spinule on genital operculum.

Male. Unknown.

Remarks. *Asterocheres exilis* n. sp. belongs to a group of *Asterocheres* characterized by the loss of the inner coxal seta on leg 1. This group comprises four known species: *A. banderaae*, *A. eugenioi*, *A. sarsi*, and *A. trisetatus* (Bandera & Conradi, 2014; 2016; Kim & Lee, 2023). However, *A. exilis* n. sp. is readily differentiated from the four congeners by having (1) a narrow body (vs. the body is broad or moderately broad in the four congeners), (2) a genital double-somite which is distinctly longer than wide (vs. wider than long in the four congeners), and (3) 19-segmented female antennule (vs. 20- or 21-segmented in the four congeners). As additional diagnostic features of *A. exilis* n. sp., the outer lobe of the maxillule is armed with three setae only, and all the setae on the exopod of leg 5 are pinnate and its innermost seta is longer than the other two setae.

Asterocheres zodius n. sp. (Figs. 40–42)

https://zoobank.org/urn:lsid:zoobank.org:act:C4B99292-4679-4171-BE57-91F74DD9CB08

Type material. Holotype (intact ♀; HNIBRIV2390), intact paratypes (2♀♀; HNIBRIV2390), and dissected paratypes (1♀, 1♂) from washings of unidentified sponges, Munseom, Seogwipo, Jeju Island (33°13′35.5″N, 126°33′45.3″E), SCUBA diving, depth 25 m, coll. T. W. Jung, H. K. Kim and J. G. Kim, 20 July 2022. Holotype and intact paratypes have been deposited in the Honam National Institute of Biological Resources (HNIBR), Mokpo. Dissected paratypes are retained in the collection of I.-H. Kim.

Additional specimens examined. 7♀♀, 3♂♂, near Biyangdo, Jeju Island (33°24′13.2″N, 126°12′12.3″E), SCUBA diving, depth 20 m, coll. T. W. Jung, H. K. Kim and J. G. Kim, 15 July 2023

Etymology. The specific name is derived from the Greek *zodi* (= little animal), alluding to the small body of the new species.

Female. Body (Fig. 40A) small, slightly depressed dorsoventrally. Body length of dissected and figured specimen 540 μm. Prosome moderately expanded, 340 μm long. Cephalothorax wider than long (218 × 290 μm), distinctly wider than succeeding pedigerous somites. All prosomal somite with rounded lateral corners. Urosome (Fig. 40B) 4-segmented. Fifth pedigerous somite 99 μm wide, distinctly wider than genital double-somite, with few spinules on lateral apical region. Genital double-somite as long as wide (80 × 80 μm), subquadrate, with rounded anterolateral corners, angularly produced posterolateral corners, and almost parallel lateral margins; genital apertures positioned dorsally at 40% region of double-somite length. Two free abdominal somites 32 × 54 and 27 × 43 μm, respectively. First free abdominal somite with convex lateral margins. Anal somite with few spinules on posteroventral margin (Fig. 40D). Caudal ramus (Fig. 40C, D) 1.33 times longer than wide (24 × 18 μm), with convex inner and straight outer margins, distally ornamented with 6 dentiform processes (2 inner ones of them serrate at tip), and armed with 6 short, naked setae (2 dorsal and 4 distal); setae I and V longest but less than twice as long as caudal ramus, other 4 setae shorter than caudal ramus.

Rostrum absent. Antennule (Fig. 40E) 19-segmented, about 195 μm long; 1st, 9th, penultimate, and terminal segments with 1 seta, 5 setae, 2 setae + aesthetasc, and

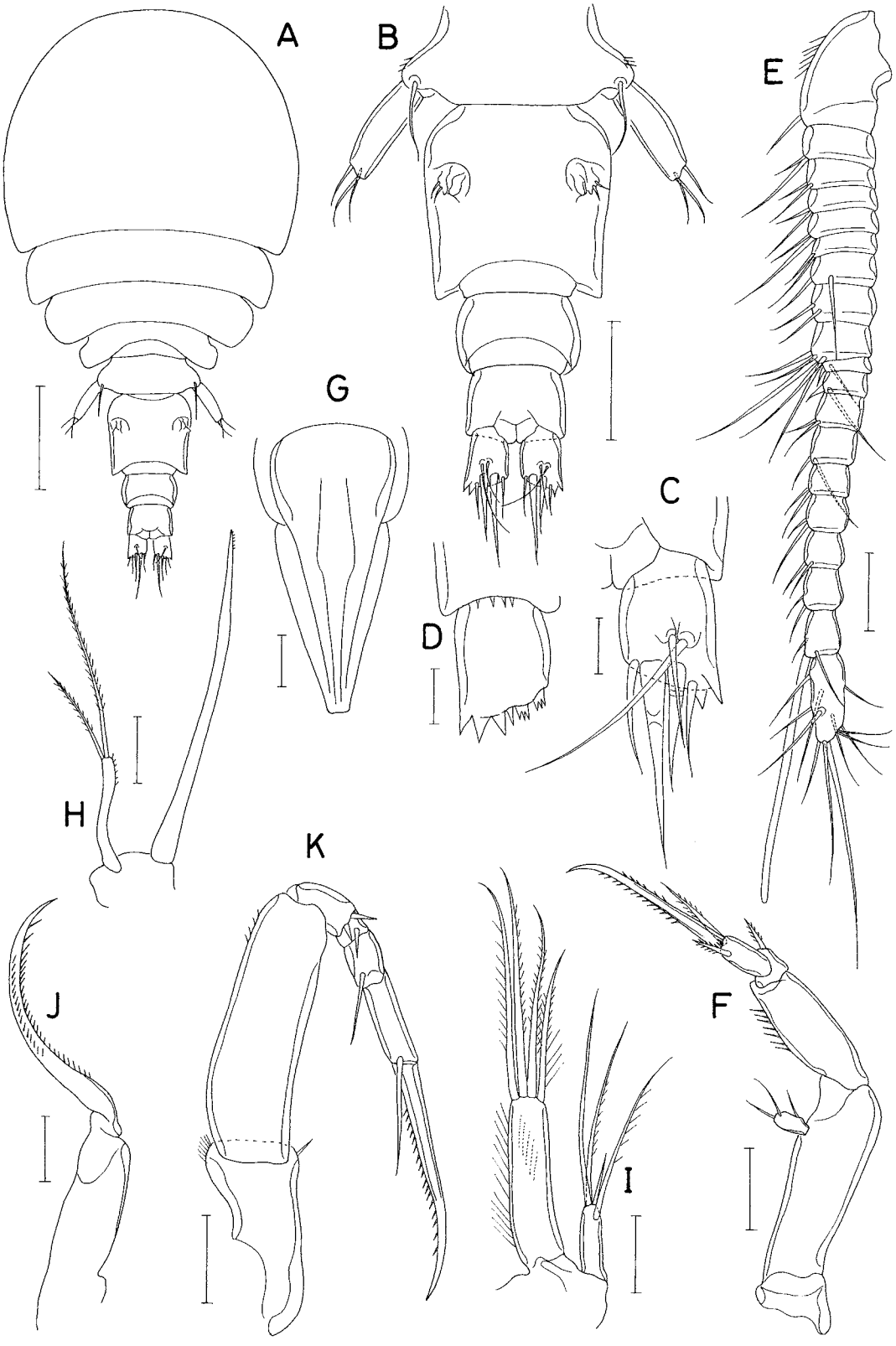

Fig. 40. *Asterocheres zodius* n. sp., female. A, habitus, dorsal; B, urosome, dorsal; C, right caudal ramus, dorsal; D, right caudal ramus, ventral; E, antennule; F, antenna; G, oral siphon; H, mandible; I, maxillule; J, maxilla; K, maxilliped. Scale bars: A, 0.1 mm; B, 0.05 mm; C, D, 0.01 mm; E–K, 0.02 mm.

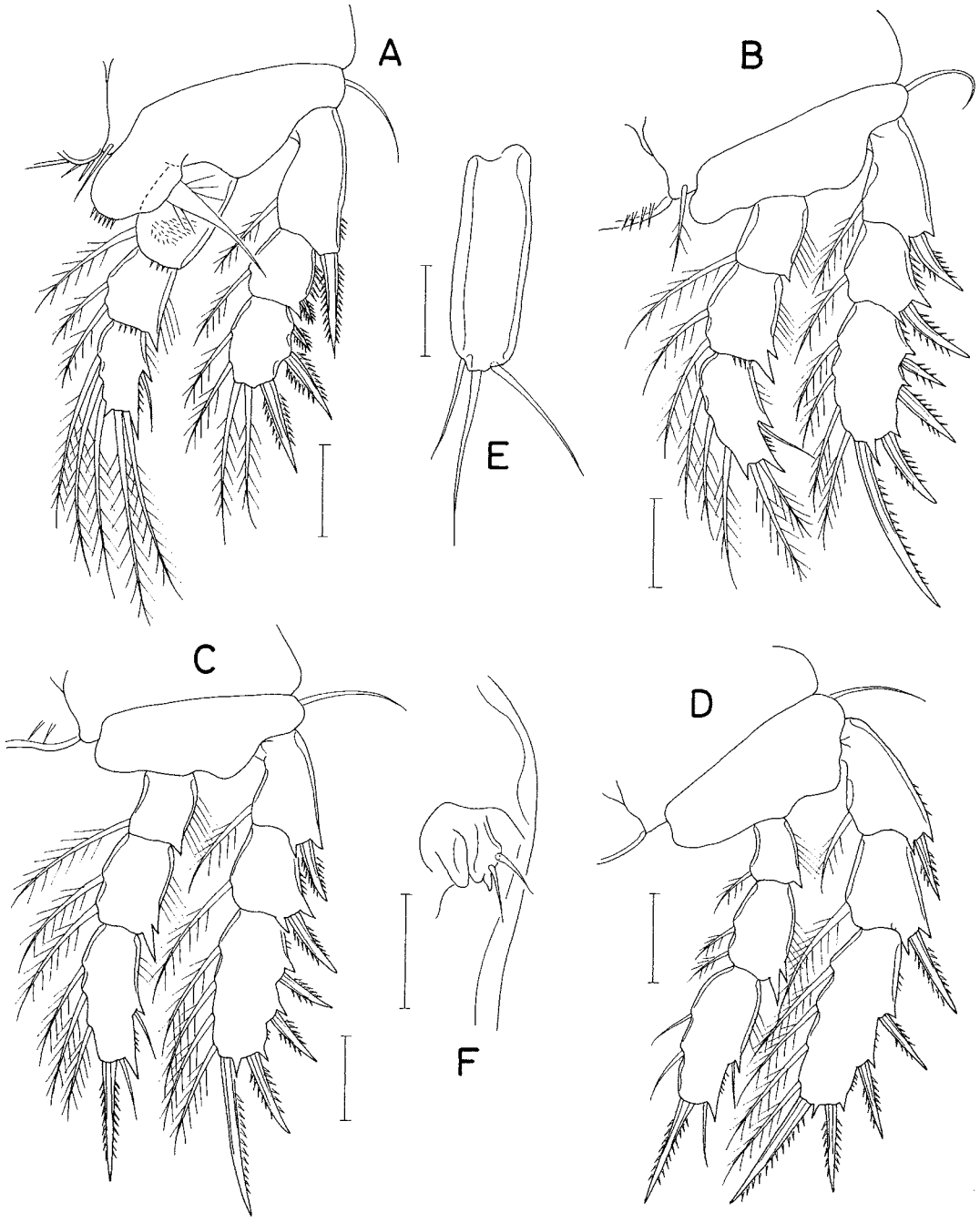

Fig. 41. *Asterocheres zodius* n. sp., female. A, leg 1; B, leg 2; C, leg 3; D, leg 4; E, exopod of leg 5; F, right genital aperture. Scale bars: 0.02 mm.

11 setae, respectively. Antenna (Fig. 40F) with unornamented coxa and basis; exopod 8 × 4 μm, with 3 setae; first endopodal segment 30 μm long, with spinules on outer margin; small second endopodal segment tipped with 1 seta; third endopodal segment with 2 setae; terminal claw spiniform, 42 μm long, 1.4 times longer than first endopodal segment, with spinules along both margins.

Oral siphon (Fig. 40G) 114 μm long, rather stout, evenly tapering, reaching insertion of maxilliped, with truncate distal tip. Mandible (Fig. 40H) with stylet of 106 μm long; palp 1-segmented, slender, 36 μm long, tipped with 2 weakly pinnate setae (longer seta 69 μm long and shorter one 36 μm long); palp plus longer distal seta 105 μm

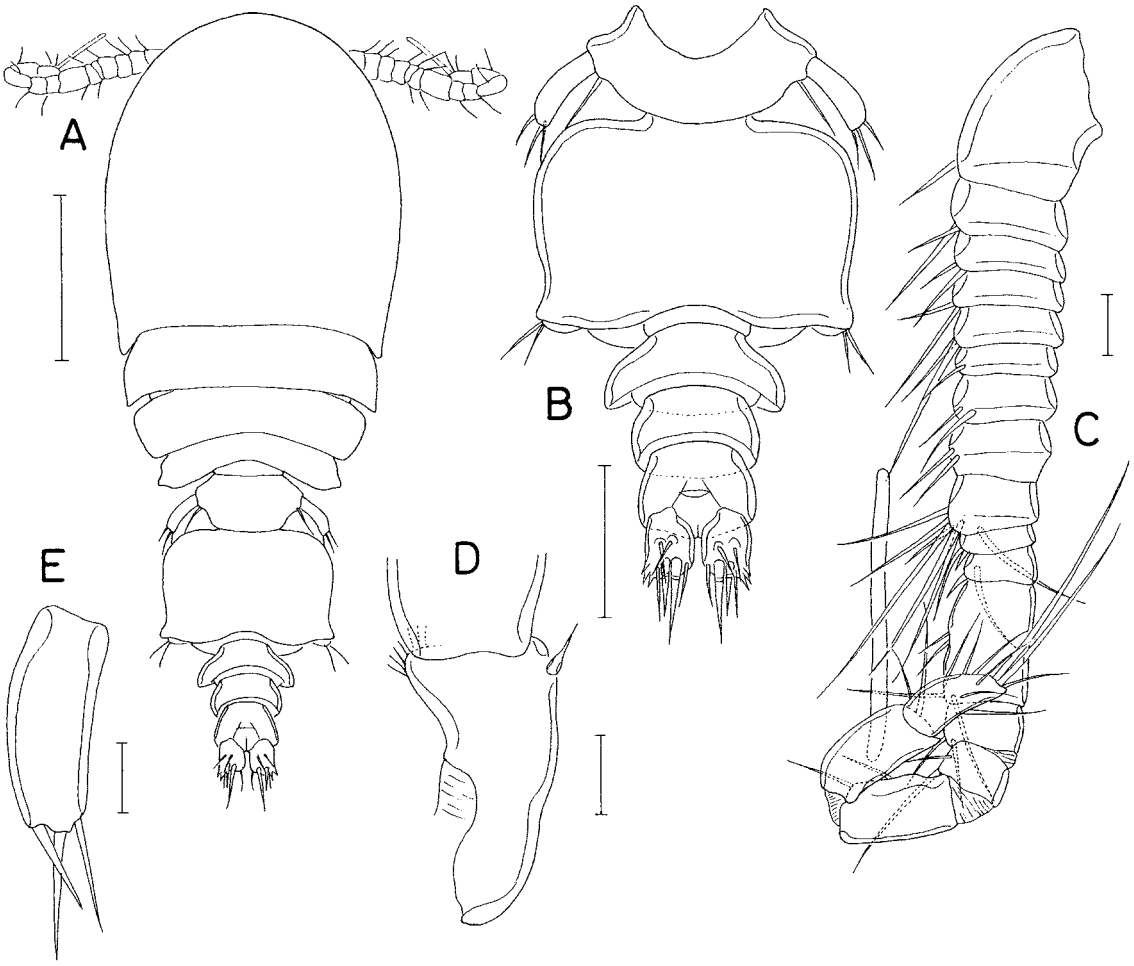

Fig. 42. *Asterocheres zodius* n. sp., male. A, habitus, dorsal; B, urosome, dorsal; C, antennule; D, syncoxa of maxilliped; E, exopod of leg 5. Scale bars: A, 0.1 mm; B, 0.05 mm; C–E, 0.01 mm.

long, as long as stylet. Maxillule (Fig. 40I) bilobed; inner lobe 45 μm long, tipped with 4 setae, longest one of them 60 μm long; outer lobe 19 μm long, tipped with 3 longer (longest one 57 μm long) and 1 short setae. Maxilla (Fig. 40J) 2-segmented; proximal segment unornamented; distal segment claw-like, arched, distinctly longer than proximal segment, spinulose along entire length. Maxilliped (Fig. 40K) 6-segmented, with armature formula 1, 0, 2, 1, 1, and 1 + claw; terminal segment 21 μm long; claw elongate, spinulose along inner margin, 55 μm long, 2.6 times longer than terminal segment.

Legs 1–4 (Fig. 41A–D) with 3-segmented rami; setae on rami, especially those on endopod of leg 4, small. Intercoxal plate of legs 1–3 with few spinules, that of leg 4 smooth. Inner coxal setae present in legs 1 and 2, but absent in legs 3 and 4. Outer seta on basis naked, equal in length in all swimming legs. Basis of leg 1 with spinules on inner distal corner; its inner distal seta proximally broadened, with few setules. Second endopodal segment with unicuspid outer distal corner in leg 1, but with bicuspid corner in legs 2–4. Armature formula for legs 1–4 as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III, 2, 2	0-1; 0-2; 1, 2, 3
Leg 2	0-1	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 2, 3
Leg 3	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 3
Leg 4	0-0	1-0	I-1; I-1; III, I, 4	0-1; 0-2; 1, 1 + I, 2

Leg 5 (Fig. 40B) consisting of 1 naked dorsolateral seta on fifth pedigerous somite and free exopod; exopodal segment (Fig. 41E) nearly rectangular, 3.27 times longer than wide (49 × 15 μm), unornamented, but armed distally with 3 naked setae; lengths of these setae 31, 37, and 23 μm, respectively, from outer to inner. Leg 6 (Fig. 41F) represented by 2 naked setae and 1 small process on genital operculum.

Male. Body (Fig. 42A) narrower than that of female.

Body length 464 μm. Prosome 282 μm long. Cephalothorax longer than wide (193 × 180 μm), with sub-parallel lateral margin. Second pedigerous somite with angular posterolateral corners. Fourth pedigerous somite with nipple-shaped lateral apices. Urosome (Fig. 42B) 5-segmented. Fifth pedigerous somite 75 μm wide. Genital somite large, rectangular, wider than long (75 × 105 μm). Three abdominal somites 22 × 59, 18 × 43, and 24 × 39 μm, respectively. First abdominal somite characteristically broadened in posterior region. Caudal ramus 1.18 times longer than wide (20 × 17 μm), armed and ornamented as in female.

Rostrum absent. Antennule (Fig. 42C) 17-segmented, geniculate between 14th and 15th segments and between 15th and 16th segments; armature formula 1, 2, 2, 2, 2, 1, 2, 2, 7, 2, 2, 4, 2, 2, 2, 1 + aesthetasc, and 10; all setae naked. Antenna as in female.

Mouthparts, except maxilliped, as in female. Inner distal seta on first segment (sncoxa) of maxilliped proximally expanded (Fig. 42D).

Legs 1–4 as in female. Exopodal segment of leg 5 (Fig. 42E) 2.83 times longer than wide (34 × 12 μm), with convex outer margin, straight inner margin, armed distally with 3 naked setae. Leg 6 (Fig. 42B) represented by 2 small setae on posterolateral corner of genital somite.

Remarks. In *Asterocheres*, the inner coxal seta is often absent in leg 4. However, the absence of the same seta in leg 3 has not been reported in this genus, thus the latter feature of *A. zodius* n. sp. is unique within the genus, which allows to differentiate the new species from all its congeners. As additional diagnostic features of the new species, the genital double-somite of the female and the genital somite of the male are quadrangular, and the caudal setae are short and naked. These features may clearly characterize the new species.

Key to species of *Asterocheres* of Korean waters (based on females)

1. Caudal ramus twice longer than wide; mandibular palp about 1.9 times longer than mandibular stylet ····· *A. lilljebogi* Boeck, 1859
– Caudal ramus distinctly less than twice as long as wide; mandibular palp at most 1.5 times longer than mandibular stylet ····· 2
2. Caudal ramus 1.3 to 1.6 times longer than wide ····· 3
– Caudal ramus distinctly less than 1.3 times as long as wide ····· 5
3. Antennule 19-segmented; leg 3 lacking inner coxal seta ····· *A. zodius* n. sp.
– Antennule 21-segmented; leg 3 with inner coxal seta ····· 4
4. Mandibular palp 2-segmented; oral siphon reaching insertion of leg 1; exopodal segment of fifth leg about 3 times longer than wide ····· *A. culicis* n. sp.
– Mandibular palp 1-segmented; oral siphon reaching insertion of maxilliped; exopodal segment of fifth leg 1.85 times longer than wide ····· *A. spiniventer* n. sp.
5. Oral siphon flexible, extending over leg 4 ····· *A. siphonatus* Giesbrecht, 1897
– Oral siphon straight, not flexible, extending before leg 2 ····· 6
6. Antennule 19-segmented, with aesthetasc on second segment from the distal ····· *A. exilis* n. sp.
– Antennule 20- or 21-segmented, with aesthetasc on third or fourth segment from the distal ····· 7
7. Leg 1 lacking inner coxal seta ····· 8
– Leg 1 bearing inner coxal seta ····· 9
8. Third endopodal segment of leg 1 bearing elongated distal process; mandibular palp plus longer distal seta shorter than stylet ····· *A. processus* n. sp.
– Third endopodal segment of leg 1 lacking elongated distal process; mandibular palp plus longer distal seta as long as stylet ····· *A. banderaae* Kim I.H. & Lee T., 2023
9. Caudal ramus with 6 setae and 1 large, attenuated aesthetasc; mandibular palp plus longer distal seta distinctly shorter than stylet; exopodal segment of female leg 5 about 4.5 times longer than wide ····· *A. quadridens* Kim, 2016
– Caudal ramus with 6 setae only; mandibular palp plus longer distal seta longer or as long as stylet; exopodal segment of female leg 5 less than 4 times as long as wide ····· 10
10. Antennule 20-segmented, with aesthetasc on third segment from the distal ····· 11
– Antennule 21-segmented, with aesthetasc on fourth segment from the distal ····· 15
11. Mandibular palp 2-segmented ····· 12
– Mandibular palp 1-segmented ····· 13
12. Postgenital lateral margin of genital double-somite with about 15 setules; mandibular stylet with 8 teeth at distal region ····· *A. cuspis* Kim, 2016
– Postgenital lateral margin of genital double-somite with 4–7 setules; mandibular stylet with 3 teeth at distal region ····· *A. tridentatus* n. sp.
13. Leg 4 lacking inner coxal seta; genital double-somite distinctly longer than wide, with 12 spinules on postgenital lateral margin ····· *A. eurychelatus* n. sp.
– Leg 4 with small inner coxal seta; genital double-somite shorter than or as long as wide, with 6–9 spinules on postgenital lateral margin ····· 14
14. Terminal claw of antenna slightly longer than first endopodal segment; mandibular stylet with 6 teeth at distal region; all setae on female leg 5 naked ····· *A. scutellatus* n. sp.
– Terminal claw of antenna shorter than first endopodal segment; mandibular stylet with 6 teeth at distal region; outer and middle setae on exopod of female

leg 5 pinnate ····· *A. tetraodontis* n. sp.
15. Mandibular palp 1-segmented ····· 16
– Mandibular palp 2-segmented ····· 18
16. Terminal claw of antenna about 1.3 times longer than first endopodal segment; postgenital lateral margin of genital double-somite with about 25 setules ····· *A. fici* n. sp.
– Terminal claw of antenna slightly longer or shorter than first endopodal segment; postgenital lateral margin of genital double-somite with less than 20 setules ····· 17
17. Fourth pedigerous somite (fourth prosomal somite) with serrate lateral margins; outer and middle setae on exopod of leg 5 more than 1.5 times as long as exopodal segment ····· *A. serratus* n. sp.
– Fourth pedigerous somite with smooth lateral margins; outer and middle setae on exopod of leg 5 less than 1.3 times as long as exopodal segment ····· *A. nodulosus* n. sp.
18. Caudal ramus 1.15 times longer than wide; oral siphon extending to insertion of leg 1; 3 inner distal setae on inner lobe of maxillule more than twice as long as inner lobe; exopodal segment of leg 5 covered with spinules all over ····· *A. horridus* Kim, 2016
– Caudal ramus shorter than or as long as wide; oral siphon extending before insertion of leg 1; 3 inner distal seta on inner lobe of maxillule less than twice as long as inner lobe; exopodal segment of leg 5 with spinules only on inner and outer margins ····· 19
19. Postgenital lateral margin of genital double-somite with about 30 setules; middle seta on exopod of leg 5 longer than other 2 setae ····· *A. simulans* (Scott T., 1898)
– Postgenital lateral margin of genital double-somite with at most 20 setules; middle seta on exopod of leg 5 shorter or as long as outer seta ····· 20
20. Terminal claw of antenna 1.6 times longer than first endopodal segment ····· *A. dokdoicus* n. sp.
– Terminal claw of antenna at most 1.1 times longer than first endopodal segment ····· 21
21. Mandibular palp about 1.4 times longer than stylet; outer seta on exopod of leg 5 longer than middle seta; postgenital lateral margin of genital double-somite with 12 thin, longer anterior spinules and 4 or 5 thicker but shorter spinules ····· *A. aesthetes* Ho, 1984
– Mandibular palp as long as stylet; outer seta on exopod of leg 5 as long as middle seta; postgenital lateral margin of genital double-somite with about 20 equally thin spinules ····· *A. geminus* n. sp.

Conflicts of Interest

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

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