Two Newly Recorded Species of the Genus Aoroides (Crustacea: Amphipoda: Aoridae) from Korea

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ABSTRACT

Two aorid amphipods, Aoroides ellipticus Ariyama, 2004 and A. semicurvatus Ariyama, 2004 from shallow waters of South Korea are reported here. Aoroides ellipticus has the characteristic setation of gnathopod 1 and the elliptical shape of basis on pereopod 7, while A. semicurvatus can be easily distinguished from congeners by combined characters of the curved propodus on gnathopod 2 and the absence of marginal spines on outer ramus of uropod 3 in mature males. This paper redescribed these two aorids and provided a key to Korean Aoroides species.

Keywords: Aoroides ellipticus, Aoroides semicurvatus, taxonomy, amphipods, Korea

INTRODUCTION

The family Aoridae Stebbing, 1899 is a large group of gammaridean amphipods containing more than 249 species belonging to 25 genera (Conlan and Bousfield, 1982; Barnard and Karaman, 1991; WoRMS, 2016). They are distributed worldwide with great diversities in tropical and warm-temperate regions, especially coral reefs, of the northern hemisphere (Myers, 1981, 2009; Conlan and Bousfield, 1982). Most of them inhabit shallow marine and brackish waters and rarely occur in intertidal or abyssal zone (Conlan and Bousfield, 1982; Myers, 2009). They have great influence on shallow benthic communities as tube-building species, but little is known about their ecology except that they appear to be suspension and selective deposit feeders (Myers, 1981, 2009; Conlan and Bousfield, 1982).

The genus Aoroides Walker, 1898 contains 18 valid species, and they have been recorded in the coastal regions of North Pacific, Hawaii, and Indonesia (Walker, 1898; Gurjanova, 1938; Barnard, 1970; Conlan and Bousfield, 1982; Myers, 1995, 2009; Ren and Zheng, 1996; Ariyama, 2004). In Japanese waters, the following nine species in this genus have been reported so far (Ariyama, 2004): A. columnaris Ariyama, 2004, A. curvipes Ariyama, 2004, A. ellipticus Ariyama, 2004, A. myojinensis Ariyama, 2004, A. punctatus Ariyama, 2004, A. rubellus Ariyama, 2004, A. semicurvatus Ariyama, 2004, A. longimerus Ren and Zheng, 1996, and A. secundus Gurjanova, 1938. In Chinese waters, two species, A. columbiæ Walker, 1898 and A. longimerus (Ren, 2006), have been recorded (Ren, 2006). In Korean waters, only one species, Aoroides columbiæ has been reported by Kim and Kim (1987) and Kim and Kim (1991). In Korean amphipod fauna, the taxonomic status of A. columbiæ sensus Kim and Kim (1987) is very confusing, because only one figure and a brief diagnosis are included in its redescriptions (Kim and Kim, 1987). In addition, its validity was based on the reports of Nagata (1960) and Hirayama (1984). However, Ariyama (2004) noted that A. columbiæ sensus Nagata, 1960 and sensus Hirayama, 1984 (not Walker, 1898) turned out to be new species of A. columnaris and A. curvipes, respectively. Ariyama (2004) also revised the Korean A. columbiæ redescribed by Kim and Kim (1987) as a new species of A. punctatus. Therefore, it is necessary to determine the taxonomic inquiry into the Korean species belonging to the genus Aoroides. Here, we report two newly recorded Aoroides species, A. ellipticus Ariyama, 2004 and A. semicurvatus Ariyama, 2004, in Korean waters with detailed descriptions and illustrations, and provided a key to Korean Aoroides species.
**Materials and Methods**

Materials examined in this study were collected from the intertidal zone by washing algae using a sieve and the sub-intertidal zone through SCUBA diving. Specimens were initially fixed with 5% formaldehyde-seawater solution and preserved with 85% ethyl alcohol after sorting in the laboratory. Before identification, they were stained with lignin pink dyes. Their appendages were dissected in a petri dish or a hole slide glass filled with glycerol using a dissection pincer and a needle under a stereomicroscope (SZH10; Olympus, Tokyo, Japan). They were mounted as temporary or permanent slides using polyvinyl lactophenol solution. Drawings were performed under a light microscope (LABOPHOT-2; Nikon, Tokyo, Japan) using a drawing tube.

**Systematic Accounts**

Order Amphipoda Latreille, 1816  
Suborder Senticaudata Lowry and Myers, 2013  
Family Aoridae Stebbing, 1899  
Genus Aoroides Walker, 1898

*Aoroides ellipticus* Ariyama, 2004 (Figs. 1–3)  
*Aoroides ellipticus* Ariyama, 2004: 16, figs. 11–15.

**Material examined.** 2♂♂♂♂: Korea: Gyeongsangnam-do, Namhae-gun, Samdong-myeon, Mulgeon-ri, 21 Mar 2009, by SCUBA diving (about 6 m depth), Jung TW, cat No. NIBRIV0000332001.

**Description. Male.** Body about 3.1 mm long in dissected specimen. Pleonal epimera 1–2, posteroventral corners acute and forming small notches bearing minute seta; epimeron 3 expanded backward, posteroventral corner not acute with small notch bearing minute seta (Fig. 1C).

Head (Fig. 1A), rostrum minute; lateral cephalic lobe developed with rounded apex; antennal sinus weak; eyes large, boundary indistinct, composed of 30 separated ommatidia.

Antenna 1 (Fig. 1A), length ratio of peduncular articles 1–3 1.00 : 1.27 : 0.53; peduncular article 1 stout, posterior margin with 2 stout spines; peduncular articles 2–3 slender; flagellum 11-articulate, each article with distal setae; distal article very reduced.

Antenna 2 (Fig. 1A, B), peduncular article 4 1.23 times as long as article 5; flagellum 3-articulate, article 1 longest, 0.33 times as long as peduncular article 5, articles 2–3 with pair of stout spines distally.

Upper lip (Fig. 1D) subovoid, apical margin round and weakly pubescent.

Lower lip (Fig. 1E), inner plate ovoid, weakly pubescent mediiodistally; outer plate expanded, mediiodistal margin round and pubescent; mandibular process developed.

Right mandible (Fig. 1F, G) with 6-dentate incisor and tricuspidate lacinia mobilis; accessory setal row composed of 2 pectinate setae; molar triturative with plumose seta; palp slender, 3-articulate, article 1 shortest, article 3 1.87 times as long as article 2 with 2 setae medially, apex with pair of long setae.

Maxilla 1 (Fig. 1H), inner plate indistinct with long plumose seta; outer plate, apical margin oblique with 9 dentate spines; palp bi-articulate, article 2 swollen distally, apex round and weakly serrate, with 7 stout spines, surface with oblique row of 5 setae.

Maxilla 2 (Fig. 1I), inner plate slender, slightly diminished distally, apex and medial margin setose, with oblique row of pectinate setae on surface; outer plate large, broad, apex round with numerous apical and subapical setae.

Maxilliped (Fig. 1J), inner plate rectangular, medial margin with 5 plumose setae submarginally, apex with 1 plumose, 4 simple setae and 2 stout spines; outer plate semi-ovoid, apex reaching end of palp article 2, medial margin straight with 9 stout spines gradually increasing distally and 2 elongate setae apically; palp stout, 4-articulate, article 1 produced distally, medial margin of article 2 expanded and lined with 16 setae, medial margin of article 3 convex and laterodistal corner with acute protrusion covered with minute setae, article 4 falcate, medial margin and surface pubescent, distal spine stout.

Gnathopod 1 (Fig. 2A) merochelate, massive, greatly larger than gnathopod 2; coxa enlarged, produced forward, anteroventral corner with elongate spine; basis 1.78 times as long as coxa, drastically expanded distally, anterior margin straight and that of distal half lined with plumose setae submarginally, anterior lobe weak, distal 2/3 of posterior margin convex and lined with plumose setae submarginally, lateral surface with horizontal and vertical rows of plumose setae distally; ischium, anterior lobe weak; merus stout, elongate, as long as carpus, apex blunt and not reaching distal end of carpus, medial and lateral surfaces near posterior margin with numerous plumose setae; carpus also stout, 0.75 times as long as basis, anterior margin swollen and medial surface with 3 rows of setae proximally, posterior margin lined with numerous plumose setae; propodus 0.65 times as long as carpus, anterior margin convex and distal corner with pair of setae, medial surface with 6 sets of setae, posterior margin and medial surface with several sets of plumose setae; dactylus falcate, 0.79 times as long as propodus, inner margin...
Fig. 1. *Aoroides ellipticus* Ariyama, male. A, Head, antenna 1 and 2; B, Flagellum of antenna 2; C, Pleonal epimera; D, Upper lip; E, Lower lip; F, Right mandible; G, Palp of mandible; H, Maxilla 1; I, Maxilla 2; J, Maxilliped. Scale bars = 0.25 mm (A, C), 0.05 mm (B, D-J).
Fig. 2. *Aoroides ellipticus* Ariyama, male. A, Gnathopod 1; B, Gnathopod 2; C, Pereopod 3; D, Pereopod 4. Scale bar = 0.25 mm (A–D).
with plumose setae.

Gnathopod 2 (Fig. 2B) moderate, subchelate; coxa quadrate, ventral margin round and lined with 3 setae; basis, anterior margin slightly concave with 5 plumose and numerous simple setae, posterior margin convex with 4 setae and distal corner with pair of setae; ischium with anterior lobe, posterodistal corner with set of 3 setae; merus subrectangular, anterodistal corner produced, posterodistal margin with setae; carpus 0.68 times as long as basis, anterior margin convex with 3 setae and distal corner with set of 3 setae, medial surface with long setae, posterior margin slightly expanded and forming weak angle, lined with numerous setae; propodus subovoid, anterior margin convex with 3 sets of setae medially and distal corner with set of 3 long setae, posterior margin lined with several sets of setae, palm oblique with defining spine; dactylus falcate, long, 0.71 times as long as propodus, inner margin lined with 3 teeth distally.

Pereopod 3 (Fig. 2C), coxa subquadrate, ventral margin lined with 5 setae; basis similar to that of gnathopod 2, as long as combined length of ischium to carpus, anterior margin almost straight with numerous setae, posterior margin convex with 5 setae and distal corner with pair of setae; ischium with anterior lobe, posterodistal corner with pair of setae; merus subrectangular, slightly expanded distally, anterior margin with 3 setae and distal corner with set of 3 setae, posterior margin with pair of setae and distal corner with set of 4 setae; carpus rectangular, 1.23 times as long as basis, anterior margin convex with 3 setae and distal corner with set of 4 setae; merus subrectangular, slightly expanded distally with seta and distal corner with pair of setae, posterior margin slightly expanded distally with seta and distal corner with set of 4 setae, palm oblique with defining spine; dactylus falcate, 0.23 times as long as propodus.

Pereopod 6 (Fig. 3B), coxa bilobate, smaller than that of pereopod 5, anterior lobe expanded downward and round ventrally with 2 minute setae, posterior lobe expanded backward; basis broad, anterior margin convex with 4 spines and distal corner with pair of setae, posterior margin more expanded proximally with 6 setae and distal corner with blunt protrusion bearing 2 stout spines; ischium with posterior lobe, anterodistal corner with pair of setae; merus rectangular, 0.58 times as long as basis, anterior margin with 2 setae and distal corner with pair of setae, posterior margin slightly expanded distally with seta and distal corner with seta; carpus rectangular, 0.70 of than merus, anterodistal corner with set of 3 setae, posterodistal corner with set of 2 setae and 3 stout spines; propodus 0.83 times as long as basis, anterior margin with 3 spines and distal corner with pair of setae, posterior margin with 2 sets of setae and distal corner with pair of setae; dactylus falcate, 0.23 times as long as propodus.

Pereopod 7 (Fig. 3C) slender, longer than pereopod 6; basis elliptical, anterior margin convex with 3 spines and distal corner with pair of spine and seta, posterior margin expanded and slightly dilated distally with 7 setae, posteroproximal corner weakly produced upward, posterodistal corner with stout spine; ischium, posterior lobe weak, anterodistal corner with seta; merus as long as basis, anterior margin with minute seta and distal corner with pair of elongate setae, posterior margin slightly expanded distally with 2 spines and distal corner with pair of spines; carpus 0.85 times as long as merus, anterior margin with pair of setae and distal corner with pair of spines, posterodistal corner with pair of spines; propodus as long as ischium and merus combined length, anterior margin with 3 pairs of setae and distal corner with set of 5 setae, posterior margin with 3 spines and pair of locking spines; dactylus falcate, 0.41 times as long as propodus.

Uropod 1 (Fig. 3D), peduncle rectangular, 0.80 times as long as outer ramus, with 2 dorsomedial and 3 dorsolateral spines, well developed inter-ramal process as long as half of peduncle; rami slender, inner ramus slightly longer than outer ramus, with 3 dorsolateral and 4 apical spines; outer ramus with 2 dorsomedial, 2 dorsolateral and 4 apical spines.

Uropod 2 (Fig. 3E), peduncle subrectangular, 0.71 times as long as that of uropod 1, with 1 dorsomedial and 1 dorsolateral spine distally; inner ramus 1.22 times as long as outer ramus, with 3 dorsomedial and 4 apical spines; outer ramus with 1 dorsomedial, 2 dorsolateral and 4 apical spines.

Uropod 3 (Fig. 3F, G) as long as peduncle of uropod 1; peduncle short, dorsodistal margin with pair of spines; rami longer than peduncle, inner ramus slightly longer than outer ramus, with 2 dorsomedial spines, apex with long seta subapically; outer ramus bi-articulate, proximal article bare or with spine dorsomedially and pair of setae mediadistally, distal article short and reduced with 2 setae apically.
Fig. 3. *Aoroides ellipticus* Ariyama, male. A, Pereopod 5; B, Pereopod 6; C, Preopod 7; D, Uropod 1; E, Uropod 2; F, Uropod 3 and telson, dorsal; G, Uropod 3 and telson, lateral. Scale bars = 0.25 mm (A–C), 0.1 mm (D–G).
Telson (Fig. 3F, G) ovoid in dorsal view, dorsal surface with 2 pairs of setae, lateral corners slightly angulate with small seta and protrusion.

**Female:** Unknown.

**Remarks.** Up to date, 18 valid species are known worldwide of the genus *Aoroides*, and the following five *Aoroides* species have plumosely setose gnathopod 1: *A. ellipticus* Ariyama, 2004, *A. longimerus* Ren and Zheng, 1996, *A. miojensis* Ariyama, 2004, *A. rubellus* Ariyama, 2004, and *A. secundus* Gurjanova, 1938 (Walker, 1898; Gurjanova, 1938; Barnard, 1970; Conlan and Bousfield, 1982; Myers, 1995, 2009; Ren and Zheng, 1996; Ariyama, 2004). Of the five, *A. ellipticus* can be clearly distinguished from the others by its poorly setose anterior margin of the carpus on gnathopod 1 in mature male and the elliptical shape of the basis on pereopod 7 (Ariyama, 2004). The Korean specimens examined in this study have these characteristic features, supporting the findings of Ariyama (2004). They can be readily assigned as *A. ellipticus*. However, the following minor differences are found between our Korean materials and the original description by Ariyama (2004): 1) antenna 1, the length ratio of peduncular articles 1–3 is 1.00 : 1.27 : 0.53 in the Korean specimens (vs. 1.0 : 1.5 : 0.6 in the Japanese original description); 2) antenna 1, the posterior margin of peduncular article 3 has two stout spines in the Korean specimens (vs. three spines in the Japanese original description); 3) antenna 2, each article 2–3 of flagellum has a pair of distal spines in the Korean specimens, but that of article 2 is absent in the Japanese original description; 4) mandibular palp, the article 3 has two marginal and one pair of apical setae in the Korean specimens (vs. two marginal and one apical setae in the Japanese original description); 5) maxilla 1, the palp article 2 has seven spines apically in the Korean specimens (vs. six in the Japanese original description); 6) maxilliped, the inner margin of outer plate has a row of nine spines in the Korean specimens (vs. six spines in the Japanese original description); 7) gnathopod 1, the setation degree of anterior margin on basis in the Korean specimens is weaker compared to that of Japanese original description; 8) gnathopod 1, the medial setae on anterior surface of carpus in Korean specimen are not plumose; and 9) uropods, the number of spines of peduncles and rami is various between the Korean specimens and the Japanese original description (Ariyama, 2004). However, the real meanings of these minor differences mentioned above need to be further studied.

**Habitat.** Ariyama (2004) mentioned that the Japanese materials of *A. ellipticus* were usually collected from sandy mud bottoms of subtidal zone (3–9 m depth). In the present study, the Korean materials were also collected from sandy mud bottoms of the subtidal zone (10–13 m depth).

**Distribution.** Korea (Korea Straits), Japan (Osaka Bay).

16 *Aoroides semicurvatus* Ariyama, 2004 (Figs. 4–7)

**Material examined.** 1♂ 1♀, Korea: Jeollabuk-do, Buan-gun, Byeonsan-myeon, Docheong-ri, Mohang Beach, 25 Nov 2009, from intertidal zone by washing algae using a sieve, Jung TW, cat No. NIBRIV0000332002.

**Description. Male:** Body 3.7 mm long in dissected specimen. Pleonal epimera 1–3, each posteroventral corner acute with minute seta (Fig. 4A).

Head (Fig. 4A, B) equal to combined length of pereonites 1–2; rostrum minute; lateral cephalic lobe, apex slightly dilated ventrally, apex round; antennal sinus developed; eyes oval.

Antenna 1 (Fig. 4A), length ratio of peduncular articles 1–3 1.00 : 1.03 : 0.34; article 1 stout, posterior margin with 4 stout setae; articles 2–3 slender; flagellum, articles with distal setae.

Antenna 2 (Fig. 4A, C), peduncular article 4 subequal to article 5; flagellum 3-articulate; article 1 longest, 0.32 times as long as peduncular article 5; articles 2–3 with pair of stout spines distally.

Upper lip (Fig. 4D) subovoid, apical margin round and weakly pubescent.

Lower lip (Fig. 4E), inner plate ovoid, weakly pubescent mediodistally; outer plate expanded, mediodistal margin round and pubescent; mandibular process developed.

Right mandible (Fig. 4H) with 5 and 1/2-dentate incisor and tricuspidate lacinia mobilis; accessory setal row composed of 2 pectinate setae; molar triturative with plumose seta; palp slender, 3-articulate; article 1 shortest, article 3 1.64 times as long as article 2, apex with 2 long pectinate setae.

Left mandible (Fig. 4I) with 5-dentate incisor and 4-dentate lacinia mobilis, accessory setal row composed of 3 pectinate setae; molar triturative with plumose seta; palp, article 2 with seta distally; article 3 with 3 long pectinate setae apically.

Maxilla 1 (Fig. 4F), inner plate small, with subapical seta; outer plate, apical margin oblique with 9 dentate spines; palp bi-articulate, article 2 swollen distally, apex round and weakly serrate, with 1 moderate and 7 dentate spines, surface with oblique row of 4 setae.

Maxilla 2 (Fig. 4G), inner plate slender, slightly diminished distally, apex and medial margin setose, with oblique row of short setae on surface; outer plate large, broad, apex round with numerous apical and subapical setae.

Original name: "힌다리밥 ------> (신칭)"
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Fig. 4. Aoroides semicurvatus Ariyama, male. A, Habitus, lateral; B, Head; C, Flagellum of antenna 2; D, Upper lip; E, Lower lip; F, Maxilla 1; G, Maxilla 2; H, Right mandible; I, Left mandible; J, Maxilliped. Scale bars = 0.5 mm (A), 0.1 mm (B-J).

Anim. Syst. Evol. Divers. 32(2), 72-85
Maxilliped (Fig. 4J), inner plate rectangular, medial margin with 5 plumose setae and 2 dentate spines, apex with 3 plumose setae and 2 dentate spines; outer plate semi-oval, apex reaching end of article 2 of palp, medial margin straight with 9 dentate spines gradually increasing distally and 2 long setae apically; palp stout, 4-articulate, article 1 produced distally, medial margin of article 2 expanded with 15 setae and laterodistal corner with pair of setae, medial margin of article 3 convex and laterodistal corner with acute protrusion covered with minute setae, article 4 falcate, medial margin and surface pubescent, distal spine stout.

Gnathopod 1 (Fig. 5A) merochelate, massive, greatly larger than gnathopod 2, anterior margins of basis and carpus forming concaved groove fitting expanded posterior margin of carpus; coxa enlarged, produced forward, anteroventral corner beyond head with stout spine; basis 2.0 times as long as coxa, curved distally and oblique lateral border from half of posterior margin successive to anterodistal lobe with 2 setae, anterior margin bare and distal lobe well developed, rounded apex expanded distally, posterior margin lined with 5 short setae proximally; ischium relatively longer, anteroproximal margin with set of 4 long pectinate setae medially; merus swollen proximally, width drastically decreased, distal apex produced, posterior margin with 3 sets of pectinate setae; carpus broad, subrectangular, gradually diminished distally, proximal 1/3 of anterior margin expanded backward and forming smooth angle, posterior margin with 2 single and 3 sets of setae; propodus 0.52 times as long as basis, anterior margin convex with minute setae, posterior margin flattened with several sets of long setae; dactylus falcate, as long as propodus, inner margin lined with several setae.

Gnathopod 2 (Fig. 5B) moderate, subchelate; coxa quadrangle, ventral margin lined with 6 setae; basis, anterior margin slightly concave with 6 stout setae, posterior margin expanded, convex, slightly dilated distally with 6 setae and distal corner with single and pair of setae; ischium with anterior lobe, posterodistal corner with set of 3 setae; merus subrectangular, anterodistal corner produced, posterodistal margin lined with long setae; carpus 0.73 times as long as basis, anterior margin convex with 2 setae and distal corner with set of 4 setae, posterior margin slightly expanded and forming weak angle with numerous setae; propodus curved, width steady, anterior margin convex with 3 setae distally and distal corner with set of 6 long setae, posterior margin concave with several sets of setae, with rounded protrusion distally, palm short and almost transverse; dactylus falcate, long, 0.71 times as long as propodus, inner margin lined with 7 teeth.

Pereopod 3 (Fig. 5C); coxa subquadrate, ventral margin and posteroventral corner lined with 8 setae; basis similar to that of gnathopod 2, as long as ischium to carpus combined, anterior margin almost straight with 5 stout setae and distal corner with stout seta, posterior margin convex with 4 setae and distal corner with pair of setae; ischium with anterior lobe, posterodistal corner with pair of setae; merus subrectangular and slightly expanded distally, anterior margin with seta and distal corner with set of 3 setae, posterior margin with 2 seta and distal corner pair of setae; carpus expanded, 1.4 times as long as merus, anterior margin convex with seta and distal corner with pair of setae, posterior margin with 2 setae and distal corner truncated obliquely with 3 setae; propodus slender, 1.08 times as long as carpus, anterior margin with seta and distal corner with set of 3 setae, posterior margin lined with proximal seta and 4 sets of setae; dactylus falcate, 0.57 times as long as propodus.

Pereopod 4 (Fig. 6A) similar to pereopod 3 except carpus with 3 spines on posteroproximal margin.

Pereopod 5 (Fig. 6B, C), coxa bilobate, anterior lobe expanded downward and round ventrally, posterior lobe smaller than anterior lobe; basis subrectangular, anterior margin convex with 5 setae and distal corner with set of 3 setae, posterior margin expanded with 4 setae and distal corner with seta; ischium with posterior lobe bearing 2 minute setae, anterodistal corner with set of 3 setae; merus 0.58 times as long as basis, anterior margin with 2 setae and distal corner with set of stout seta and paired simple setae, posterior margin expanded distally with minute and stout seta and distal corner weakly produced with set of stout seta and paired simple setae; carpus rectangular, 0.75 times as long as merus, anterior margin with seta and distal corner with set of 4 setae, surface near posterior margin with row of 4 stout spines, posterodistal corner with row of 4 stout spines and paired setae; propodus slender, 0.76 times as long as basis, anterior margin with 3 sets of 3 spines and distal corner with locking spine, posterior margin bare, posterodistal corner with set of 5 setae; dactylus falcate, 0.47 times as long as propodus.

Pereopod 6 (Fig. 6D); basis subrectangular, anterior margin slightly convex with 3 spines and distal corner with pair of spine and seta; posterior margin more expanded proximally with 5 setae and distal corner with stout and simple seta; ischium with posterior lobe, anterodistal corner with set of stout seta and paired simple seta; merus 0.67 times as long as basis, anterior margin with 5 minute setae and distal corner with set of 3 setae and spine, posterior margin lined with stout seta and pair of stout and simple seta, posterodistal corner with set of stout seta and paired simple setae; carpus rectangular, 0.69 times as long as merus, anterior margin with row of 4 spines and distal corner with set of 7 setae, posterior margin with pair of spines and distal corner with set of 4 stout spines; propodus 1.67 times as long as merus, anterior margin lined with 1-1-3-3 spines in formula and distal corner with pair of locking spines, posterior margin with minute seta and set of 4 long setae, and distal cor-
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Fig. 5. Aoroides semicurvatus Ariyama, male. A, Gnathopod 1; B, Gnathopod 2; C, Pereopod 3. Scale bar = 0.2 mm (A–C).
Fig. 6. *Aoroides semicurvatus* Ariyama, male. A, Pereopod 4; B, Pereopod 5; C, Coxa of pereopod 5; D, Pereopod 6; E, Pereopod 7. Scale bar = 0.2 mm (A-E).
distal corner with 2 spines and paired setae, posterior margin with 2 spines and 1 pair of spine and seta and distal corner with pair of spine and seta; carpus 0.81 times as long as merus, slightly dilated distally, anterior margin with set of 4 setae and distal corner with set of 4 setae and 2 stout spines, posterior margin with pair of setae and distal corner with set of 4 setae; propodus as long as basis, anterior margin with 5 single and 1 paired spines and distal cornor with pair of locking spines, posterior margin with 1 seta and 2 sets of 3 and 8 setae and distal corner with set of 9 setae; dactylus falcate, 0.35 times as long as propodus.

Uropod 1 (Fig. 7A), peduncle equal to outer ramus, with 4 dorsomedial and 6 dorsolateral spines, developed inter-ramal process 0.38 times as long as peduncle; inner ramus slightly longer than outer ramus, with 3 dorsomedial, 1 dorsolateral and 4 apical spines; outer ramus with 2 dorsomedial, 3 dorsolateral and 4 apical spines.

Uropod 2 (Fig. 7B), peduncle 0.65 times as long as that of uropod 1, each dorsomedial and dorsolateral corners with spine; inner ramus longer than peduncle, with 3 dorsomedial, 1 dorsolateral and 4 apical spines; outer ramus with 2 dorsomedial, 2 dorsolateral and 4 apical spines.

Uropod 3 (Fig. 7C) equal to inner ramus of uropod 2; peduncle shortest, medial margin with pair of setae proximally, laterodistal corner with 2 spines; inner ramus with 3 dorsomedial spines, apex with large pectinate spine; outer ramus bi-articulate, slightly shorter than inner ramus, proximal article with 4 setae subdistally and set of 3 plumose setae laterodistally, distal article short with 2 plumose setae apically.

Telson (Fig. 7D) ovoid in dorsal view, dorsal surface with 2 sets of paired plumose and 1 or 2 simple setae lateral corners slightly angulate with small seta and protrusion.

Female: Body 3.3 mm long in dissected specimen.

Gnathopod 1 (Fig. 7E) moderate, subchelate; coxa dilated anteroventrally, anterior margin convex, ventral margin short with 2 minute setae, posterior margin oblique; basis linear, anterior margin straight with 3 minute setae, posterior margin slightly convex; ischium with anterior lobe, posterodistal corner with set of 3 setae; merus 1.58 times as long as ischium, posterior margin produced with 5 setae distally; carpus subcircular, 0.73 times as long as basis, gradually broadened distally, width greatest in distal 2/3, posterior margin short with several setae; propodus as long as carpus, anterior margin slightly convex with seta and distal corner with set of 6 setae, posterior margin flatten with setae and distal 3/4 with stout spine, palm short, setose; dactylus falcate, 0.61 times as long as propodus, inner margin lined with 5 teeth.

Gnathopod 2 (Fig. 7F) similar to gnathopod 1 in size; coxa subrectangular, anterior margin convex, posterior margin slightly concave, ventral margin with 7 setae; basis linear, anterior margin straight with 3 setae and distal corner with seta, posterior margin with 3 minute setae and distal corner with pair of minute setae; ischium with anterior lobe, posterior distal corner with pair of setae; merus subrectangular, distal 1/3 of posterior margin with 6 setae; carpus, anterior margin not angulate with minute seta and distal corner with set of 3 setae, posterior margin angulate with several setae; propodus 0.89 times as long as that of gnathopod 1, slightly expanded distally, anterior margin convex with 2 pairs of setae and distal corner with set of 3 setae, posterior margin straight with setae and distal 3/4 with stout spine, palm short, round, setose; dactylus falcate, 0.79 times as long as that of gnathopod 1, inner margin lined with 3 teeth.

Remarks. From Korean waters, only one species, A. columbiaceae, has been reported as an Aoroides species by Kim and Kim (1987) and Kim and Kim (1991). However, the Korean A. columbiae (not Walker, 1898) redescribed by Kim and Kim (1987) was revised as a new species of Aoroides punctatus by Ariyama (2004). Aoroides punctatus has the following characteristic features of gnathopod 1 in mature males: 1) coxa is somewhat depressed than that of other Aoroides; 2) anterior margin is lined with setae laterally, but posterior margin is bare in basis; 3) ventral process of merus is slightly obtuse; and 4) posterior margins from carpus to dactylus are densely setose (Ariyama, 2004). Moreover, the validation of Korean A. columbiae by Kim and Kim (1987) was performed based on the reports of Nagata (1960) and Hirayama (1984). However, Ariyama (2004) recently suggested that A. columbiaceae sensus Nagata, 1960 and sensus Hirayama, 1984 (not Walker, 1898) should be revised as new species of A. columnaris and A. curvipes, respectively.

According to Ariyama (2004), the posteriorly curved propodus of gnathopod 2 in mature male of Aoroides species is confirmed in A. curvipes Ariyama, 2004, A. semicurvatus Ariyama, 2004, and A. viitosus Myers, 1995. However, A. viitosus can be clearly discriminated from A. curvipes and A. semicurvatus by the absence of mandibular palp and the absence of marginal spines on the outer ramus of uropod 1 and both rami of uropod 3 (Myers, 1995; Ariyama, 2004). Aoroides semicurvatus is very similar to A. curvipes in the poorly setose anterior margins of gnathopod 1 and the curved propodus of gnathopod 2 in mature male (Ariyama, 2004). In this study, we also found that it was difficult to identify Korean Aoroides specimens because of the similar shapes of gnathopods between A. curvipes and A. semicurvatus. However, A. semicurvatus is definitely different from A. curvipes in the following characteristic features: 1) gnathopod 1, the posterior margin of propodus is straight in mature male (vs. concave in A. curvipes); 2) pereopods 3–7, the setation degree of basis is on weaker than that of A. curvipes; 3) pereopods 3–4, the anterior margins of carpus are convex (vs. rectangular shaped carpus in A. curvipes); 4) pereopod 7 is
stouter and shorter than that of *A. curvipes*; 5) uropod 1, the inter-ramal process is stronger than that of *A. curvipes*; and 6) uropod 3, the marginal spines of outer ramus are absent (vs. one or two marginal spines in *A. curvipes*).

The following minor differences are found between our Korean material and the original description by Ariyama (2004): 1) antenna 1, the length ratio of peduncular articles 1–3 is 1.00 : 1.03 : 0.34 in the Korean specimens (vs. 1.0 : 1.4 : 0.5 in the Japanese original description; 2) antenna 2, the flagellum has 0, 2, 2 distal spines in each article (vs. 1, 1, 2 spines in the original description); 3) mandibular palp, the article 3 has two or three apical setae (vs. six marginal...
and one apical setae in original description); 4) maxilla 1, the palp article 2 has seven dentate and one simple spines apically (vs. six spines in the original description); 5) maxilliped, the inner margin of outer plate is lined with nine stout spines (vs. eight spines in the original description); 6) gnathopod 1, the setation of posterior margin on merus is stronger than that of original description; 7) gnathopod 2, the defining spine of palm is absent (vs. one stout spine in the original description); 8) pereopods 5–6, sets of stout spines on lateral surface or margin of carpus are absent in the original description; 9) uropod 2, the peduncle has one dorsolateral spine (vs. two dorsolateral and two dorsomedial spines in the original description). However, the real meanings of these minor differences mentioned above merit further study.

**Habitat.** Ariyama (2004) mentioned that the Japanese specimens of *A. semicurvatus* were usually collected from the intertidal zone. In the present study, the Korean materials were also collected from sandy mud bottoms of the intertidal zone.

**Distribution.** Korea (Yellow Sea), Japan (Osaka Bay).

### Key to the Korean species belonging to the genus Aoroides Walker, 1898

1. Gnathopod 1 weakly setose; gnathopod 2, propodus curved ………………………………………. *A. semicurvatus*
   – Gnathopod 1 densely setose; gnathopod 2, propodus straight ……………………………………………………………. 2

2. Pereopod 7, basis elliptical ……………………………………… *A. ellipticus*
   – Pereopod 7, basis not elliptical ……………………………………… *A. punctatus*

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