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2017년 2월

박사학위 논문

한국의 해수 및 기수역에 서식하는  
갈고리노벌레류(갑각강: 요각야강:  
갈고리노벌레목)의 분류학적 연구

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A Taxonomic Study on the Harpacticoids (Crustacea:  
Copepoda: Harpacticoida) from Marine and Brackish  
Waters in Korea

2017년 2월 24일

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위원장 대구대학교 교수 장천영 (인)

위원 한국해양과학기술원 책임연구원 이지민 (인)

위원 조선대학교 교수 이정섭 (인)

위원 조선대학교 교수 송상기 (인)

위원 조선대학교 교수 윤성명 (인)

2016년 12월

조선대학교 대학원

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## ABSTRACT

### A Taxonomic Study on the Harpacticoids (Crustacea: Copepoda: Harpacticoida) from Marine and Brackish Waters in Korea

Kim, Jong Guk

Advisor: Prof. Yoon, Seong Myeong, Ph. D.

Department of Marine Life Science

Graduate School of Chosun University

A taxonomic study on the harpacticoids collected from marine and brackish waters of Korea was performed. The harpacticoids were collected from various habitats at 95 localities in Korean waters during a periods of June, 2011 to August, 2016. In the present study, 98 harpacticoid copepods belonging to 70 genera of 28 families were identified. Among them, four species, including *Strongylacron glabrum* Kim, Jung & Yoon, 2016, *Zosime destituta* Kim, Jung & Yoon, 2016, *Syngastes multicavus* Kim, Jung & Yoon, 2016, and *S. pseudofoveatus* Kim, Jung & Yoon, 2016, have been described as new species and three species, such as *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, *Halectinosoma perforatum* Itô, 1981, and *Microarthridion littorale* (Poppe, 1881), have been newly recorded in Korean fauna. In addition, 12 species (*Brianola* sp. nov., *Scottolana* sp. nov., *Fladenia* sp. nov., *Amphiascus* sp. nov., *Bulbamphiascus* sp. nov., *Typhlamphiascus* sp. nov. 1, *Typhlamphiascus* sp. nov. 2, *Nannopus* sp. nov., *Normanella* sp. nov., *Halectinosoma* sp. nov., *Alteutha* sp. nov., and *Alteuthella* sp. nov.) were described as new species, and one genus was erected to accommodate Laophontoidea gen. nov. & sp. nov. These 20 species were described in detail with figures and scanning electron microscope photographs. In the present study, the keys for harpacticoid genera and species of Korean waters were also provided, together with the information on the zoogeographical distribution and inhabits for total 183 harpacticoids that had been recorded previously from Korean marine and brackish waters. The results showed that they could be categorized by five climatic forms as follows: the portions of the Far Eastern endemic form, the cosmopolitan, the warm temperature form, the cold temperature form, and the tropical form were found to be 114 species (62.3%), 25 species (13.7 %), 24 species (12.6%), 12 species (6.5%), and

nine species (4.9%), respectively. High rate of the Far Eastern endemic species in Korean harpacticoids might be caused by the dominance of benthic life style of harpacticoid copepods inhabiting on sediments or macroalgae. When categorized by life styles, 114 species (62.3%) were benthic, 43 species (23.5%) were associated with marine algae or sea grass, 11 species (6.0%) were associated with other invertebrates, nine species (4.9%) were associated with wood infested by isopods, and six species (3.3%) were planktonic. In Korean waters, 149 species (81.4%) have been recorded from intertidal zone and 34 species (18.6%) have been reported from subtidal zone. However, there were still poor surveys on subtaidal harpacticoids in Korean waters. Therefore, many undescribed species would be discovered by the progress of researches from subtidal zone.

# 1. 서론

## 1) 국내외 연구동향

요각아강(Copepoda)의 9 개 목 중 하나인 갈고리노벌레류(Harpacticoids)는 56 과 589 속 4,300 여종 이상이 알려져 있다(Wells 2007). 이들은 적응방식이 잘 된 분류군으로서 대부분 해양과 기수지역의 저서환경에서 자유생활을 하며, 해조류와 무척추동물들에 공생 혹은 기생하기도 한다(Lee et al. 2012). 일부 속(*Microsetella*, *Euterpina*, *Clytemnestra*, *Macrosetella*)은 플랑크톤성이며, 3 개 과(*Chappuisiidae*, *Phyllognathopodidae* 및 *Parastenocarididae*)의 약 1,000 여 종은 담수환경에서만 서식하는 것으로 알려져 있다(Huys et al. 1996). 중형저서생물군집에서 갈고리노벌레류는 선형동물 다음으로 높은 생물량을 보이며, 군집에서 생태학적으로 중요한 역할을 담당하고 있다(Coull et al. 1983; Huys et al. 1996).

갈고리노벌레류의 분류학적 연구는 19 세기 초에 시작되었으며, 지중해, 유럽의 대서양연안, 그리고 인도양을 중심으로 활발히 진행되어 Brady (1880), Sars (1903-1911, 1921), Lang (1948), Wells & Rao (1987) 그리고 Apostolov & Marinov (1988) 등에 의하여 중요한 모노그래프가 완성되었다(Song 2000; Lee et al. 2012). 특히 Lang (1948)은 그 이전까지 기록된 1,400 여 종들에 대한 계통과 동물지리학적 분포를 고찰하여 분류학적으로 중요한 업적을 남겼다. 최근, Wells (2007)는 약 4,300 여종에 대한 검색표를 제시하였는데, 이는 Lang (1948) 이후에 갈고리노벌레의 종수가 약 3 배 정도 증가하였음을 보여준다. 과학기술의 발달에 의한 현미경의 발전과(예, 주사전자현미경, 공초점주사레이저현미경) 함께 과거 채집이 어려웠던 남극이나 심해 등의 지역에서도 연구가 진행됨에 따라 갈고리노벌레류에 대한 분류학적 연구는 더욱 발전할 것으로 보인다(Lee et al. 2002).

현재 갈고리노벌레류의 분류계통의 토대는 Sars (1905)에 의하여 이루어 졌다. 그는 갈고리노벌레류를 요각류의 1 개의 아목으로 두었으며, 이를 악각과 수컷 제 1 측각의 형질에 따라서 2 개의 절로 나누고 그 밑에 20 과를 만들었다(Sars,

1905; Chang 2009b). 그 후, Lang (1948)은 제 1 흉지의 저절에 강모의 유무, 제 1 및 제 2 촉각, 소악 및 악각의 형질에 따라서 2 개의 절, Polyarthra 와 Oligoarthra 로 나누었다(Lang 1948; Chang 2009b). 현재, Polyarthra 아목은 단계통군으로 여겨지고 있으나, Oligoarthra 아목은 다계통군으로 여겨지고 있다(Seifried 2003; Huys et al. 1996).

동아시아의 경우, 중국에서는 육수산 갈고리노벌레류에 관한 연구(예, Shen & Tai 1962, 1963, 1964, 1979)가 1960 년대부터 이루어졌으며, Shen (1979)이 출판한 담수산 요각류의 모노그래프에는 갈고리노벌레류 67 종이 기록되어 있다. 해산 갈고리노벌레류에 관한 연구는 최근 Mu & Gee (2000), Mu & Huys (2002, 2004), Ma & Li (2011)에 의하여 분류학적 연구가, 그리고 Mu et al. (2002)에 의하여 생태학적 연구가 수행되었다. 일본은 비교적 이른 1900 년대 초반부터 요각류에 관한 연구가 시작되었으며, Ishida & Kikuchi (2000)가 담수산 갈고리노벌레류 57 종을 정리하였다(Chang 2009b). 그리고 해산 갈고리노벌레류는 Itô (1968–1988)가 35 종을 훗카이도에서 보고하였으나, 이후 연구는 다른 요각류에 관한 연구에 비하여 미진한 상황이며, 최근 *Dactylopusioides* 속 2 종, *Sarsamphiascus kawamurai*, *Tegastes okinawaensis* 그리고 *Leptocaris ryukyuensis* 등이 신종으로 보고되었을 뿐이다(Song 2000; Shimono et al. 2004, 2010; Ueda & Nagai 2005; Back et al. 2010; Song et al. 2012a).

한국에서 갈고리노벌레류에 관한 분류학적 연구는 Miura (1969)에 의하여 처음 수행되었는데, 그는 석회동굴과 우물에서 Canthocamptidae 의 6 종과 *Parastenocaris nippensis* 를 기록하였다(Chang 2009b). 이후 90 년대 초반부터 현재까지 담수 및 해수에 서식하고 있는 갈고리노벌레류의 분류학적 연구가 지속적으로 수행되어 오고 있다(Chang & Kim 1991, 1992; Chang & Song 1995; 1997a, b 등) 그 결과로서 Chang (2009b)의 육수산 요각류의 모노그래프에는 갈고리노벌레류가 10 과 29 속 66 종(기수종 다수 포함)이 보고되었다. 최근, Song et al. (2012)는 해산과 기수역에서 출현하는 갈고리노벌레류에 대한 생태학적 check list 를 제시하였는데, 23 과 58 속 88 종을 포함하고 있다. 대부분의 종들이 저서환경에서 자유생활하는 것으로 보고되었으며, 공생성 7 종, 플랑크톤성

6 종을 포함하였다(Song et al. 2012). 그 이후, 다양한 서식지에서 연구가 활발히 진행되고 있다: Paramesochridae에 관한 연구(Back & Lee 2010, 2011, 2012, 2013, 2014b); Parastenocarididae에 관한 연구(Karanovic & Lee 2012); Ameiridae에 관한 연구(Karanovic & Cho 2012); Cletodidae에 관한 연구(Kim et al. 2014; Karanovic et al. 2015; Song et al. 2014; Kim et al. 2016a); Laophontidae에 관한 연구(Back & Lee 2014a; Kim 2013); Normanellidae에 관한 연구(Kim et al. 2014); Cletopsyllidae에 관한 연구(Kim 2013); Ancorabolidae에 관한 연구(Kim 2013); Harpacticidae에 관한 연구(Lee et al. 2014); Miraciidae에 관한 연구(Karanovic & Kim 2014; Karanovic et al. 2014; Karanovic & Cho 2016); Ectinosomatidae에 관한 연구(Kim et al. 2015); Tegastidae에 관한 연구(Kim et al. 2016c); Tachidiidae에 관한 연구(Kim et al. 2016); Zosimeidae에 관한 연구(Kim et al. 2016b); Tisbidae에 관한 연구(Karanovic & Lee 2016); Nannopodidae에 관한 연구(Vakati et al. 2016) 등이 수행되었다. 이상의 연구를 종합한 결과 현재까지 보고된 해수 및 기수역에 서식하는 갈고리노벌레류는 32과 93속 168종이다. 한국의 갈고리노벌레류에 대한 분류학적 연구는 꾸준히 발전해오고 있지만, 영국의 주변 해역에서만 190속 800여종이 밝혀진 것에 비교하여 볼 때 미진한 상황이다(Huys et al. 1996; Lee et al. 2002).

## 2) 형태 및 명칭

갈고리노벌레의 형태적 용어는 Huys & Boxshall (1991)의 것을 따랐으며, 각 명칭의 국명은 Chang (2009b)의 것을 기준으로 정리하였다.

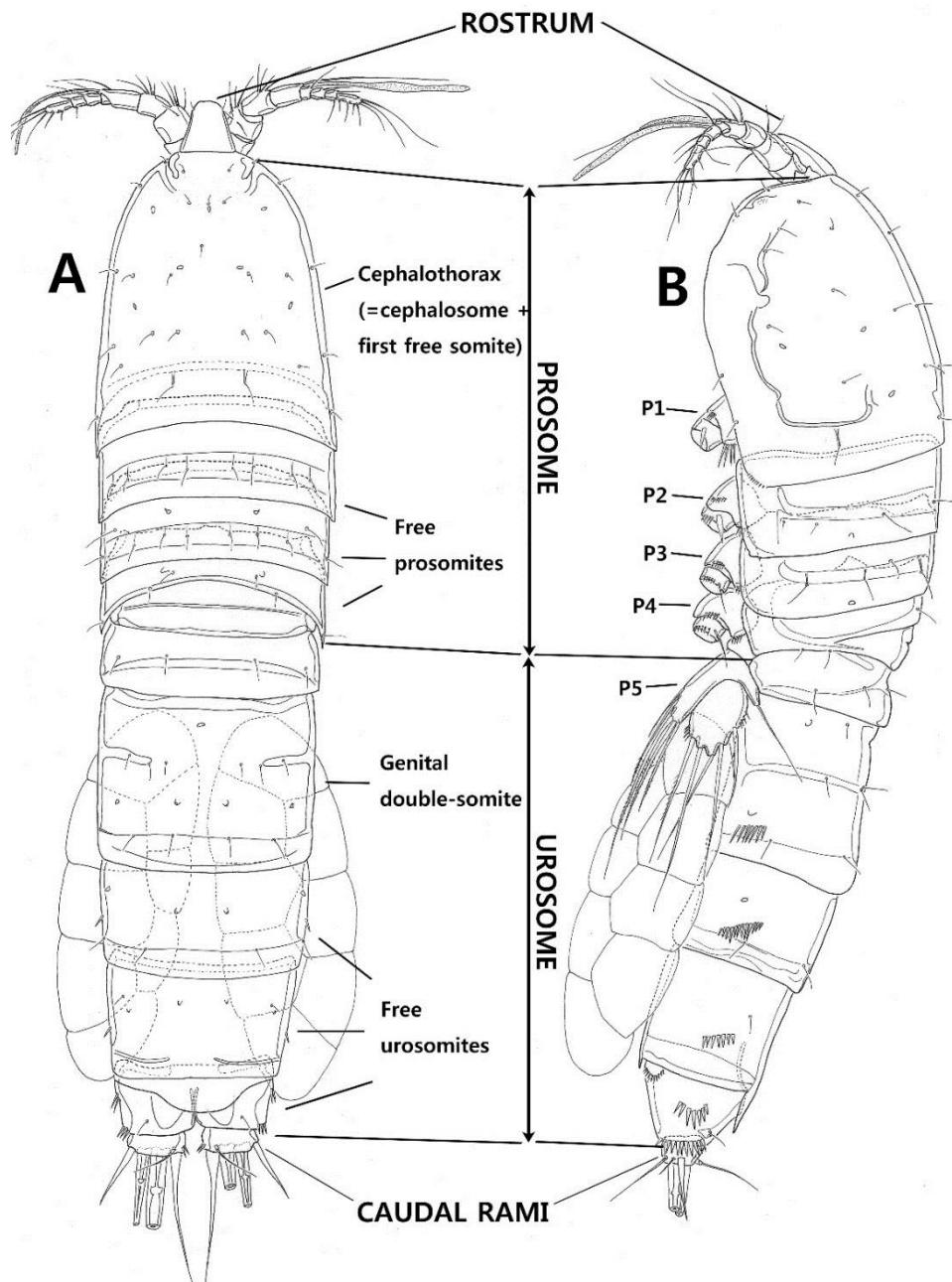
### (1) 일반적 형태

갈고리노벌레류의 체형은 길다란 형, 등배로 납작한 형, 검물벼룩과 유사한 형 등 다양한 체형을 갖는다. 몸은 전체부(prosome)와 후체부(urosome)로 이루어져 있으며, 제 4 흉절과 제 5 흉절 사이에서 구별된다. 갈고리노벌레류는 두 부분의 사이가 조금 좁아지므로, 각 분류군의 체형에 따라 전체부와 후체부가 명확하지 않은 그룹도 많다(Chang 2009b).

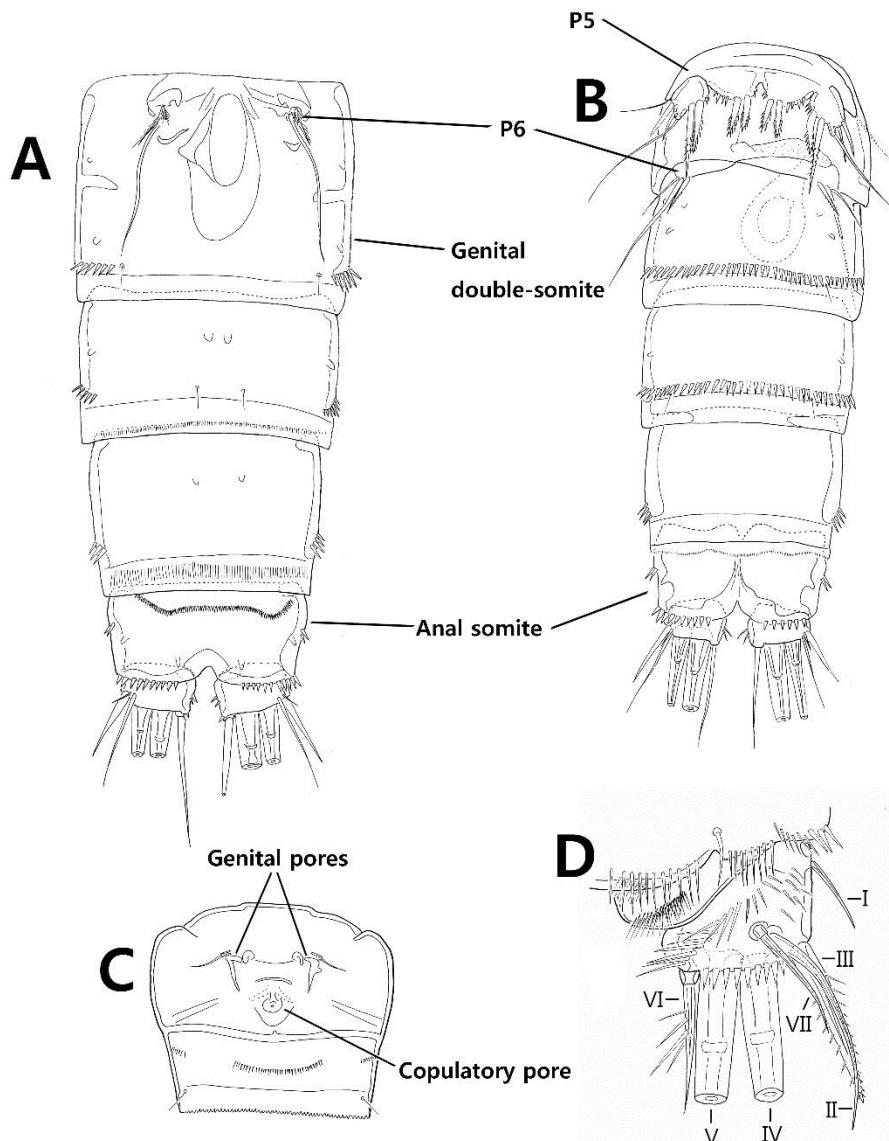
전체부는 두절(cephalosome)과 제 1 흉절-제 4 흉절로 구성된다. 두절은 6 쌍의 부속지, 즉 제 1 촉각(antennule), 제 2 촉각(antenna), 대악(mandible), 제 1 소악(maxillule), 제 2 소악(maxilla), 그리고 악각(maxilliped)를 가지는 6 개의 체절이 융합되어 이루어 졌다. 제 1 흉지(first thoracic leg 또는 first swimming leg; P1)를 가지는 체절은 대부분 두부와 융합하여 두흉절(cephalothorax)을 이룬다. 두절의 앞쪽은 돌출하여 이마돌기(rostrum)을 형성하며 분류군에 따라 그 형태가 다양하다.

후체부는 제 5 흉절(fifth thoracic leg 또는 first urosomite; P5), 생식이중절(genital double-somite), 3 개의 복절(abdominal somite), 그리고 항절(anal somite)로 구성된다. 암컷의 경우, 제 6 흉지(sixth thoracic leg 또는 second urosomite, P6)를 가지는 체절과 생식절(genital somite 또는 third urosomite)가 융합하여 생식이중절을 이룬다. 수컷은 이를 형성하지 않거나 제 6 흉절의 복면 뒷부분에 생식덮개(opercular plat)를 형성하고 생식공을 덮고 있다. 그 말단에는 2-3 개의 강모와 가시를 가지는데 이를 제 6 흉지를 나타내는 것으로 본다. 항절의 등면에는 항문판(anal operculum)을 가지는데 뒷가장자리의 잔가시 유무와 수가 중요한 형질로 사용된다.

항절 뒷부분에 한 쌍의 미차(caudal ramus)를 가진다. 각 미차에는 7 개의 강모(setae)를 가지는데 각 강모의 길이, 종류, 위치가 중요한 분류학적 형질로 사용된다. 미차 측면에 2 개의 꼬리강모 I 과 II (setae I and II), 뒷옆모서리에 꼬리강모 III (seta III), 말단에 위치한 2 개의 꼬리강모 IV 와 V (setae IV and V), 안끝모서리에 꼬리강모 VI (seta VI), 그리고 등면에 위치한 꼬리강모 VII (seta VII)를 가진다.



**Fig. 1.** General morphology of harpacticoid copepods showing the terms used in this study.  
A, habitus, dorsal; B, habitus, lateral.



**Fig. 2.** General morphology of urosomite and caudal rami in harpacticoid copepods showing the terms used in this study. A, female urosome except for P5-bearing somite, ventral; B, male urosome, ventral; C, genital double-somite, ventral; D, caudal ramus, dorsal.

## (2) 부속지(appendages)

### ① 제 1 촉각(antennule)

암컷의 경우, 제 1 촉각은 3~9 마디로 구성되며, 수컷은 교미를 위하여 불잡이촉각으로 변형된다(예, subchirocer, haplocer). 암수 모두에서 촉모(aesthetasc)를 가지는데, 종에 따라 위치, 수, 그리고 길이에서 차이를 보인다.

### ② 제 2 촉각(antenna)

제 2 촉각의 원절(protopod)은 저절(coxa)과 기절(basis)로 나뉘어 있으며, 외지(exopod)와 내지(endopod)가 이분지형(biramous)을 이룬다. 저절은 보통 매우 작고, 잔가시열을 가지지 않는다. 그리고 저절은 가지지 않거나 기절과 융합된 경우도 나타난다. 외지는 최대 9 마디(예, suborder Polyarthra)를 가지며 보통 4 마디(예, suborder Oligoarthra) 이하로 이루어져 있다. 외지의 마디 수와 강모수는 속을 나누는 중요한 분류학적 형질이다. 내지는 보통 2 마디로 이루어 져있으며, 3 마디를 가지는 경우(예, Longipediidae)도 있다. 기절과 내지의 첫 번째 마디는 부분적 혹은 완전히 융합되어 기절내지합부(allobasis)를 형성하는 경우가 많다. 외지가 축소되어 1 마디로 구성된 촉지(palp)를 가지는 종들도 있다(예, *Leptastacus corsicaensis*).

### ③ 대악(mandible)

대악의 저절은 포식에 알맞은 형태로 분화하였는데, 먹이의 운반과 파쇄에 도움이 되는 악기(gnathobase)를 가진다. 악기는 보통 톱날모양의 이(tooth)들과 2 개의 강모를 가진다. 기절은 최대 4 개의 강모와 외지와 내지를 가진다. 외지는 최대 4 마디로 구성되며, 내지는 보통 1 마디로 이루어져 있다.

### ④ 제 1 소악(maxillule)

제 1 소악의 원절은 근본적으로 전저절(preacoxa), 저절, 그리고 기절로 이루어진다. 전저절은 잘 발달된 가동내돌기(arthrite)를 가지는데, 그 말단 가장자리에 몇몇의 가시들과 강모들을 가지며 표면에 보통 2 개의 강모를 가진다. 저절에 있는 내돌기(endite)는 저절과 융합되어 있으며 최대 5 개의 강모를 가진다. 기절은 2 개의 내돌기(보통 서로 융합됨)와 내지와 외지를 가진다. 내지와 외지는 보통 각각 1 마디로 이루어져 있다.

#### ⑤ 제 2 소악(maxilla)

제 2 소악의 원절은 근본적으로 각각 2 개의 내돌기를 가지는 전저절과 저절을 가지나, 이 둘은 서로 융합되어 전저합절(syncoxa)를 형성한다. 기절과 내지의 첫 번째 마디는 서로 융합되어 기절내지합부를 진다. 기절내지합부의 내돌기는 보통 곡선의 발톱모양이다. 내지는 최대 4 마디로 구성되며, 외지는 축소되어 존재하지 않는다.

#### ⑥ 악각(maxilliped)

악각의 제 2 소악과 유사하게 잘 발달된 전저합절을 가진다. 전저합절과 기절은 안쪽 가장자리에 가시나 강모를 가진다. 내지는 근본적으로 2 마디로 이루어져 있으나 몇몇 과들(예, Cerviniidae, Tisbidae, Paramesochridae)을 제외한 대부분의 갈고리노벌레류에서는 1 마디로 구성되거나 흔적만 남아있다. 그 끝에 갈고리모양의 발톱을 가져 붙잡을 수 있는 구조(subchelate)를 이룬다. 몇몇 과에 속하는 종들은 악각이 잡을 수 있는 구조가 아니거나(stenopodial type; 예, Ectinosomatidae, Zosimeidae), 넓은 잎 모양(phyllopodial type; 예, Canuellidae, Longipediidae)을 가지는 종들도 있다. 외지는 존재하지 않는다.

#### ⑦ 제 1–4 흉지

흉지는 근본적으로 작은 전저절, 잘 발달된 저절과 기절, 그리고 외지와 내지를 가진다. 원쪽과 오른쪽의 흉지는 저절간판(intercoxal sclerite)으로 연결되어 있다. 저절에는 대부분의 갈고리노벌레류종들에서는 안쪽 가시를 가지지 않으나 Canuellidae 와 Longipediidae 에서는 이를 가진다. 기절은 안쪽가시와 바깥강모를 가진다. 외지와 내지는 최대 3 마디로 이루어져 있으며 각 마디에 존재하는 강모와 가시의 수는 종을 구별하는 주요한 분류학적 형질로 여겨진다. 따라서, 분류학적 논문의 기재문에서는 강모의 수를 아라비아숫자로 강모식(setal formula)을 제시한다. 기절에 가까운 마디부터 안쪽 가장자리에 존재하는 강모의 수를 적고, 각각의 마디는 마침표(.)로 구별한다. 마지막 마디에 존재하는 강모와 가시의 수는 안쪽, 말단, 바깥 가장자리 순으로 제시한다(예, 외지: 0.1.233, 내지: 1.0.321). 제 2–4 흉지 흉지는 유형지형을 나타내지만, 제 1 흉지는 대부분의 종에서 크게 변형되어 있으며 그 형태는 중요한 분류학적 형질로 사용된다. 수컷의

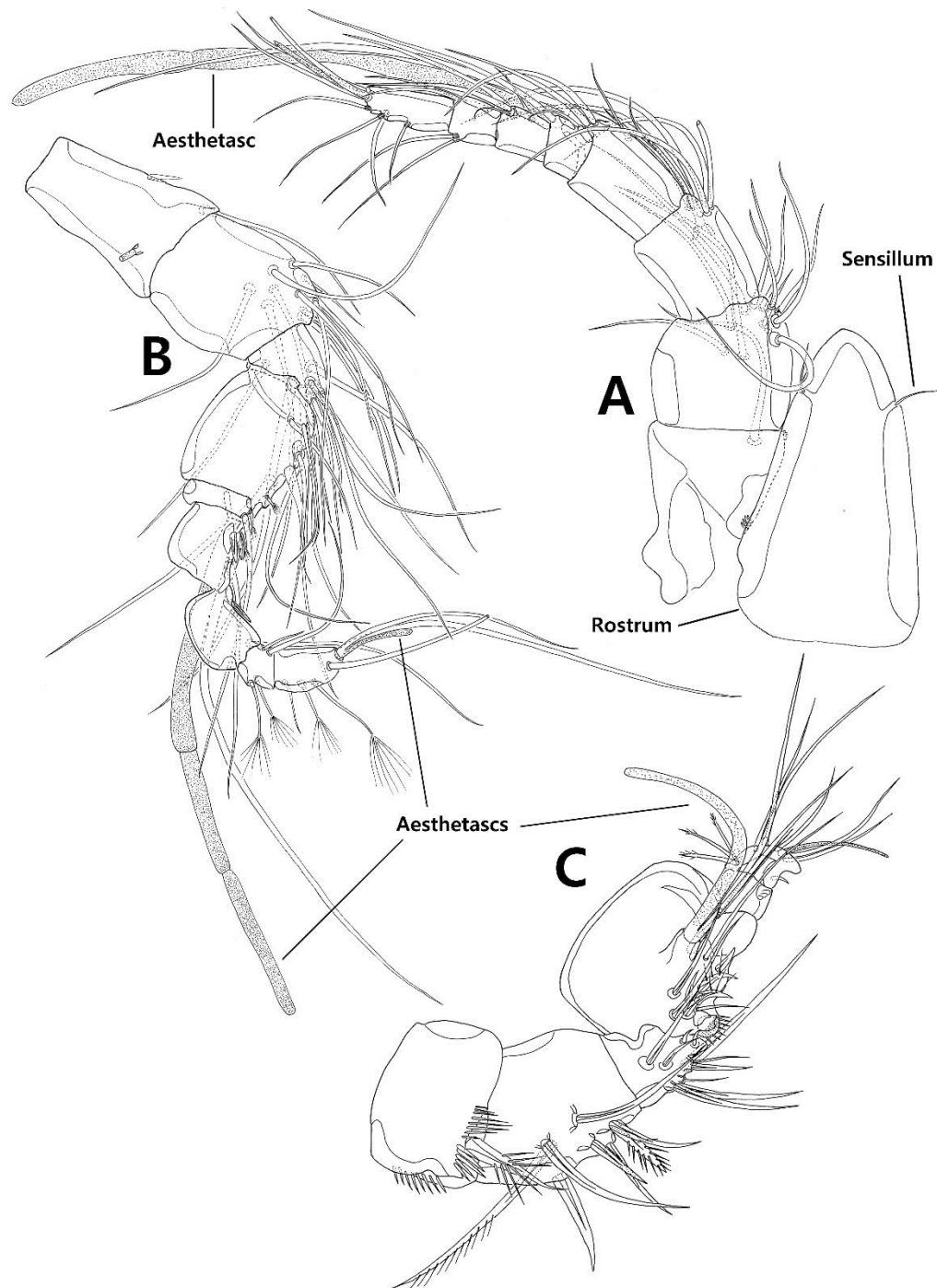
내지의 모형이 변형되어 성적이형을 나타내는 경우가 많으며 이는 종과 속을 나누는 중요한 형질이다.

⑧ 제 5 흉지

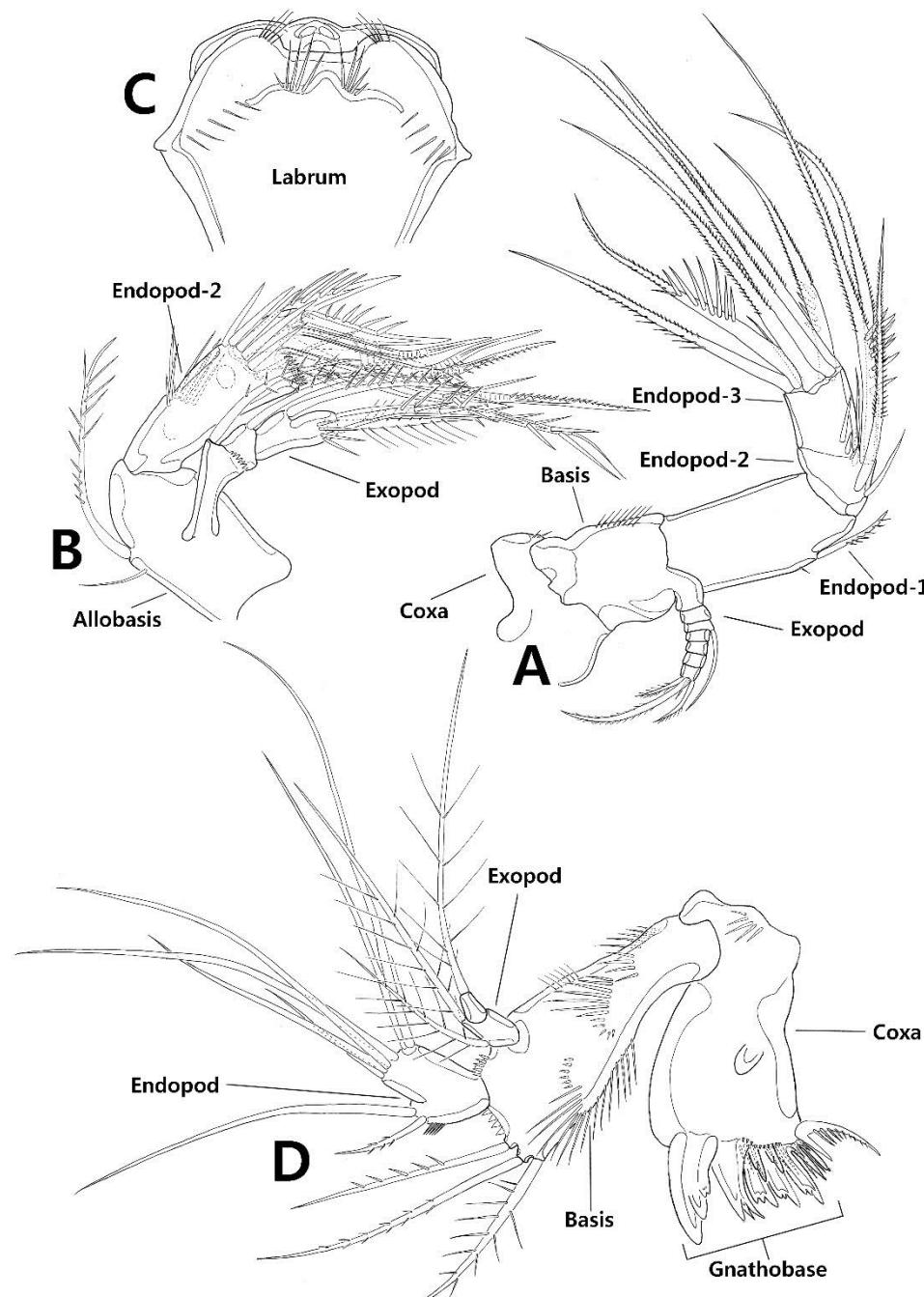
제 5 흉지는 축소되어 있는데, 보통 기절과 내지가 융합된 기내지(baseoendopod)와 알 모양의 외지로 구성된다. 기내지에는 엽이 발달 하였는데 이를 내지엽(endopodal lobe)이라 부른다. 양쪽다리는 중간에서 융합하거나 축소된 저절간판을 가진다. 수컷의 제 5 흉지는 암수이형을 나타내며, 보통 암컷의 것보다 축소되어 있다.

⑨ 제 6 흉지

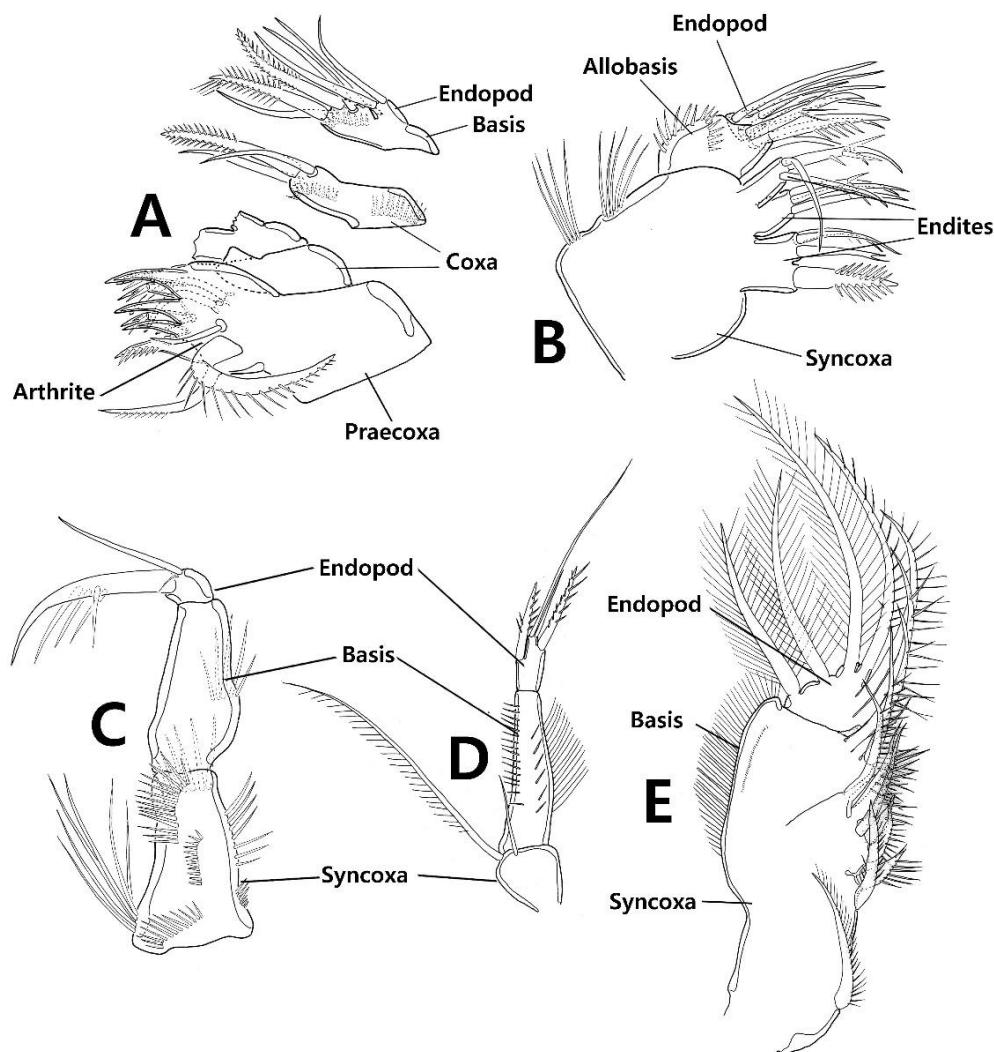
암컷의 제 6 흉지는 생식절 복면 앞쪽에 작은 돌기와 강모의 형태로 흔적적으로 남아 있다. 수컷의 경우 작은 판자모양으로 축소되어 있으며 2–3 개의 강모 또는 가시를 가진다.



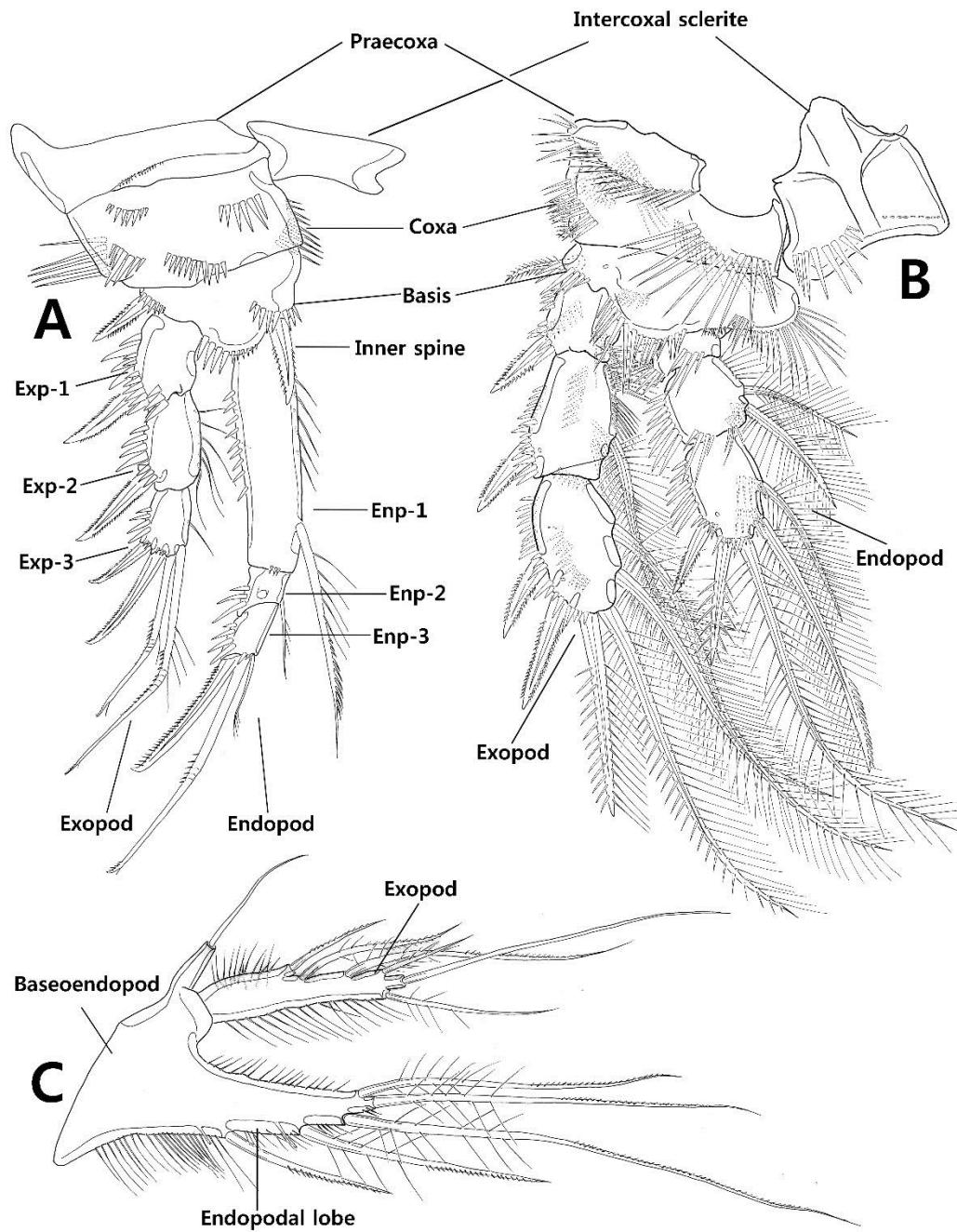
**Fig. 3.** Basic structure of antennule in harpacticoid copepods. A, female; B, haplocer type in male; C, subchirocer type in male.



**Fig. 4.** Basic structure of mouth appendages in harpacticoid copepods. A, antenna, polyarthra; B, antenna, oligoarthra; C, labrum; D, mandible.



**Fig. 5.** Basic structure of mouth appendages in harpacticoid copepods. A, maxilla; B, maxilla; C, maxilliped, general oligoarthra; D, maxilliped, Ectinosomatidae; E, maxilliped, polyarthra.



**Fig. 6.** Basic structure of thoracic legs in harpacticoid copepods. A, P1; B, P2–P4; C, P5.

## 2. 재료 및 방법

본 연구의 관찰재료는 2011년 6월부터 2016년 8월까지 남한 전역의 해안에 걸쳐 다양한 서식지에서 채집하였으며, 각 정점들은 그림 7과 같다. 요각류의 서식지 환경에 따라 다양한 채집방법을 사용하였다. 조간대의 사질 또는 니질에 서식하는 요각류는 저질의 표층을 규격체(망목크기 64–212 μm)로 걸러서 채집하였다. 조하대의 경우, 그렙과 SCUBA diving 을 이용하여 저질과 해조류를 채집한 후 이를 규격체로 걸러서 요각류를 채집하였다. 야간에는 방파제 주변에 light trap 을 설치하고 이를 4시간 후 건져내어 채집하였다. 일부 지역에서는 플랑크톤네트(망목크기 212 μm; 망구 30cm)을 이용하여 채집하였다. 채집된 샘플들은 현장에서 99% 에탄올 또는 4% 포르말린으로 고정하여 실험실로 운반하였다. 실험실에서 해부현미경(Discovery, V8; Carl Zeiss) 하에서 요각류 시료를 구별한 후 분류군별로 표본병에 옮겨 99% 에탄올에 보관하였다.

표본의 전체모습은 aluminum hole slide 를 이용하거나, 슬라이드글라스 위에 커버글라스를 2장 겹쳐 생긴 공간에 개체를 놓고 관찰하였다. 각 부속지를 자세히 관찰할 때는 개체를 polyvinyl lactophenol 또는 lactophenol 에 놓고 미세해부침을 사용하여 해부한 후 슬라이드 표본을 제작하였다. 몸길이 측정과 도판제작에는 광학현미경(ECLIPSE 80i; Nikon)에 부착된 drawing tube 를 이용하였다.

표본의 미세한 형태를 관찰하기 위하여 주사전자현미경 사진을 촬영하였다. 관찰할 표본을 25% 염산(HCl) 용액에 담근 후 90°C에서 수초간 중탕하여 표면에 붙은 이물질을 제거하였다. 이어서 표본을 4% 포름글루타르알데히드(Form-glutaraldehyde)로 전고정, 2% OsO<sub>4</sub>로 후고정 하였다. 계속하여 에탄올 농도 순으로 (50, 60, 70, 80, 90, 100%) 각각 30분 동안 표본을 탈수 시켰다. 건조된 표본은 금으로 코팅한 후 전자현미경(VEGA 3LM; Tescan) 하에서 관찰, 촬영하였다(가속전압: 20kV; 작동거리: 15.0–20.7 mm).

관찰재료에 대한 기록은 개체수, 채집지, 채집일자 순서로 정리 하였다. 신종 후보종의 모식표본을 포함한 모든 표본은 국립생물자원관, 또는 조선대학교 동물분류및생태실험실에 보관되어 있다.

연구 기간 동안 갈고리노벌레류를 채집한 지역을 행정구역 별로 정리하면 다음과 같다(그림 7).

- 1) 경기도: 1. 인천 강화군 삼산면 매음리, 석모도; 2. 인천 강화군 내가면 황청리; 3. 인천 강화군 길상면 동검리; 4. 인천 앞바다, 조하대; 5. 인천 중구 운서동, 영종도, 용유해수욕장.
- 2) 충청도: 6. 경기도 옹진군 영흥면, 영흥도; 7. 충남 태안군 이원면 내리, 가로림만; 8. 충남 태안군 방갈리, 민어도; 9. 충남 태안군 이원면; 10. 충남 태안군 소원면; 11. 충남 태안군 남면 원청리, 청포대해수욕장; 12. 충남 태안군 안면읍 승언리, 안면도, 꽃지해수욕장; 13. 충남 보령시 오천면 장고도리, 장고도; 14. 충남 보령시 웅천읍 관당리, 무창포해수욕장; 15. 충남 서천군 서면 도둔리, 춘장대해수욕장; 16. 충남 서천군 장항읍 송림리, 송림산림해수욕장
- 3) 전라도: 17. 전북 군산시 비응도동; 18. 전북 군산시 옥도면 비안도리, 가력도; 19. 전북 부안군 변산면 대항리; 20. 전북 부안군 진서면 곰소리, 곰소항; 21. 전북 고창군 해리면 금평리; 22. 전남 영광군 백수읍 대신리; 23. 전남 영광군 염산면 두우리, 백바위해수욕장; 24. 전남 무안군, 함평만; 25. 전남 신안군 지도읍, 지도; 26. 전남 신안군 신용리, 압해도; 27. 전남 신안군 비금면, 비금도; 28. 전남 신안군 흑산면 가거도리, 가거도; 29. 전남 진도군 진도읍, 산월리; 30. 전남 진도군 지산면 가학리; 31. 전남 진도군 임회면; 32. 전남 진도군 의신면 금갑리, 금갑해수욕장; 33. 전남 진도군 의신면 초사리; 34. 전남 진도군 고군면 내산리; 35. 전남 해남군 문내면 예락리; 36. 전남 해남군 화산면; 37. 전남 해남군 송지면; 38. 전남 완도군 보길면, 보길도; 39. 전남 강진군 도암면 신기리; 40. 전남 완도군 신지면, 신지도; 41. 전남 완도군 금일면, 금일도; 42. 전남 고흥군,

- 거금도; 43. 전남 고흥군 과역면 노일리; 44. 전남 순천 여자만; 45. 전남 순천시 해룡면 상내리; 46. 전남 여수시 화양면 이목리; 47. 전남 여수시, 금오도; 48. 전남 여수시 신덕동; 49. 전남 광양시 광양읍 도월리; 50. 전남 광양시 진월면 신아리, 섬진강교.
- 4) 경상도: 51. 경남 남해군 상주면; 경남 남해군 미조면 송정리; 52. 경남 사천시 사천읍 구호리, 중선포천 하구역; 53. 경남 고성군 삼산면 미룡리; 54. 경남 통영시 산양읍 미남리; 55. 경남 통영시 한산면, 한산도; 56. 경남 통영시 한산면, 용초도; 57. 경남 통영시 한산면, 장사도; 58. 경남 통영시 한산면, 소매물도; 59. 경남 거제시 남부면; 60. 경남거제시 사등면 사곡리, 사곡해수욕장; 61. 부산시 기장군 일광면 학리, 일광해수욕장; 62. 울산 을주군 서생면 나사리, 나사해수욕장; 63. 울산시 동구 일산동, 일산해수욕장; 64. 경북 경주시 감포읍 전촌리; 65. 경북 포항시 장기면 모포리; 66. 경북 포항시 남구 구룡포읍; 67. 경북 포항시 호미곶면 강사리; 68. 경북 포항시 남구 동해면 입암리; 69. 경북 포항시 북구 청하면 방어리; 70. 경북 영덕군 남정면 장사리, 장사해수욕장; 71. 경북 영덕군 축산면 경정리; 72. 경북 울진군 매화면 덕신리, 덕신해수욕장; 73. 경북 울진군 울진읍 연지리; 74. 경북 울릉군 울릉읍 저동리, 죽도; 75. 경북 울릉군 울릉읍 독도리, 독도.
- 5) 강원도: 76. 강원 삼척시 원덕읍 노곡리; 77. 강원 삼척시 근덕면 궁촌리, 궁촌항; 78. 강원 삼척시 교동; 79. 강원 동해시 뮤호동, 뮤호항; 80. 강원 양양군 현남면 남애리; 81. 강원도 양양군 현북면 하광정리, 하조대해수욕장; 82. 강원 양양군 강현면 주청리, 낙산해수욕장; 83. 강원 속초시 대포동, 외옹치항; 84. 강원 고성군 죽왕면 오호리, 송지호해수욕장; 85. 강원 고성군 현내면 대진리.
- 6) 제주도: 86. 제주시 애월읍 곽지리, 곽지해수욕장; 87. 제주 제주시 한립읍 협재리, 협재해수욕장; 88. 제주 서귀포시 안덕면 화순리, 화순해수욕장; 89. 제주 서귀포시 대포동; 90. 제주 서귀포시 보문동, 기린여; 91. 제주

서귀포시 남원읍 위미리, 위미항; 92. 제주 서귀포시 표선면 표선리, 표선해수욕장; 93. 제주 제주시 우도면, 우도; 94. 제주 제주시 구좌읍 김녕리, 김녕해수욕장; 95. 제주 제주시 조천읍 함덕리, 함덕해수욕장.

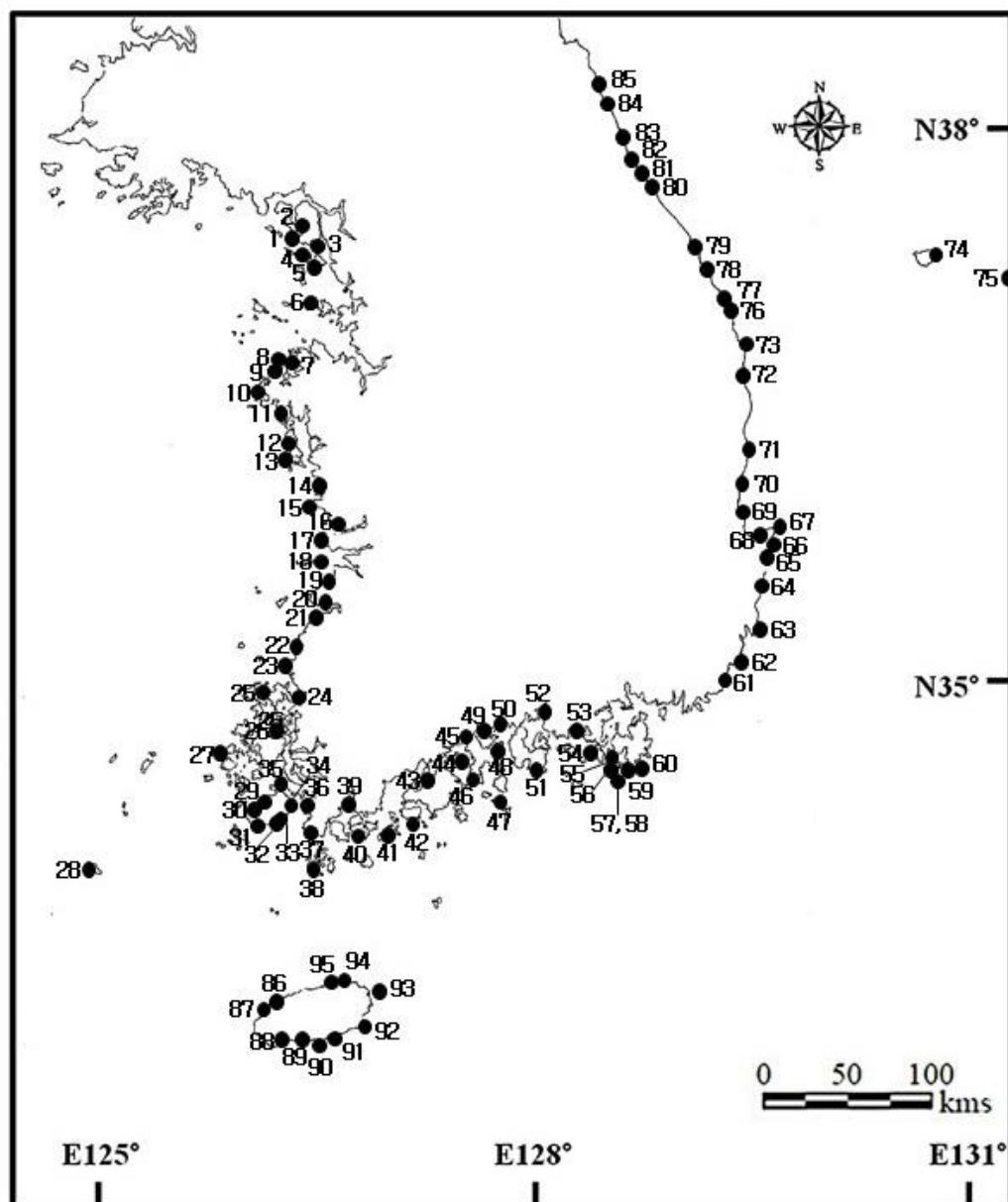


Fig. 7. Localities where harpacticoid copepods were collected.

### 3. 결과

#### 1) 분류 목록

본 연구를 통하여 확인된 한국산 해산 갈고리노벌레류의 목록은 다음과 같다[Wells (2007)의 분류 체계를 따름; \*, 한국미기록종; \*\*, 신종 및 신종후보종].

**Class Crustacea Pennant, 1777** 갑각 강

**Subclass Copepoda Milne-Edwards, 1840** 요각 아강

**Order Harpacticoida Sars, 1903** 갈고리노벌레 목

**Suborder Polyarthra Lang, 1944**

**Family Longipediidae Boeck, 1865** 긴다리노벌레 과

**Genus Longipedia Claus, 1862** 긴다리노벌레 속

1. *Longipedia weberi* A. Scott, 1909 *sensu* Yoo & Lee, 1995

**Family Canuellidae Lang, 1944** 카누노벌레과

**Genus Brianola Monard, 1926**

\*\*2. *Brianola* sp. nov.

**Genus Scottolana Huys, 2009** 스코트노벌레 속

3. *Scottolana bulbifera* (Chislenko, 1971) 둥근털스코트노벌레

\*\*4. *Scottolana* sp. nov.

**Suborder Oligoarthra Lang, 1944**

**Infraorder Podognonta Lang, 1944**

**Superfamily [as yet unnamed in Wells (2007)]**

**Family Harpacticidae Dana, 1846** 장수노벌레 과

**Genus Harpacticus Milne-Edwards, 1840** 장수노벌레 속

5. *Harpacticus uniremis* Kröyer, 1842 장수노벌레

6. *Harpacticus nipponicus* Itô, 1976 왜장수노벌레

**Genus Zaus Goodsir, 1845** 납작장수노벌레 속

7. *Zaus unisetosus* Itô, 1974 한털납작장수노벌레

**Genus Tigriopus Norman, 1869** 호랑장수노벌레 속

8. *Tigriopus japonicus* Mori, 1938 호랑장수노벌레

**Genus *Harpacticella* Sars, 1908** 어리장수노벌레 속

9. *Harpacticella oceanica* Itô, 1977 바다어리장수노벌레

10. *Harpacticella itoi* Chang & Kim, 1991 어리장수노벌레

**Superfamily [as yet unnamed in Wells (2007)]**

**Family Pseudotachidiidae Lang, 1936**

**Subfamily Danielsseniinae Huys & Gee in Huys et al., 1996**

**Genus *Fladenia* Gee & Huys, 1990**

\*\*11. *Fladenia* sp. nov.

**Genus *Sentiopsis* Huys and Gee, 1996**

12. *Sentiopsis coreana* Kim, Lee & Huys, 2011

**Superfamily [as yet unnamed in Wells (2007)]**

**Family Parasteneliidae Lang, 1936** 부요정노벌레 과

**Genus *Parastenelia* Thompson & Scott, 1903** 부요정노벌레 속

13. *Parastenelia spinosa* (Fischer, 1860)

14. *Parastenelia pyriformis* Song, Kim & Chang, 2003 배부요정노벌레

**Family Dactylopusiidae Sars, 1905** 발톱장수노벌레 과

**Genus *Dactylopusia* Norman, 1903** 발톱장수노벌레 속

15. *Dactylopusia pauciarticulata* Chang & Song, 1997

**Genus *Paradactylopodia* Lang, 1948**

16. *Paradactylopodia koreana* Chang & Song, 1997

**Family Hamondiidae Huys, 1990** 하몬드장수노벌레과

**Genus *Ambunguipes* Huys, 1990** 양발톱노벌레 속

17. *Ambunguipes rufocincta* (Brady, 1880) 붉은양발톱노벌레

**Superfamily Thalestroidea Sars, 1905**

**Family Miraciidae Dana, 1846** 놀람장수노벌레 과

**Subfamily Diosaccinae Sars, 1906**

**Genus *Diosaccus* Boeck, 1873** 두주머니장수노벌레 속

18. *Diosaccus ezoensis* Itô, 1974 에조두주머니장수노벌레

**Genus *Sarsamphiascus* Huys, 2009**

19. *Sarsamphiascus kawamurai* (Ueda & Nagai, 2005)

**Genus *Schizopera* Sars, 1905 갈래장수노벌레 속**

20. *Schizopera clandestina* (Klie, 1924) 갈래장수노벌레

21. *Schizopera yeonghaensis* Karanovic & Cho, 2016

**Genus *Amphiascoides* Nicholls, 1941 부쌍낭장수노벌레 속**

22. *Amphiascoides coreanus* Lee, Soh & Suh, 2007 한국부쌍낭장수노벌레

**Genus *Dactylopodamphiascopsis* Lang, 1944 손다리쌍낭장수노벌레 속**

23. *Dactylopodamphiascopsis latifolius* (Sars, 1909) 넓은잎손다리장수노벌레

**Genus *Amonardia* Lang, 1944 세모뿔장수노벌레 속**

24. *Amonardia normani* (Brady, 1872) 세모뿔장수노벌레

25. *Amonardia coreana* Song, Rho & Kim, 2007 한국세모뿔장수노벌레

**Genus *Amphiascus* Sars, 1905**

- \*\*26. *Amphiascus* sp. nov.

**Genus *Bulbamphiascus* Lang, 1944 둥근쌍낭장수노벌레 속**

27. *Bulbamphiascus spinulosus* Mu & Gee, 2000 가시둥근쌍낭장수노벌레

- \*\*28. *Bulbamphiascus* sp. nov.

**Genus *Typhlamphiascus* Lang, 1944**

- \*\*29. *Typhlamphiascus* sp. nov. 1

- \*\*30. *Typhlamphiascus* sp. nov. 2

**Genus *Paramaphiascella* Lang, 1948 나도쌍낭장수노벌레 속**

- \*31. *Paramaphiacella fulvofasciata* Rosenfield & Coull, 1974 노랑나도쌍낭장수노벌레

**Genus *Sinamphiascus* Mu & Gee, 2000 신쌍낭장수노벌레 속**

32. *Sinamphiascus dominatus* Mu & Gee, 2000 우점신쌍낭장수노벌레

**Subfamily Steneliinae Brady, 1880****Genus *Wellstenhelia* Karanovic & Kim, 2014**

33. *Wellstenhelia clio* Karanovic & Kim, 2014

34. *Wellstenhelia erato* Karanovic & Kim, 2014

35. *Wellstenhelia qingdaoensis* (Ma & Li, 2011)

**Genus *Itostenhelia* Karanovic & Kim, 2014**

36. *Itostenhelia polyhymnia* Karanovic & Kim, 2014

**Genus *Willenstenhelia* Karanovic & Kim, 2014**

37. *Willenstenhelia thalia* Karanovic & Kim, 2014

**Family Thalestridae Sars, 1905 장군여왕노벌레 과****Subfamily Thalestrinae Sars, 1903****Genus *Amenophia* Boeck, 1865 아메노여왕노벌레 속**

38. *Amenophia orientalis* Ho & Hong, 1988

**Genus *Parathalestris* Brady & Robertson, 1873 부장군여왕노벌레 속**

39. *Parathalestris bulbiseta* Lang, 1965

40. *Parathalestris verrucosa* Itô, 1970 흑부장군여왕노벌레

41. *Parathalestris areolata* Itô, 1972 고리부장군여왕노벌레

42. *Parathalestris parviseta* Chang & Song, 1997 털부장군여왕노벌레

43. *Parathalestris jejuensis* Song & Hwang, 2010

**Genus *Phyllothalalestris* Sars, 1905 편장군여왕노벌레 속**

44. *Phyllothalalestris sarsi* Sewell, 1940 사스편장군여왕노벌레

**Subfamily Eudactylopusinae Willen, 2000****Genus *Eudactylopus* Scott A., 1909 진손가락여왕노벌레 속**

45. *Eudactylopus spectabilis* (Brian, 1923) 수진손가락여왕노벌레

46. *Eudactylopus andrewi* Sewell, 1940 앤드류진손가락여왕노벌레

**Superfamily Ameiroidea Boeck, 1865****Family Ameiridae Boeck, 1873 맵시장수노벌레 과****Genus *Ameira* Boeck, 1865 맵시장수노벌레 속**

47. *Ameira parvula* (Claus, 1866) *sensu* Chang, 2007 맵시장수노벌레

**Genus *Nitokra* Boeck, 1865 수려장수노벌레 속**

48. *Nitokra spinipes* Boeck, 1865 가시수려장수노벌레

49. *Nitokra affinis californica* Lang, 1965 유사수려장수노벌레

50. *Nitokra koreanus* Chang, 2007 수려장수노벌레

**Family Canthocamptidae Brady, 1880 딱정장수노벌레 과**

**Subfamily Canthocamptinae Brady, 1880****Genus *Mesochra* Boeck, 1865** 큰뿔장수노벌레 속51. *Mesochra suifunensis* Borutzky, 1952 큰뿔장수노벌레52. *Mesochra hinumaensis* Kikuchi, 1972 앞치마큰뿔장수노벌레**Family Lourinidae Monard, 1927** 매끈장수노벌레 과**Genus *Lourinia* Wilson, 1924** 매끈장수노벌레 속53. *Lourinia armata* (Claus, 1866) 병정매끈장수노벌레**Superfamily Cletodoidea T. Scott, 1905****Family Cletodidae T. Scott, 1905** 뿔장수노벌레 과**Genus *Enhydrosoma* Boeck, 1873** 날씬뿔장수노벌레 속54. *Enhydrosoma curticauda* Boeck, 1873 잘린꼬리뿔노벌레55. *Enhydrosoma coreana* Kim, Trebukhova, Lee & Karanovic, 201456. *Enhydrosoma robustum* Karanovic, Kim & Lee, 2015**Genus *Limnocletodes* Borutsky, 1926** 기수뿔장수노벌레 속57. *Limnocletodes behningi* Borutsky, 1926 기수뿔장수노벌레58. *Limnocletodes angustodes* Shen & Tai, 1963 작대기뿔장수노벌레**Genus *Kollerua* Gee, 1994** 꼬마뿔장수노벌레 속59. *Kollerua longum* (Shen & Tai, 1979) 꼬마뿔장수노벌레**Genus *Strongylacron* Gee & Huys, 1996**\*\*60. *Strongylacron glabrum* Kim, Jung & Yoon, 2016**Genus *Paracrenhydrosoma* Gee, 1999**61. *Paracrenhydrosoma kiai* Song, Dahms, Lee, Ryu & Khim, 2014**Genus *Geehydrosoma* Kim, Trebukhova, Lee & Karanovic, 2014**62. *Geehydrosoma intermedia* (Chislenko, 1978)**Family Nannopodidae Brady, 1880****Genus *Huntemannia* Poppe, 1884**63. *Huntemannia doheoni* Song, Rho & Kim, 2007**Genus *Nannopus* Brady, 1880**\*\*64. *Nannopus* sp. nov.

**Family Rhizothricidae Por, 1986 모래털노벌레과****Genus *Rhizothrix* Brady & Robertson, 1876 모래털노벌레 속**65. *Rhizothrix sejongi* Nam & Lee, 2005 세종모래털노벌레**Superfamily Laophontoidea T. Scott, 1905****Family incertae sedis****Genus *Apolethon* Wells, 1967 나도갈고리노벌레 속**66. *Apolethon articulatus* Lee & Chang, 2008**Genus *Laophontoidea* gen. nov.**\*\*67. *Laophontoidea* gen. nov. & sp. nov.**Family Laophontidae T. Scott, 1904 가혹노벌레 과****Subfamily Laophontinae T. Scott, 1905****Genus *Laophonte* Phillippe, 1840 가혹노벌레 속**68. *Laophonte cornuta* Phillippi, 1840 큰가혹노벌레69. *Laophonte inopinata* A. Scott, 1902 못난마디가혹노벌레**Genus *Heterolaophonte* Lang, 1948 이형가혹노벌레 속**70. *Heterolaophonte discophora* (Willey, 1929) *sensu* Itô, 1974 꼬인이형가혹노벌레**Genus *Paralaophonte* Lang, 1948 부가혹노벌레 속**71. *Paralaophonte congenera* (Sars, 1908) 동종부가혹노벌레**Genus *Jejulaophonte* Back & Lee, 2014**72. *Jejulaophonte hyeopjaeensis* Back & Lee, 2014**Family Normanellidae Lang, 1944****Genus *Normanella* Brady, 1880**\*\*73. *Normanella* sp. nov.**Family Orthopsyllidae Huys, 1990 정벼룩노벌레 과****Genus *Orthopsyllus* Brady & Robertson, 1873 정벼룩노벌레 속**74. *Orthopsyllus cf. linearis* (Claus, 1866) 선상정벼룩노벌레**Infraorder Podognonta****Family Cletopsyllidae Huys & Willems, 1999 어리뿔노벌레 과****Genus *Isocletopsyllus* Huys & Lee, 1999 어리뿔노벌레붙이 속**

75. *Isocletopsyllus maximus* Song, Kim & Hwang, 2010 큰어리뿔노벌레불이

**Superfamily Ectinosomatoidea Sars, 1903**

**Family Ectinosomatidae Sars, 1903**

**Genus Microsetella Brady & Robertson, 1873 작은뿔노벌레 속**

76. *Microsetella norvegica* (Boeck, 1865) 노르웨이작은뿔노벌레

**Genus Halectinosoma Vervoort, 1962 모래날씬장수노벌레 속**

\*77. *Halectinosoma perforatum* Itô, 1981 구멍모래날씬장수노벌레

\*\*78. *Halectinosoma* sp. nov.

**Infraorder Exanechentera Lang, 1944**

**Idyanthidimorpha Seifried, 2003**

**Family Zosimeidae Seifried, 2003**

**Genus Zosime Boeck, 1973**

\*\*79. *Zosime destituta* Kim, Jung & Yoon, 2016b

**Superfamily [as yet unnamed in Wells (2007)]**

**Family Paramesochridae Lang, 1944**

**Genus Remanea Klie, 1929**

80. *Remanea naksanensis* Back, Lee & Huys, 2011

**Genus Wellsopsyllus Kunz, 1981**

81. *Wellsopsyllus (Scotropsyllus) koreanus* Back & Lee, 2014

**Superfamily Tachidioidea Boeck, 1865**

**Family Tachidiidae Boeck, 1865 날래장수노벌레 과**

**Genus Tachidius Lilljeborg, 1853 날래장수노벌레 속**

82. *Tachidius discipes* Giesbrecht, 1881 날래장수노벌레

**Genus Microarthridion Lang, 1944 조막마디날래장수노벌레 속**

\*83. *Microarthridion littorale* (Poppe, 1881) 조막마디날래장수노벌레

84. *Microarthridion litospinatus* Shen & Tai, 1973 가시날래장수노벌레

**Genus Neotachidius Shen & Tai, 1963 세모날래장수노벌레 속**

85. *Neotachidius coreanus* Huys, Ohtsuka, Conroy-Dalton & Kikuchi, 2005

고려세모날래장수노벌레

86. *Neotachidius parvus* Huys, Ohtsuka, Conroy-Dalton & Kikuchi, 2005

작은세모날慨장수노벌레

**Superfamily Tisboidea Stebbing, 1910**

**Family Peltidiidae Claus, 1860** 갑옷장수노벌레 과

**Subfamily Peltidiinae Claus, 1860**

**Genus *Peltidium* Philippi, 1839** 갑옷장수노벌레 속

87. *Peltidium quinquesetosum* Song & Yun, 1999 오가시갑옷장수노벌레

**Genus *Alteutha* Baird, 1846** 고갑옷장수노벌레 속

88. *Alteutha depressa* (Baird, 1837) 납작고갑옷장수노벌레

\*\*89. *Alteutha* sp. nov.

**Genus *Alteuthella* A. Scott, 1909**

\*\*90. *Alteuthella* sp. nov.

**Genus *Alteuthoides* Hicks, 1986** 비고갑옷장수노벌레 속

91. *Alteuthoides affinis* Kim & Kim, 1998 우리비고노벌레

**Family Tegastidae Sars, 1904**

**Genus *Syngastes* Monard, 1928** 넓은배장수노벌레 속

\*\*92. *Syngastes multicavus* Kim, Jung & Yoon, 2016 구멍넓은배장수노벌레

\*\*93. *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016 나도구멍넓은배장수노벌레

**Family Porcellidiidae Boeck, 1865** 딱정노벌레 과

**Genus *Porcellidium* Claus, 1860** 딱정노벌레 속

94. *Porcellidium ofunatense* Harris & Iwasaki, 1996 오후나토딱정벌레

95. *Porcellidium brevicavum* Kim & Kim, 1997 짧은구멍딱정노벌레

**Genus *Kushia* Harris & Iwasaki, 1996**

96. *Kushia gamoi* (Harris & Iwasaki, 1996) 가모딱정노벌레

**Genus *Kensakia* Harris & Iwasaki, 1996**

97. *Kensakia acuta* Kim & Kim, 1997 뾰족뿔딱정노벌레

**Family Tisbidae Stebbing, 1910** 티스베노벌레 과

**Genus *Scutellidium* Claus, 1866** 방패노벌레 속

98. *Scutellidium longicauda acheloides* Itô, 1976 마녀긴꼬리방패노벌레

## 2) 종의 기재 및 검색표

Order Harpacticoida Sars, 1903 갈고리노벌레 목

Suborder Polyarthra Lang, 1944

Family Longipediidae Boeck, 1865 긴다리노벌레 과

Genus *Longipedia* Claus, 1862 긴다리노벌레 속

모식종: *Longipedia coronata* Claus, 1863

### 1. *Longipedia weberi* A. Scott, 1909 *sensu* Yoo & Lee, 1995

*Longipedia weberi* A. Scott, 1909 *sensu* Yoo & Lee, 1995, figs. 1–4.

[non] *Longipedia weberi* A. Scott, 1909, p. 196, pl. 59, figs. 9–12; Ito, 1980, p. 19, figs. 1–28.

관찰재료: 5♀♀, 1♂, 경기 옹진군 영흥면 외리, 용담리해수욕장(사질, 니질), 2012.7.17.

고찰: Yoo & Lee (1995)는 서해의 시화호에서 암컷 1 개체를 기준으로 *Longipedia weberi*로 동정, 기재한 바 있다. 본 연구에서 시화호의 근접 지역인 영흥도에서 *Longipedia weberi* A. Scott, 1909 *sensu* Yoo & Lee, 1995 와 잘 일치하는 시료를 채집, 관찰 할 수 있었다. 이 속의 정확한 동정을 위한 주요 형질로 Chullasorn & Kangtia (2008)는 복절의 잔가시열의 배열과 hyaline frill의 형태, 제 2 흉지 내지의 강모식과 형태, 그리고 제 5 흉절의 모형과 강모의 수를 제시한바 있다. Yoo & Lee (1995)의 기재와 그림은 매우 간략하여 본 연구의 시료와 위의 형질들의 일치 여부를 확인할 수는 없었지만, 이들은 대부분의 부속지의 강모식과 형태에서 서로 잘 일치하였다. 그러나 이들은 Itô (1980)에 의해 기록된 일본산 종 *L. weberi* *sensu* Itô, 1980 와는 차이를 보였다. Itô (1980)의 암컷은 생식절의 배쪽 hyaline frill이 잘 발달된 잔가시열로 장식이 되어있지만, 본 연구의 영흥도 시료는 매우 약한 잔가시열을 가지고 있었다. 암컷 제 5 흉지 외지의 너비에 대한 길이의 비는 *L. weberi* *sensu* Yoo & Lee, 1995 에서 약 1.8 배, *L. weberi* *sensu* Itô, 1980 에서 약

2.6 배로 서로 차이를 보였다. 또한, 일본산 수컷은 제 5 흉지 외지에 총 8 개의 강모를 가지나, 영릉도 시료는 총 7 개의 강모를 가지고 있었다. 이러한 중요한 형질의 차이는 Yoo & Lee (1995)가 오동정하였기 때문인 것으로 판단된다. 긴다리노벌레 속(*Longipedia*)의 종들은 우리나라 서해안과 남해안의 니질과 사질이 혼합된 저질에서 흔히 출현하는 것으로 여겨진다. 이 속에 대한 분류학적 연구가 지속적으로 이루어진다면 이 종 이외에도 다수의 긴다리노벌레 속의 종들이 기록될 것이다.

### Family Canuellidae Lang, 1944 카누노벌레 과

#### 한국산 카누노벌레 과(Canuellidae)의 속에 대한 검색표

1. 제 4 흉지 내지의 마지막 마디에 3 개의 강모/가시를 가진다.....집게살이노벌레 속 *Sunaristes*
  - 제 4 흉지 내지의 마지막 마디에 4 개의 강모/가시를 가진다. ....2
2. 제 3 흉지 외지의 세 번째 마디에 4 개의 강모/가시를 가진다; 제 1 흉절은 두흉절과 융합한다 .....*Brianola*
  - 제 3 흉지 외지의 세 번째 마디에 5 개의 강모/가시를 가진다; 제 1 흉절은 두흉절과 융합하지 않는다 .....스코트노벌레 속 *Scottolana*

### Genus *Brianola* Monard, 1926

모식종: *Brianola stebleri* (Monard, 1926)

#### 2. *Brianola* sp. nov. (Figs. 8–14)

**Type locality.** Korea, Gyeongsangnam-do Province: Namhae-gun County, Sangju-myeon, Sangju-ri, Sangju beach, 34°43.209'N, 127°59.438'E. Sand sediment in intertidal zone.

**Material examined.** Holotype ♀ (NIBRIV0000713448) and allotype ♂ (NIBRIV0000713449) dissected on each slide. Paratypes: 5♀♀, 8♂♂ (NIBRIV0000713450) preserved together in 99.9 % ethanol solutions. 2♀♀, 2♂♂ were examined under SEM. All specimens were collected from the type locality by J.G. Kim on 3 October 2013.

**Description. Female.** Habitus (Fig. 8A, B) elongate, cylindrical, without constriction between prosome and urosome; total length measured from tip of rostrum to posterior margin of caudal rami about 1,220  $\mu\text{m}$ ; greatest width at posterior part of cephalothorax about 200  $\mu\text{m}$  in dorsal view.

Rostrum (Fig. 8H) large, bell-shaped, separated from cephalothorax at its base; tip with subdistally vestige of 2 sensilla and dorsal surface with 6 pairs of small papilla.

Prosome (Fig. 8A, B) composed of cephalothorax and 3 free pedigerous somites. First pedigerous somite fused with cephalothorax. Cephalothorax about 250  $\mu\text{m}$  in dorsal view, length/width ratio about 1.25, with 5 pairs of sensilla along posterior and ventral margins. Free pedigerous somites narrower than cephalothorax. First free somite with 1 pair of sensilla on dorsal surface and 3 pairs of sensilla along posterior margin. Second free somite as long as preceding one, with 1 pair of sensilla on dorsal surface and 3 pairs of sensilla along posterior margin. Third free somite smaller than preceding one; dorsal surface with 1 pair of sensilla and 2 rows of minute spinules; posterior margin with 3 pairs of sensilla.

Urosome (Figs. 8A–C, 14A–C) composed of fifth leg bearing somite, genital double-somite and 3 free abdominal somites. Fifth leg bearing somite small, with 6 sensilla on dorsal surface and 1 row of minute spinules on lateral surface. Genital double-somite elongate, length/width ratio about 1.3 in dorsal view; lateral surface with chitinous ridge; genital somite with 1 pair of sensilla and 1 pair of spinular rows on dorsal surface, and 1 pair of spinular rows on ventral surface; genital apertures (Fig. 8C, D) located anteriorly on ventral surface, produced; each genital pore with 1 seta representing P6; third urosomite with 2 pairs of sensilla on dorsal surface and 1 pair of spinular rows on ventral surface; hyaline frill narrow and crenulate dorsally, but wide and serrate ventrally. Fourth urosomite, anterior surface with 2 rows of minute spinules, and dorsal surface with 1 pair of sensilla; hyaline frill narrow and crenulate dorsally, but wide and serrate ventrally. Fifth urosomite with 2 rows of minute spinules on anterior surface; hyaline frill serrate; pseudoperculum (Fig. 8F) with deeply

serrated posterior margin. Anal somite (Fig. 8F) very small about 0.25 times as long as preceding one; hyaline frill narrow and crenulate.

Caudal rami (Figs. 8F, G, 14C) cylindrical, tapering posteriorly, about 2.0 times as long as greatest width, with 1 pair of spinular rows on lateral surface; distal margin of ventral surface produced as lancet-shape. Seta I very small, inserted at about 1/4 of ventral surface. Seta II small, located around distal margin of dorsal surface. Seta III long, about 2.5 times as long as seta II, inserted ventrally at distal corner of inner margin. Terminal setae IV and V well developed; seta V about 2 times longer than seta IV. Seta VI small, as long as seta II. Seta VII bi-articulate at its base, small, as long as seta II, inserted dorsally at distal corner of inner margin.

Antennule (Fig. 9A) short, robust, 4-segmented. First segment with 1 unipinnate, 2 bare setae. Second segment longest, with incomplete demarcation proximally, having 26 setae (15 bare, 5 short spinulose, 2 long spinulose, 2 long plumose, and 2 unipinnate) and 2 aesthetascs. Third segment small, with 2 spinulose setae. Forth segment elongate, with 7 spinulose and 5 bare setae.

Antenna (Fig. 9B). Coxa broad, with several spinules on lateral margin. Basis slightly longer than its width, with 1 row of spinules along abexopodal margin. Exopod 7-segmented, with 1 seta on third segment and 4 setae on distal segment; first segment fused with basis. Endopod 3-segmented; first segment about 2 times as long as width, with 1 seta distally; second segment small, with 2 long spinulose and 1 long pinnate setae, and 2 small bare setae; third segment with several spinules on surface; distal armature of third segment composed of 2 long spinulose, 4 long pinnate and 1 small bare setae.

Labrum (Fig. 9C) hexagonal; posterior surface with 1 pair of setule rows and 1 pair of setule groups; distal margin with 1 pair of setule groups.

Mandible (Fig. 10A) with strong gnathobase having several multicuspid teeth, 3 spinules, and 1 unipinnate seta. Palp comprising basis, exopod and endopod; basis elongate, with 2 long setae on lateral margin and 1 row of setules on distal margin; exopod 2 segmented, proximal segment with 1 long seta and 1 row of setule, distal segment with 1 lateral and 3 apical plumose setae; endopod 2-segmented, proximal segment with 3 setae, distal segment with 6 spinulose and 2 bare setae.

Maxillule (Fig. 10B). Praecoxal arthrite well-developed, with 6 spines and 2 setae; anterior surface with 2 parallel setae, posterior surface with 1 group of small spinules. Coxa with 3 long plumose setae on outer margin and 1 endite bearing 3 plumose apical setae. Basis broad, with 1 row of delicate setules on surface and 2 endites; proximal endite with 2 plumose, 1 unispinulose and 1 bare setae; distal endite with 3 plumose and 1 bare setae. Exopod 1-segmented, broad, with 6 plumose and 1 spinulose setae. Endopod 2-segmented; proximal segment with 1 plumose and 2 spinulose setae; distal segment with 3 plumose, 2 spinulose and 1 bare setae.

Maxilla (Fig. 10C). Praecoxa with 2 endites; proximal endite with 4 plumose apical setae, distal endite with 2 spinulose setae. Coxa smaller than preceding one, with 2 groups of small spinules and 2 endites; proximal endite small with 3 spinulose apical setae; distal endite elongate with 3 spinulose apical setae. Allobasis drawn out into claw, with 1 slender seta on distal margin and 1 unispinulose, 1 bare setae on surface; claw with accessory armature consisting of 2 plumose and 1 spine-like setae. Endopod 1-segmented, with 5 bare, 3 unipinnate and 1 plumose setae.

Maxilliped (Fig. 10D) phyllopodial, 2-segmented. Syncoxa and basis fused, but with incomplete demarcation; syncoxa with 9 spinulose setae, basis with 3 spinulose setae; outer margin armed with fine setules, surface with 1 row of minute spinules. Endopod 1-segmented, with 3 plumose and 3 unispinulose setae.

P1 (Fig. 11A). Coxa with 4 rows of spinules on anterior surface, 1 row of setules on posterior surface, and 1 spinulose spines on inner margin. Basis smaller than preceding one, with 1 row of minute spinules on anterior surface, 1 plumose outer seta, and 1 pinnate inner spines; distal margin demarcated with endopod produced, serrated. Exopod 3-segmented; exp-1 with 1 row of spinules and 1 serrate spine on outer margin, and few setules on inner margin; exp-2 with 1 serrated spine and several spinules on outer margin, and 1 plumose seta and several setules on inner margin; exp-3 elongate with 1 serrate spine, 2 pinnate spines and several stout spinules on outer margin, bearing, 1 stout spinulose seta on apical margin, and 1 plumose seta on inner margin. Endopod 3-segmented, longer than exopod; enp-1 with several stout spinules at distal corner of outer margin, 1 large pore on anterior surface, and several setules and 1 plumose seta on inner margin; enp-2 with 1 group of stout spinules on anterior surface distally, and several setules and 1 long plumose seta on inner margin; enp-3

with 1 group of stout spinules and 2 spines on outer margin, several setules, 1 very small bare and 2 long plumose setae on inner margin, and 1 stout spinulose seta on apical margin.

P2 (Fig. 11B). Coxa large, with 3 rows of spinules and 1 row of minute spinules on anterior surface, 1 row of setules on posterior surface, 1 row of minute spinules on outer margin, and 1 row of stout spinules on distal margin; distal margin deeply serrate. Basis small, partially covered by coxal membrane, with 1 small outer seta; distal margin produced halfway into spinous process. Exopod 3-segmented; exp-1 with 1 spine on outer margin and 1 group of spinules on anterior surface; exp-2 with 1 group of spinules on anterior surface, 1 spine on outer margin, and 1 long plumose seta on inner margin; exp-3 with 2 spines and 1 group of spinules on outer margin, 1 plumose seta on inner margin, and 1 stout spinulose seta on apical margin. Endopod 3-segmented, longer than exopod; enp-1 with 1 group of spinules and 1 large pore on anterior surface, and several setules and 1 plumose seta on inner margin; enp-2 with group of stout spinules on outer margin and several setules, 1 long plumose seta on inner margin, and 1 pore on anterior surface; enp-3 with several stout spinules and 2 outer spines on outer margin, 2 long plumose setae on inner margin, 1 stout spinulose seta on apical margin, and 1 pore on anterior margin.

P3 (Fig. 12A). Coxa large, with 2 rows of spinules and 1 row of minutes spinules on anterior surface, 1 row of minute spinules on outer margin, and 1 row of stout spinules on distal margin; distal margin deeply serrate. Basis small, partially covered by coxal membrane, with 1 small outer seta; distal margin produced halfway into spinous process. Exopod 3-segmented; exp-1 with 1 spine on outer margin and 1 group of spinules on anterior surface; exp-2 with 1 group of spinules on anterior surface, 1 spine on outer margin, and 1 plumose seta on inner margin; exp-3 with 2 spines and 1 group of spinules on outer margin, 1 plumose seta on inner margin, 1 stout spinulose seta on apical margin, and 1 pore on anterior surface. Endopod 3-segmented, longer than exopod; enp-1 with 1 group of spinules and 1 large pore on anterior surface, and 1 plumose seta on inner margin; enp-2 with group of stout spinules on outer margin, 1 long plumose seta on inner margin, and 1 pore on anterior surface; enp-3 with several stout spinules and 2 outer spines on outer margin, 1 plumose seta on inner margin, 1 stout spinulose seta on apical margin, and 1 pore on anterior margin.

P4 (Fig. 12B). Coxa large, with 3 rows of spinules and 1 row of minute spinules on anterior surface, 1 row of spinules on posterior surface, 1 row of minute spinules on outer margin,

several spinules on inner margin, and 1 row of stout spinules on distal margin; distal margin deeply serrate. Basis small, partially covered by coxal membrane, with 1 small outer seta and 2 row of spinules posteriorly; distal margin produced halfway into spinous process. Exopod 3-segmented; exp-1 with 1 spine on outer margin, 1 row of spinules on inner margin, and 1 group of spinules on anterior surface; exp-2 with 1 group of spinules on anterior surface, 1 spine on outer margin, and few spinules on inner margin; exp-3 with 2 spines and 1 group of spinules on outer margin, 1 stout spinulose seta on apical margin, 1 small pectinate seta on inner margin, and 1 pore on anterior surface. Endopod 3-segmented, longer than exopod; enp-1 with 1 group of spinules and 1 pore on anterior surface, and 1 very small plumose seta on inner margin; enp-2 with 1 group of stout spinules on outer margin, several row of spinules on inner margin, and 1 pore on anterior surface; enp-3 with several stout spinules and 2 outer spines on outer margin, 1 row of spinules and 1 small pectinate seta on inner margin, 1 stout spinulose seta on apical margin, and 1 pore on anterior margin.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.113	1.1.312
P2	0.1.112	1.1.212
P3	0.1.112	1.1.112
P4	0.0.112	1.0.112

P5 (Fig. 8E) incorporated into somite, with 4 setae.

**Male.** Habitus (Fig. 13A) as in female; total length measured from tip of rostrum to posterior margin of caudal rami about 1,060 µm. Sexual dimorphism observed in antennule, urosomite and genital field.

Genital somite and third urosomite not fused (Fig. 13A, B). Genital somite with 2 pairs of spinular rows on dorsal surface and 1 pair of spinular rows; genital field located on posterior part of ventral surface. Third urosomite, lateral and ventral surfaces each with 1 row of spinules.

Genital field (Figs. 13E, 14D) covered by 2 triangular process bearing 3 stout spines and 1 row of spinules; P6 represented by 1 seta; copulatory pores paired, located at posterior of genital aperture.

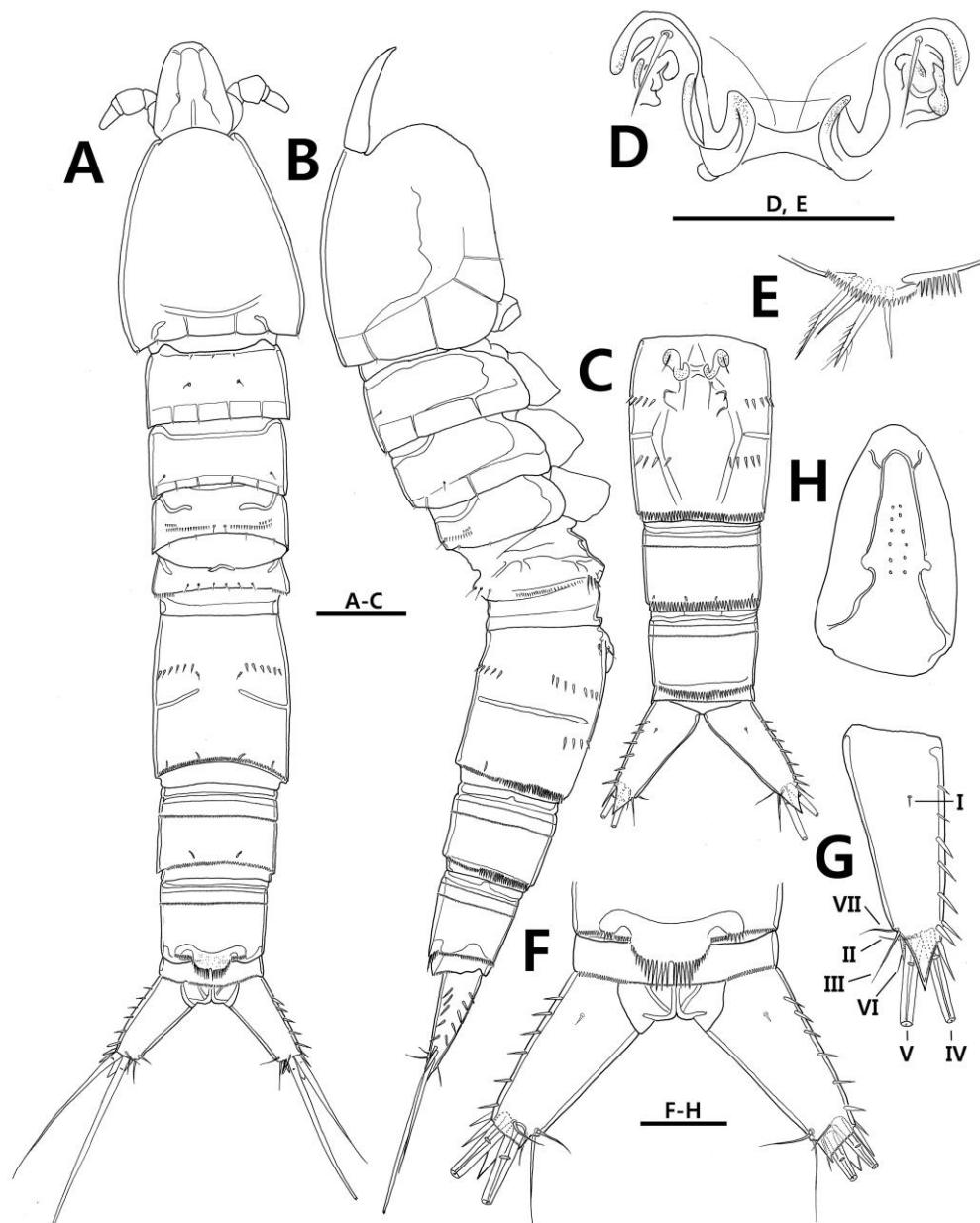
Antennule (Figs. 13C, D, 14E, F) 6-segmented, chirocer; first segment with 3 setae and 1 row of spinules; second segment largest, with 4 spinulose, 3 pinnate, 9 bare, and 1 aesthetasc; third segment smallest, with 2 spinulose setae and 1 aesthetasc; forth segment small, with 1 spinulose and 2 bare setae; fifth segment swollen, with 3 plumose, 2 pinnate and 2 bare setae; sixth segment claw-like, with 6 bare setae and 1 aesthetasc.

**Remarks.** At present, 8 valid species have been known in the genus *Brianola* Monard, 1926 (Table 1). The setal formula of thoracic legs is a key character used to distinguish *Brianola* species (Hamond 1973). Among *Brianola* species, three species represent unique setal formula: the P1 enp-3 of *B. stebleri* (Monard, 1926) has four setae/spines (vs. six setae/spines); the P1 exp-2 of *B. exigua* Por, 1967 has no inner seta (vs. one inner seta); the P4 enp-1 of *B. vangoethemi* Fiers, 1982 has no inner seta (vs. one inner seta) (Monard 1926; Por 1967; Fiers 1982). In the setal formula of thoracic legs, characteristic feature of the new species, *B. inconspicuus* sp. n., is identical to that of *B. sydneyensis* Hamond, 1973. However, the new species can be clearly distinguishable from the latter by the following characteristics: (1) the antennary exopod is seven-segmented (vs. six-segmented in *B. sydneyensis*); (2) the antennary exopod has one seta on the third segment and four setae on the seventh segment (vs. 1 setae on the second segment and three setae on the sixth segment in *B. sydneyensis*); (3) the pseudoperculum has convex distal margin (vs. concave distal margin in *B. sydneyensis*); (4) the outer spine on the P1 exp-1 is deeply serrate as that on P1 exp-2 (vs. naked in *B. sydneyensis*); (5) the proximal inner seta on the P1 enp-3 is very small, about 1/6 of the P1 enp-3 in length, and naked (vs. long, about as long as the P1 enp-3, and plumose in *B. sydneyensis*) (Hammond 1973).

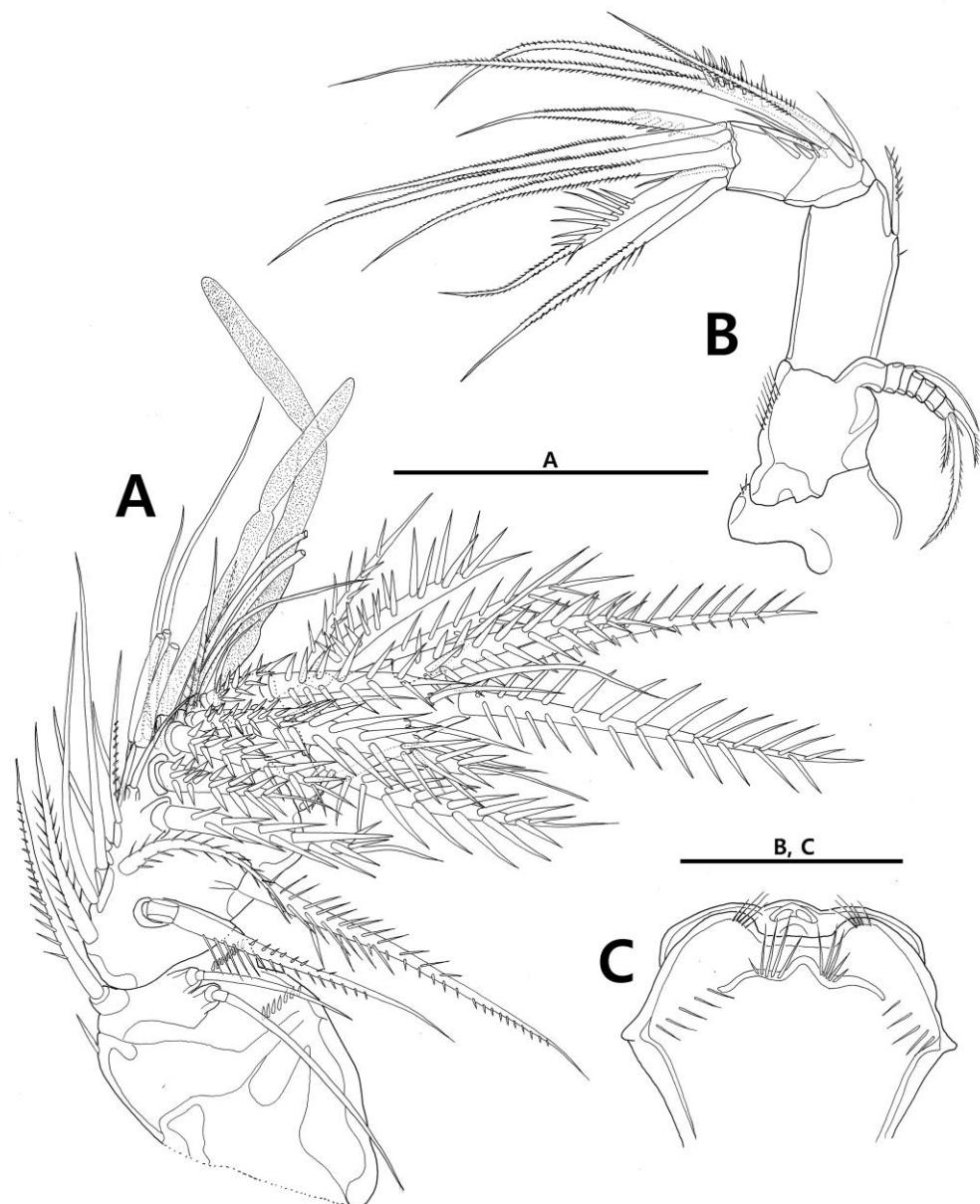
Wells & Rao (1987) have reported *B. sydneyensis* and *B. hamondi* Wells & Rao, 1987 from the Andaman and Nicobar Islands. They have mentioned that *B. hamondi* is very similar to *B. sydneyensis* in most aspects as well as thoracic legs (Wells & Rao 1987). However, according to their illustrations, there are two significant differences in the setal formula of thoracic legs between these two species as follows: (1) the P1 exp-3 of *B. hamondi* has two outer spines compared to three outer spines in *B. sydneyensis* (see Hamond 1973, Fig. 29; see Wells & Rao 1987, Fig. 5a); (2) the P2 exp-3 of *B. hamondi* has one small inner halfway seta, whereas it is absent in *B. sydneyensis* (see Hamond 1973, Fig. 38; see Wells & Rao 1987, Fig. 5b). Although these major differences existed, Wells & Rao (1987) only discussed some minor

differences between the two species in the genital field, body length, abdominal ornamentation, and the feature of thoracic setae and spines without commenting on these major differences. On the other hand, they have mentioned that Hamond's (1973) original description of *B. sydneyensis* is completely accurate after comparing their materials of *B. sydneyensis* collected from the Andaman and Nicobar Islands to two paratype females of Hamond's (1973) collection without providing description or figures on the thoracic legs of *B. sydneyensis*. The proximal outer seta on the P1 exp-3 is present in *B. sydneyensis* (Hamond 1973). However, it is absent in *B. hamondi* (Wells & Rao 1987). If it is correct that the setal formula of thoracic legs are identical in the two species as referred by Wells & Rao (1987), the proximal outer seta on P1 exp-3 of *B. hamondi* might have been missed or omitted in the original description (Hamond 1973). The small inner seta on the P2 exp-3 absent in *B. sydneyensis* was clearly described in the illustration of *B. hamondi* (Hamond 1973; Wells & Rao 1987). This is an important problem in taxonomy because the total number of the setae and spines on P2 exp-3 is presently considered as one of the key characteristics for the identification of canuellid genera (Huys 1995; Boxshall & Halsey 2004). To resolve this problem, it is necessary to study the type materials or the materials from type localities of *B. sydneyensis* and *B. hamondi*.

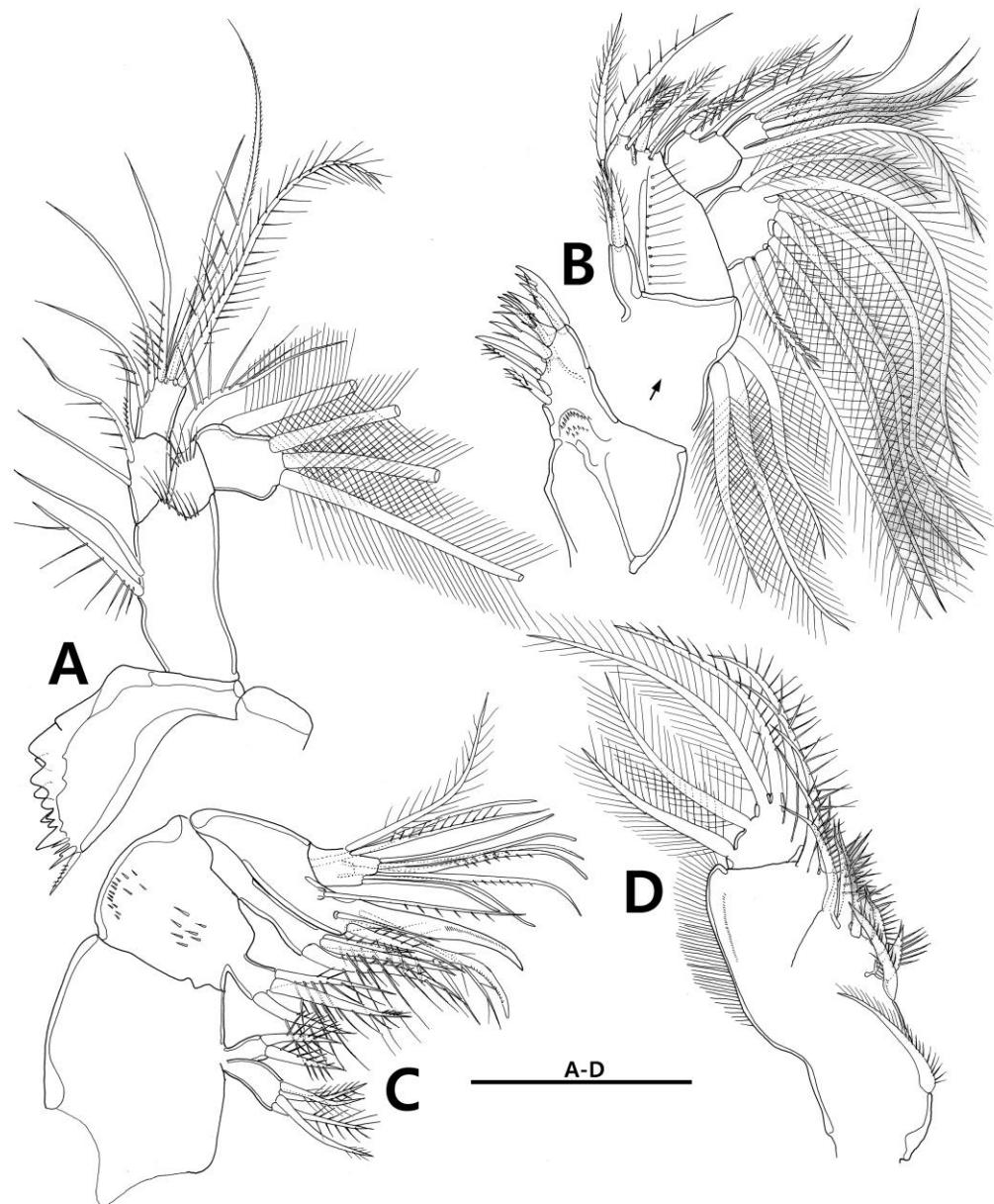
Wells & Rao (1987) have given attention to detailed features of abdominal ornamentation and elements on the thoracic legs to distinguish *B. hamondi* from *B. sydneyensis*. Such fine characteristics are also considered as key characteristics to separate species in other harpacticoid genera (Clément & Moore 1995; Mu & Gee 2000; Karanovic & Cho 2012; Karanovic & Kim 2014). Even though the setal formula of *B. hamondi* are indeed identical to those of *B. sydneyensis*, the new species, *B. inconspicuus* sp. nov., can be discriminated from *B. hamondi* by the following character states: (1) the genital double-somite is fused dorsally (vs. separated in *B. hamondi*); (2) both urosomites 4 and 5 have two rows of spinules on surface throughout (vs. two rows of spinules are present on only lateral surface in *B. hamondi*); (3) the proximal outer spine on P1 exp-3 is deeply serrate (vs. finely serrate in *B. hamondi*); (4) the inner seta on P4 exp-1 is elongate and plumose (vs. bulbous and naked in *B. hamondi*).



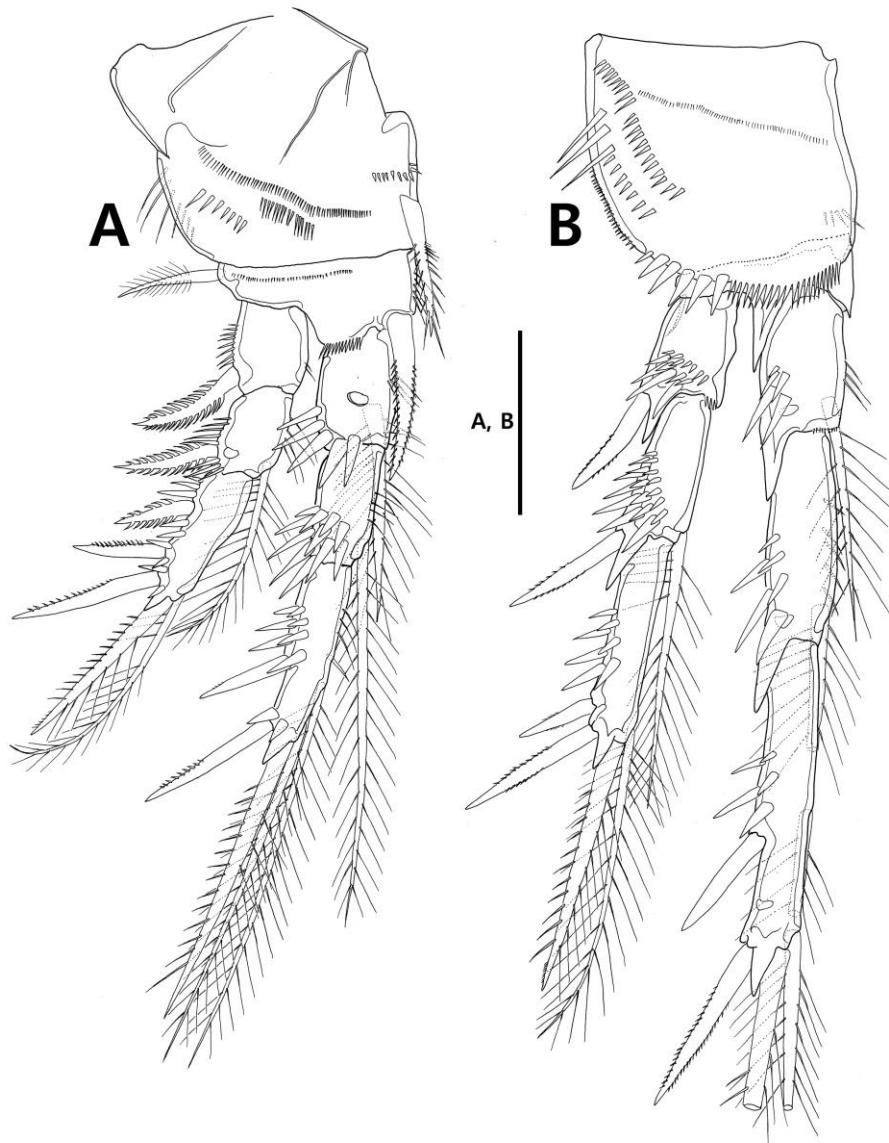
**Fig. 8.** *Brianola* sp. nov., female. A, habitus, dorsal; B, habitus, lateral; C, urosome except for P5-bearing somite; D, genital field; E, P5; F, pseudoperculum, anal somite and caudal rami, dorsal; G, caudal rami, ventral; H, rostrum, dorsal. Scale bars: 50 µm (D–H); 100 µm (A–C).



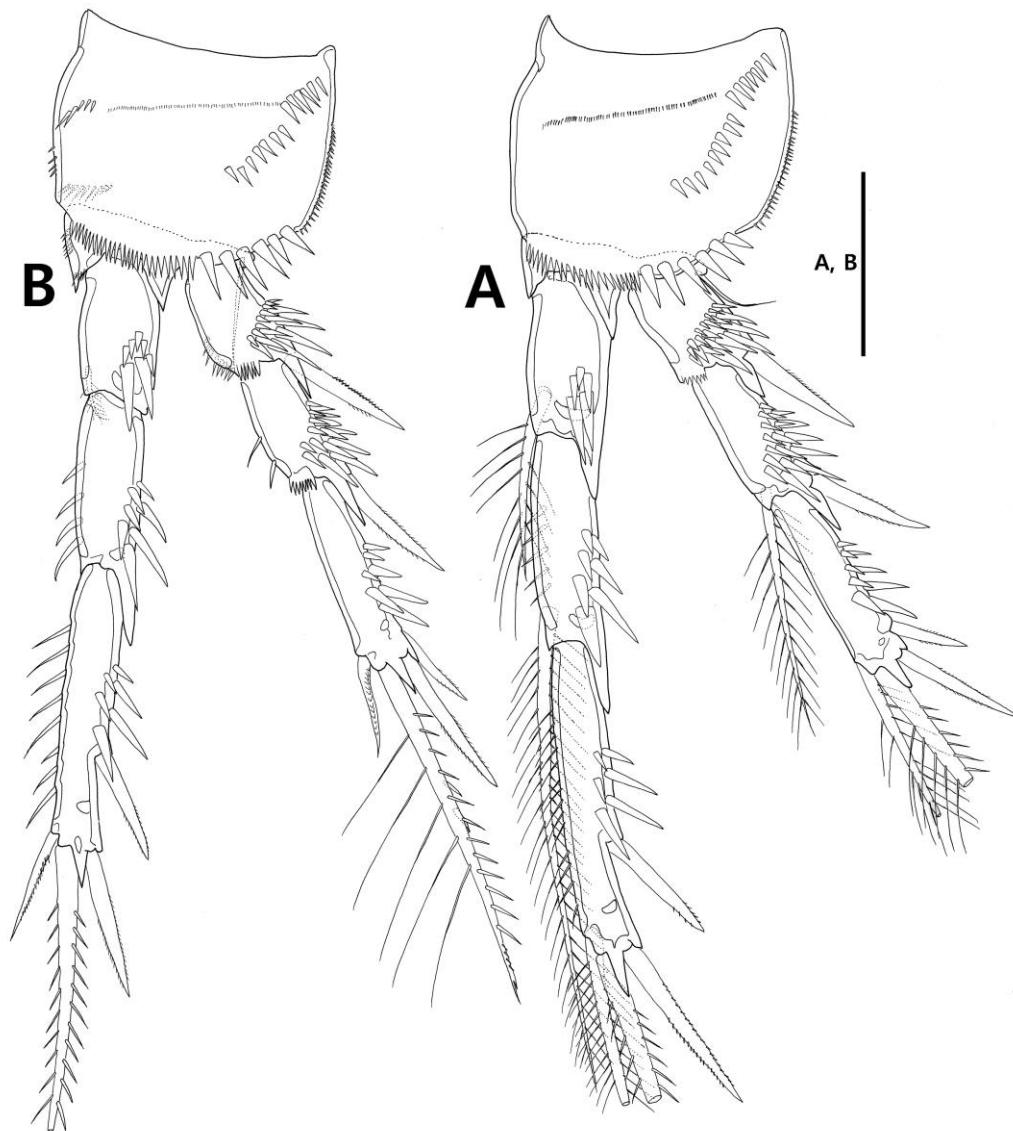
**Fig. 9.** *Brianola* sp. nov., female. A, antennule; B, antenna; C, labrum. Scale bars: 50  $\mu\text{m}$ .



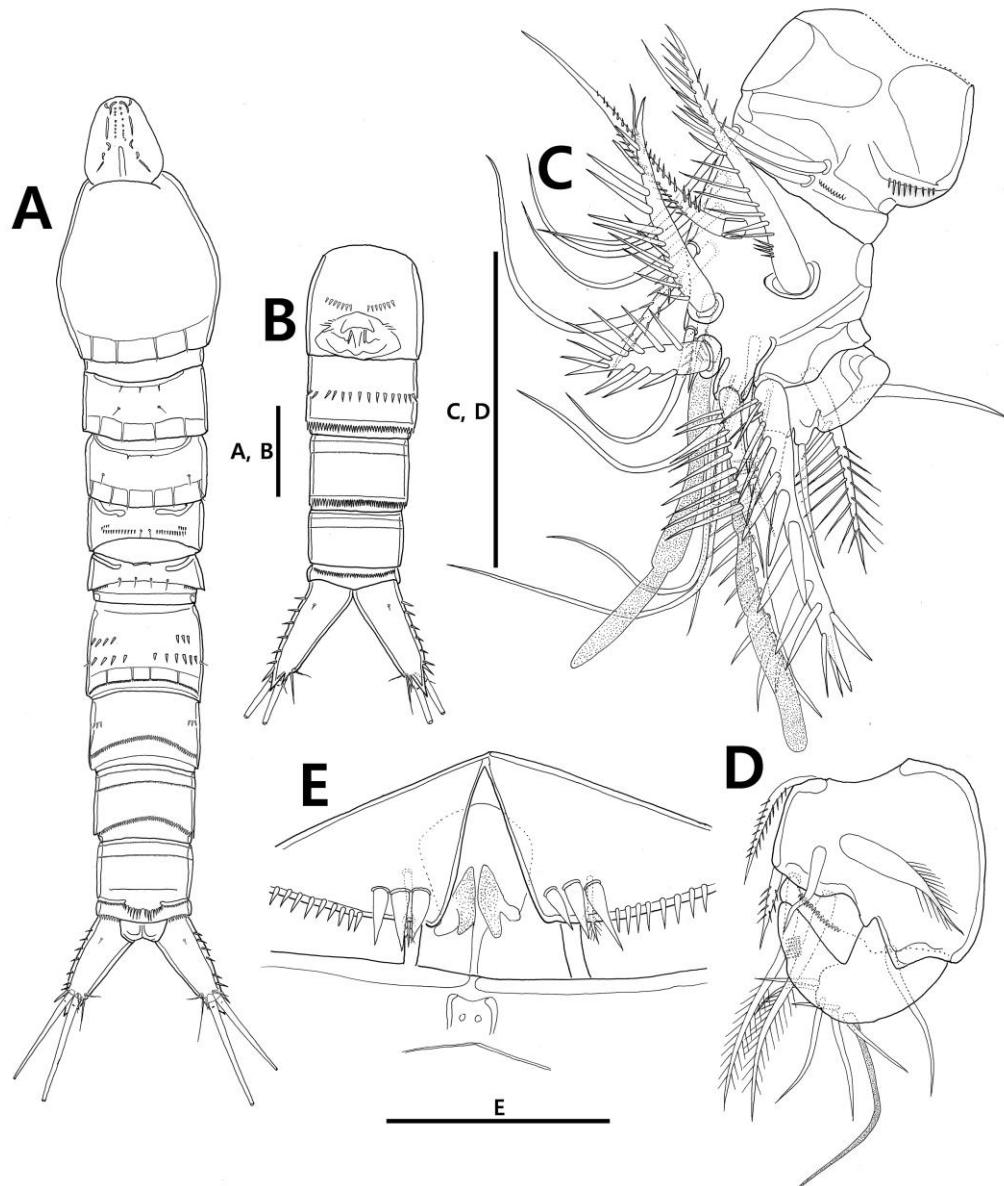
**Fig. 10.** *Brianola* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, maxilliped. Scale bar: 50  $\mu$ m (A–D).



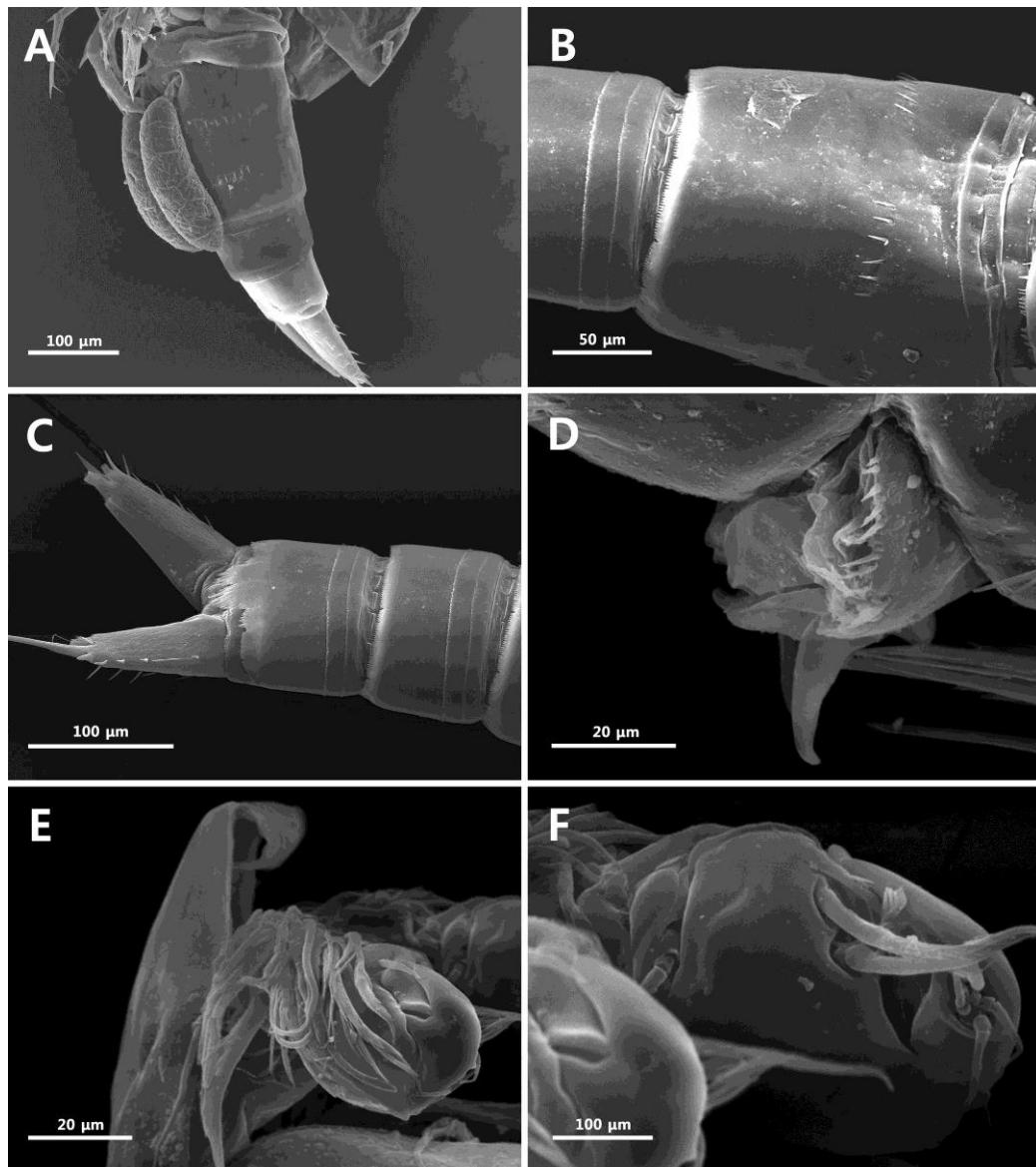
**Fig. 11.** *Brianola* sp. nov., female. A, P1; B, P2. Scale bar: 50  $\mu$ m.



**Fig. 12.** *Brianola* sp. nov., female. A, P3; B, P4. Scale bar: 50  $\mu\text{m}$ .



**Fig. 13.** *Brianola* sp. nov., male. A, habitus, dorsal; B, urosome except for P5-bearing somite, ventral; C, antennular segments 1–4; D, antennular segments 5 and 6; E, genital field. Scale bars: 50 µm (C–E); 100 µm (A, B).



**Fig. 14.** Scanning electron micrographs of *Brianola* sp. nov. Female (A–C): A, urosome, lateral; B, genital double somite, dorsal; C, urosomites 4 and 5, anal somite, and caudal rami, dorsal. Male (D–F): D, genital field, lateral; E, rostrum and antennule; F, inner surface of the antennular segments 5 and 6.

**Table 1.** Comparison of the morphological characteristics of species in the genus *Brianola* Monard, 1926

	<i>B. stebleri</i> (Monard, 1926)	<i>B. reichi</i> (Por, 1964)	<i>B. exigua</i> Por, 1967	<i>B. curvirostris</i> Bozic, 1968	<i>B. elegans</i> Hamond, 1973	<i>B. sydneyensis</i> Hamond, 1973	<i>B. vangoethemi</i> Fiers, 1982	<i>B. hamondi</i> Wells & Rao, 1987	<i>Brianola</i> sp. nov.
<b>Body length ♀ (μm)</b>	900-1040	1000	810	700	970	1,430	1,140	865-1120	820
length ♂ (μm)	750	970	810	-	800	1,380	780	631-642	690
<b>A2, exopod</b>	6-seg	-	6-seg.	7-seg.	5 or 6-seg.	6-seg.	7-seg.	-	7-seg.
Coxa	1	1	0	0	0	1	1	1	1
<b>Setal formula</b>	<b>P1</b> exp	0.1.5	0.1.4	0.0.4	0.1.6	0.1.6	0.1.5	0.1.4	0.1.5
	enp	1.1.4	1.1.5	1.1.6	1.1.6	1.1.6	1.1.6	1.1.6	1.1.6
<b>P2</b>	exp	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4	0.1.5	0.1.4
	enp	1.1.5	1.1.4	1.1.5	1.1.5	1.1.5	1.1.5	1.1.5	1.1.5
<b>P3</b>	exp	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4	0.1.4
	enp	1.1.4	1.1.4	1.1.4	1.1.4	1.1.4	1.1.4	1.1.4	1.1.4
<b>P4</b>	exp	0.0.4	0.0.4	0.0.4	0.0.4	0.0.4	0.0.4	0.0.4	0.0.4
	enp	1.0.4	1.0.4	1.0.4	1.0.4	1.0.4	1.0.4	1.0.4	1.0.4
<b>Genital double-somite in dorsal</b>	-	-	fused	separate	separate	fused	separate	fused	fused
<b>Pseudoperculum</b>	convex	convex	convex	convex	convex	concave	concave	convex	convex
<b>Caudal rami, Length:width ♀</b>	2.7	3.0	2.0	1.9	1.9	1.8	1.9	1.8	2.0
<b>Reference</b>	Monard 1926; Por 1964	Por 1964	Por 1967	Bozic 1968	Hamond 1973	Hamond 1973	Fiers 1982	Wells & Rao 1987	present study

## Genus *Scottolana* Huys, 2009 스코트노벌레 속

모식종: *Scottolana geei* (Mu & Huys, 2004)

### 한국산 스코트노벌레 속(*Scottolana*)의 종에 대한 검색표

1. 이마뿔의 끝은 둥글다; 수컷 제 4 흉지 내지의 두 번째 마디는 성적이형을 보이지 않는다 ..... 둉근털스코트노벌레 *S. bulbifera*  
- 이마뿔의 끝은 삼각형 모양이다; 수컷 제 4 흉지 내지의 두 번째 마디는 성적이형을 보인다..... *Scottolana* sp. nov.

### 3. *Scottolana bulbifera* (Chislenko, 1971) 둉근털스코트노벌레

*Canuella bulbifera* Chislenko, 1971, p. 151, figs. 1–4.

*Scottolana bulbifera*: Mu & Huys, 2004, p. 18, figs. 13–23; Park & Lee, 2011, p. 67, figs. 1–6; Lee et al., 2012, p. 9, figs. 2–7.

**관찰재료:** 2♀♀, 다박포선착장, 전남 해남군 화산면 평호리(갯벌), 2015.5.1; 5♀♀, 3♂♂, 전남 순천 여자만( $34^{\circ}40'8''N$ ,  $127^{\circ}32'3.99''E$ ; 수심 12m, 니질), 2015.5.11; 14♀♀, 4♂♂, 전남 강진군 도암면 신기리, 2016.5.6.

**분포.** 한국, 중국(발해만), 러시아(포셋만).

**고찰.** 한반도 주변 조하대에서 주로 서식하고 있는 것으로 보고되었으나(Lee et al. 2012), 본 연구에서는 해남의 조간대 갯벌에서도 채집, 확인되었다. 본 연구에서 관찰된 표본은 Mu & Huys (2004)와 Lee et al. (2012)의 기재문들과 잘 일치하였다.

### 4. *Scottolana* sp. nov. (Figs. 15–21)

**Type locality.** Korea, Jeollanam-do Province: Wando-gun County, Sinji-myeon, Daegok-ri, Myeongsasipri beach ( $34^{\circ}19.533'N$ ,  $126^{\circ}49.666'E$ ). Sand sediment in intertidal zone.

**Material examined.** Holotype ♀ (NIBRIV0000713482) and allotype ♂ (NIBRIV0000713483) dissected on each slide. Paratypes: 1 ♀ (NIBRIV0000713484) undissected on a hole slide; 5♀, 2♂ preserved together in 99.9 % ethanol solution (NIBRIV0000713485). 3♀ were examined under SEM. All specimens were collected from the type locality by T.W. Jung on 14 June 2011.

**Description. Female.** Habitus (Fig. 15A) elongate, robust, without constriction between prosome and urosome; total length 1,850 µm including tip of rostrum and posterior margin of caudal rami; greatest width measured at P2-bearing somite, about 589.5 µm. Body covered with paired sensilla.

Rostrum (Fig. 15B) long, large, about half of cephalosome; anterior margin triangular in shape, with pointed tip.

Prosome (Fig. 15A) comprising cephalosome and 4 pedigerous somites; first pedigerous somite separated from cephalosome; cephalosome (Fig. 15A) about 526 µm in dorsal view, length/width ratio about 0.94:1. P2-bearing somite about 1/3 length of cephalosome. P3-bearing somite as long as preceding one. P4-bearing somite narrower and shorter than preceding one.

Urosome (Figs. 15A, 21B) composed of P5-bearing somite, genital double-somite and 2 post genital somites. Genital double-somite (Fig. 15A, C) slightly shorter than cephalosome, about 463.2 µm, subdivided laterally by chitinous ridge, but fused ventrally and dorsally. Urosomite 4 half as long as genital double-somite. Penultimate somite with semicircular operculum. Anal somite absent.

Caudal rami (Figs. 15A, D, 21E, F) long, about 2 times as long as greatest width, tapering posteriorly, with patch of strong spinules on ventral surface distally and 7 setae: seta I short, pinnate distally, with rounded tip; seta II plumose, inserted on inner margin halfway; seta III plumose, inserted on dorsal surface halfway; terminal setae IV and V well-developed, seta V at least 2 times as long as seta IV; seta VI very small, naked; seta VII short, naked, bi-articulated, as long as seta VI, inserted on inner margin distally. Proximal inner margin with hook-like extension.

Antennule (Figs. 16A, 21C) elongate, 3-segmented. First segment large, stout, with several incomplete sutures, with 4 plumose, 5 bare, 15 pinnate setae, and 2 aesthetascs. Second

segment very small, with 4 spinulose setae. Third segment elongate, with 4 plumose, 4 naked, and 5 pinnate setae.

Antenna (Figs. 16B, 21C, D). Coxa small, naked. Allobasis elongate, with 1 long pinnate seta on abexopodal margin. Exopod 8-segmented; first segment longest; second and third segments small; first to third segments each with plumose seta; fourth to sixth segments each with pinnate seta; seventh segment with plumose seta; terminal segment (Fig. 21D) subsquare, with 1 long plumose, 2 long and 1 short pinnate setae. Endopod elongate, as long as allobasis; outer margin with 1 small spinulose and 3 long pinnate setae proximally; distal armature composed of 6 long pinnate or spinulose setae and 1 small seta

Labrum (Fig. 17A) subhexagonal; lateral margin with 1 paired row of setules subdistally; posterior surface with 1 paired rows of spinules and 1 paired row of setules.

Mandible (Fig. 17B). Coxal gnathobase well-developed, armed with 8 stout and several small awl-like teeth; distal corner with pinnate seta and inner surface with 1 patch of spinules. Basis broad, with 3 plumose setae on inner margin. Exopod 3-segmented; proximal segment with 2 long plumose setae on inner margin; middle segment longest, with 1 long plumose seta on inner margin proximally; distal segment small, with 3 long plumose setae. Endopod 2-segmented; proximal segment with 3 setae subdistally; distal segment with 8 setae distally.

Maxillule (Fig. 17C). Praecoxal arthrite armed with 9 spines along distal margin, 2 juxtapose seta on anterior surface, and 2 pinnate setae on posterior surface. Coxa with 2 plumose setae on outer margin; cylindrical endite with 4 apical setae. Basis with 2 small endites; proximal and distal endites with 3 and 4 pinnate setae, respectively; posterior surface with 1 row of spinules proximally. Exopod large, foliaceous, with 5 slender setae, 6 stout plumose setae, and 1 small plumose seta; inner margin with 1 row of setules. Endopod 2-segmented; proximal segment with 5 setae on lateral margin; distal segment smaller preceding one, with 1 plumose seta on lateral margin, and 2 pinnate and 3 plumose setae on apical margin.

Maxilla (Fig. 17D). Praecoxa large, with 1 row of short spinules at distal corner, 1 row of setule on surface proximally, and 2 endites; proximal endite elongate, with 1 row of spinules near apical margin, 4 pinnate setae on apical margin, and 1 small bare seta at subdistal corner; distal endites smaller than preceding one, with 2 pinnate setae on apical margin and 1 row of spinules near apical margin. Coxa small 1/3 length of preceding one, with 2 cylindrical endites;

proximal endite with 2 rows of spinules near apical margin and 3 pinnate setae on apical margin; distal endite with 1 row of spinules near apical margin and 3 pinnate setae on apical margin. Allobasis drawn out in to pinnate claw; accessory armature of claw consisting of 4 setae. Endopod 3-segmented; proximal segment very small, with 1 plumose seta; middle segment with 2 setae; distal endite with 8 setae.

Maxilliped (Fig. 17E) phyllopodial, elongate, and composed of protopod and endopod. Protopod divided by incomplete suture; proximal segment with 4 plumose and 5 unispinulose setae along lateral margin, bearing 4 groups of small spinules around lateral margin; distal segment with 1 unspinulose and 2 plumose setae along lateral margin, 1 row of spinules near lateral margin, 2 rows of spinules around distal margin, and 1 row of setules along outer margin. Endopod 1-segmented, with 4 unispinulose and 4 plumose setae.

P1 (Fig. 18A). Coxa large, with 1 long pinnate seta at inner distal corner, 1 row of spinules on anterior surface, 1 row of fine hairs near inner margin. Basis with 1 outer spinulose seta, 1 stout inner spine, 1 row of fine hairs on inner margin posteriorly, and 1 pore on anterior surface. Exopod 3-segmented; exp-1 elongate, with 1 long pinnate spine and 1 group of stout spines on outer margin, and several setules on inner margin, bearing 1 row of spinules along distal corner; exp-2 1/2 length of preceding one, with 1 pinnate spine and 1 row of small spinules on outer margin, 1 long plumose seta on inner margin, bearing serrate distal margin; exp-3 elongate, with 3 pinnate spines on outer margin, 2 plumose setae on inner margin, and 1 spine-like and 1 plumose setae on apical margin. Endopod as long as exopod, 3-segmented; emp-1 with 1 long plumose seta on inner margin and 1 row of dense setules on outer margin; emp-2 with 1 long plumose seta and 1 row of setules on inner margin and 1 group of stout spinules on outer margin; emp-3 slightly shorter than preceding one, with 2 pinnate spines on outer margin, 2 long multipinnate setae and 1 row of setules along inner margin, and 1 small spine and 1 long multipinnate seta on apical.

P2 (Fig. 18B). Coxa large, with 1 long pinnate seta on inner margin, 1 patch of stout spinules on anterior surface; posterior surface with 1 patch of spinule and 1 row of setule around inner distal corner. Basis with 1 long pinnate seta on outer margin; posterior surface with conical process (Fig. 18C). Exopod 3-segmented; exp- 1 with 1 group of stout spinules and 1 spine on outer margin; exp-2 with 1 spine on outer margin, and 1 row of setules and 1 plumose seta on inner margin; exp-3 elongate, with 2 spines on outer margin, 1 spine and 1

pinnate seta on apical margin, and 3 plumose setae on inner margin. Endopod as long as exopod, 3-segmented; enp-1 small, with 1 plumose seta on inner margin and 1 mucroniform process reaching end of exp-2 on distal margin anteriorly; enp-2 with 1 plumose seta on inner margin and 2 rows of spinules on anterior surface; enp-3 elongate, longer than enp-1 and -2 combined, with 1 spine on outer margin, 1 spine and 1 pinnate seta on apical margin, and 2 plumose setae on inner margin.

P3 (Fig. 19A). Coxa large, with 1 group of spinules and 1 spinulose seta on anterior surface, and 1 row of minute spinules on distal margin. Basis narrower than coxa, with 1 long spinulose outer seta, 1 row of minute spinules on distal margin, 1 hammer-like process on posterior surface. Exopod 3-segmented; exp-1 with 1 spine on outer margin and 1 group of spinules on anterior surface; exp-2 with 1 spine on outer margin, 1 long plumose seta on inner margin, and 1 group of spinules on anterior surface; exp-3 gradually broaden toward apical margin, with 3 spines and 2 pinnate setae. Endopod longer than exopod; enp-1 with 1 spinulose seta on inner margin and 1 group of spinules on anterior surface; enp-2 about 1.7 times as long as preceding one, with 1 spinulose seta on inner margin and 1 group of spinules on anterior surface; enp-3 about 2 times as long as preceding one, with 2 spines on outer margin, and 1 spinulose and 1 pinnate setae.

P4 (Fig. 19B). Coxa smaller than those of P2 and P3, with 1 small spine on inner margin, 1 row of spinules on anterior margin, and 1 row of minute spinules on distal margin. Basis smaller than those of P2 and P3, with 1 row of minute spinules on distal margin and 1 long spinulose outer seta. Exopod 3-segmented; exp-1 with 1 seta-like spine on outer margin, 1 group of spinules on anterior surface; exp-2 with 1 long seta-like spine on outer margin, 1 long spinulose seta on inner margin; exp-3 elongate, as long as exp-1 and -2 combined, with 1 seta-like outer seta, 2 spinulose apical setae, and 1 spinulose inner seta.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.223	1.1.222
P2	0.1.322	1.1.221
P3	0.1.122	1.1.121
P4	0.1.121	1.0.121

P5 (Fig. 15E) vestigial, incorporated into somite, represented by 2 small naked and 2 long plumose setae; outermost seta separated from others.

**Male.** Sexual dimorphism in antennule, urosome, genital field, P3, and P4.

Urosome (Fig. 20A) 5-segmented, composed of P5-bearing somite, genital somite, 3 free abdominal somites; genital and urosomite 3 separate.

Antennule (Fig. 20B) 4-segmented, with geniculation between third and fourth segments. First segment elongate, stout, with incomplete sutures, bearing 1 row of setules proximally, 19 elements, and 2 aesthetascs. Second segment small, with 1 spine and 4 setae. Third segment cylindrical, tapering proximally, with incomplete suture, 7 setae, and 1 row of spinule. Fourth segment smallest, with 7 setae and 1 process.

Genital field (Fig. 20A). Posterior margin ventrally with 2 pairs of triangular process; inner one of which represent P6. P6 covered with small setules with 1 small seta on posterior surface; additional element arising from inner margin proximally.

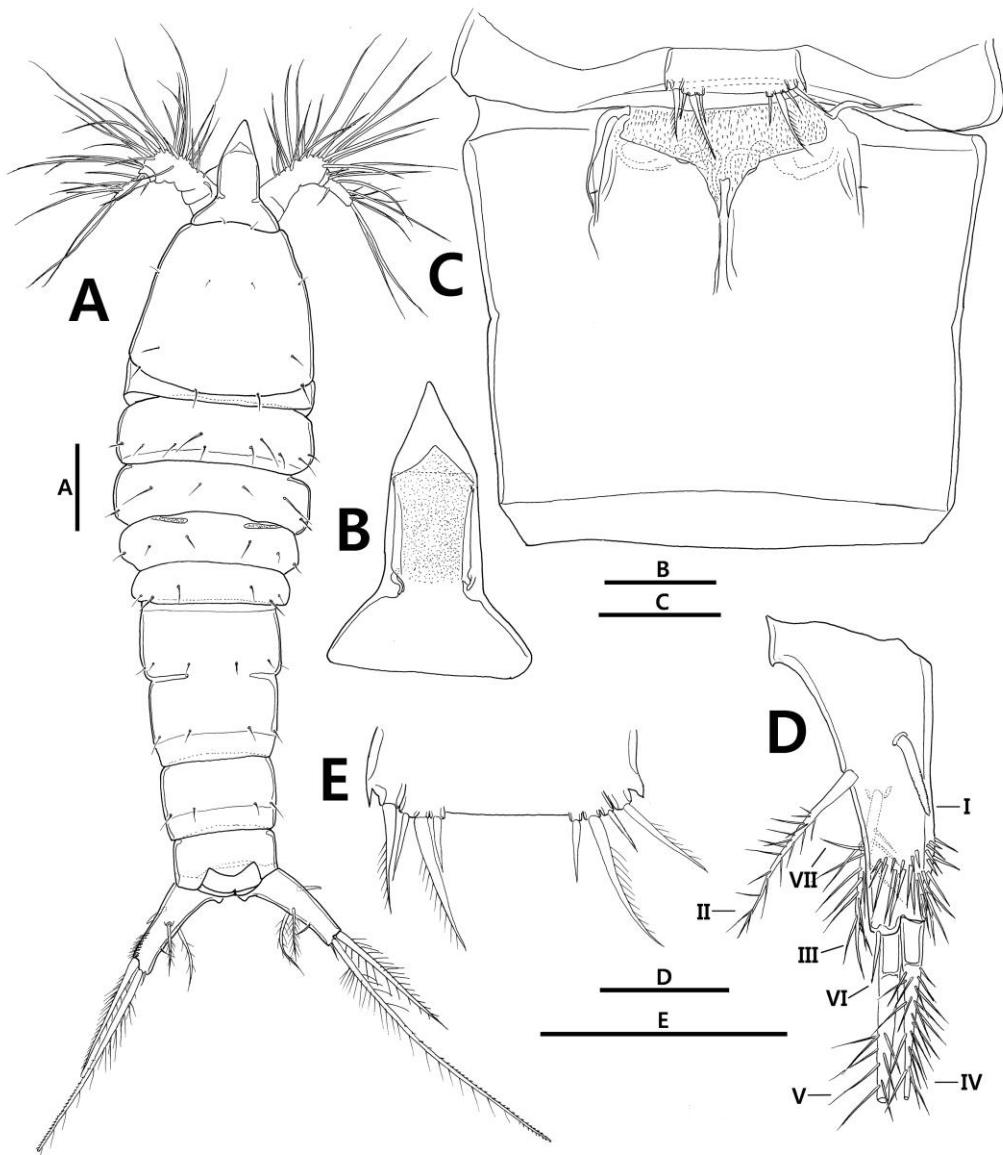
P3 basis with 1 bifid process (Fig. 19E) on posterior margin; enp-3 (Fig. 19C) shorter than that of female; inner margin with 1 modified tube-pore.

P4 enp-2 (Fig. 19D) modified; inner margin concave, with 2 rows of small spinules.

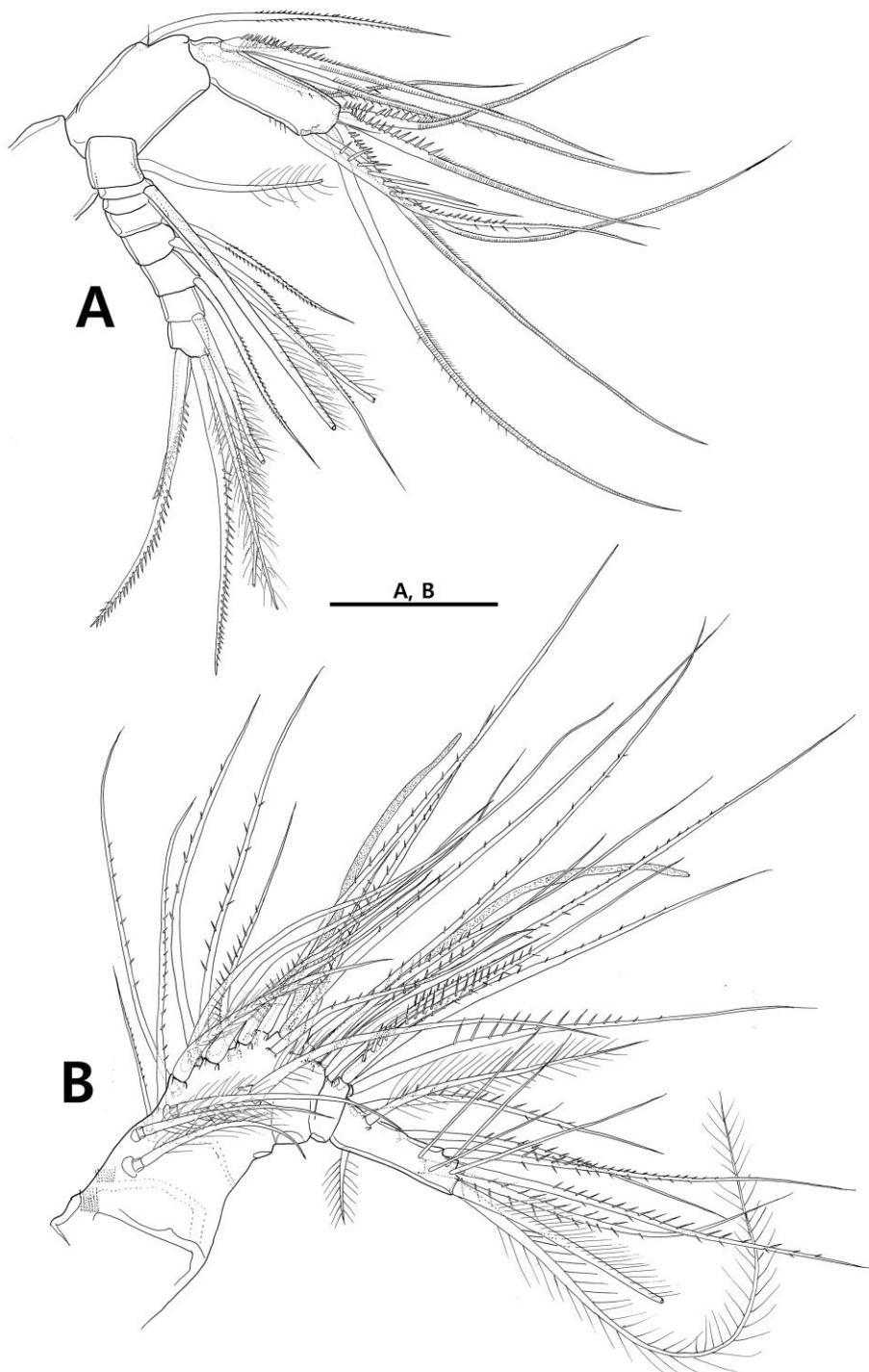
**Remarks.** Mu & Huys (2004) have proposed the *longipes*-group within the genus *Scottolana* Huys, 2009 based on halfway the fact that they share the following apomorphies: (1) urosome with two postgenital somites in female and with three in male; (2) P4 modified in both sexes; (3) male P3 enp-3 with modified inner tube pore; (4) P2–P4 with a recurved spinous process on each posterior surface of the basis; (5) caudal rami with hook-like extension and spinular patch; (6) sexual dimorphism of caudal setae II. This group currently includes *S. longipes* (Thompson & Scott, 1903), *S. longipes sensu* Por, 1964, *S. longipes sensu* Wells, 1967, *S. dissimilis* Fiers, 1982, *S. uxoris* Por, 1983, *S. longipes sensu* Wells & Rao, 1987, and *G. geei* Mu & Huys, 2004 (Mu & Huys 2004). The new species, *Scottolana* sp. nov., can be also placed in this group based on its representation of five apomorphies among the six characters above (except the sexual dimorphism of caudal seta II).

Within the *longipes*-group, *Scottolana* sp. n. is mostly similar to *S. geei* described from the central region of Bohai Sea, China. However, this new species can be clearly distinguished from the latter by a combination of following morphological features: (1) antennary exopod is eight-segmented (vs. nine-segmented in *S. geei*); (2) mandibular basis has three setae (vs.

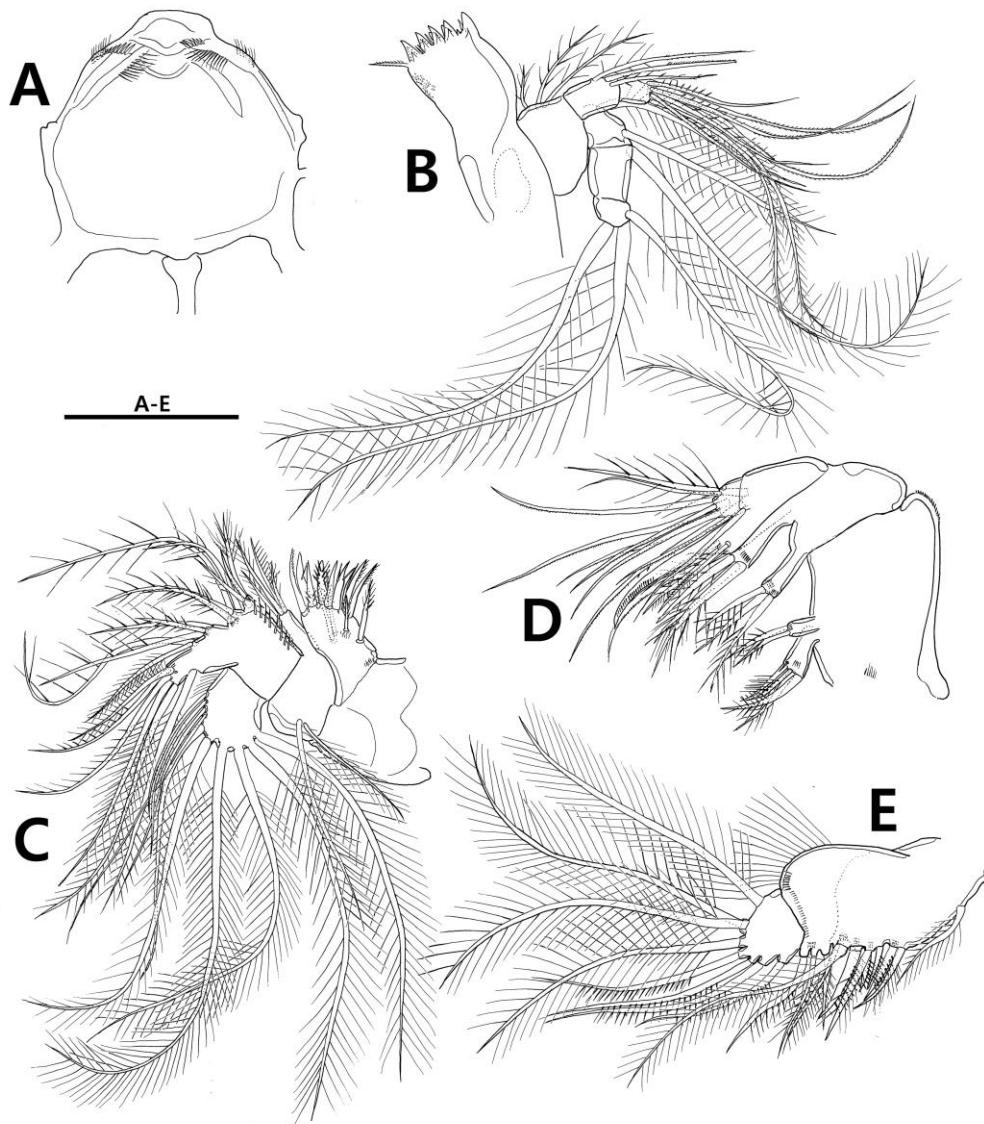
two setae in *S. geei*); (3) female P3 enp-3 is elongate, about 2.0 times as long as preceding segment (vs. about 1.5 times long in *S. geei*); (4) female genital field is small, extending over proximal 1/4 of genital double-somite (vs. large, proximal 3/4 of genital double-somite in *S. geei*); (5) male P6 has a small spinous process reaching to proximal half of the third urosomite (vs. well-developed, exceeding the end of urosomite 3 in *S. geei*); (6) male P4 enp-2 has a modified inner margin, which is concave with two rows of small spinules (vs. not modified inner margin in *S. geei*); (7) caudal seta II does not represent sexual dimorphism (vs. represent a sexual dimorphism of the proximally swollen seta in female *S. geei*).



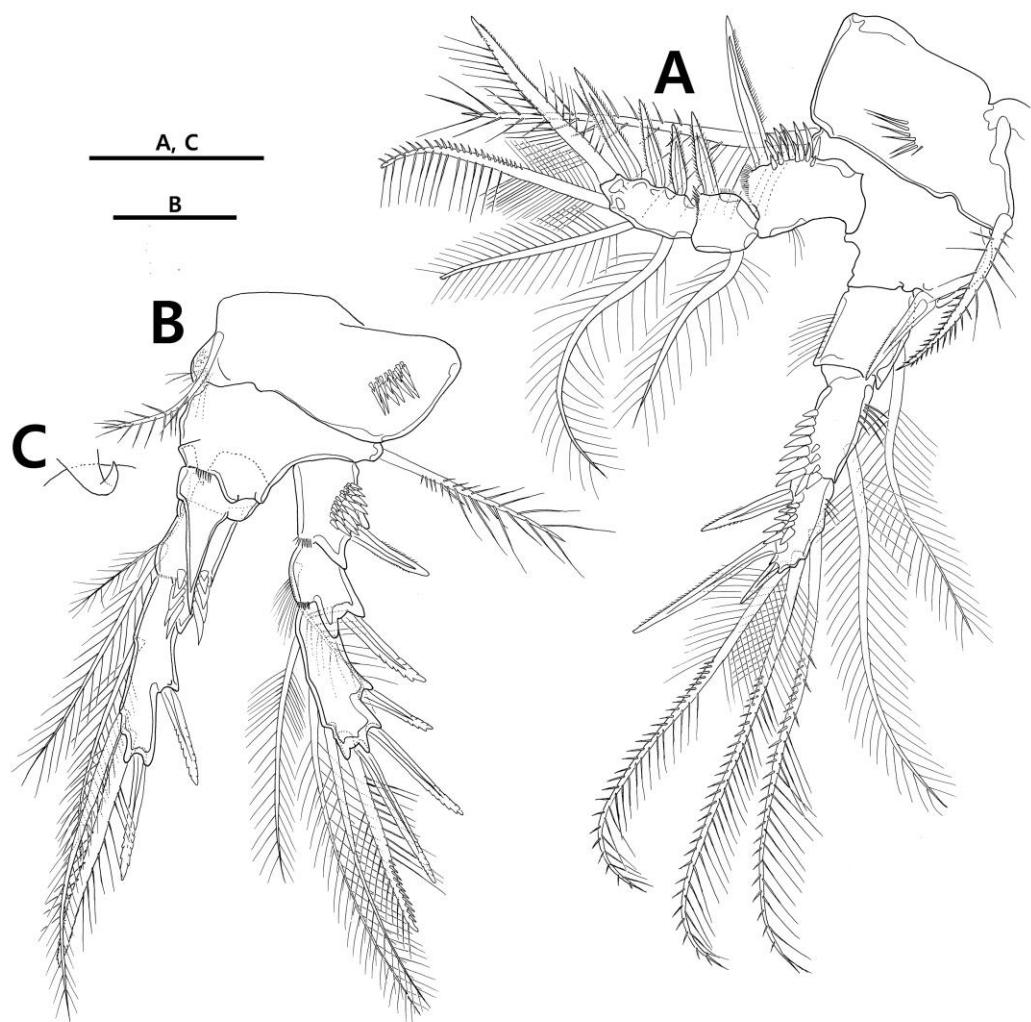
**Fig. 15.** *Scottolana* sp. nov., female. A, habitus, dorsal; B, rostrum, C, P5-bearing somite and genital double-somite; D, caudal ramus, E, P5. Scale bars: 100 µm (B–E); 200 µm (A).



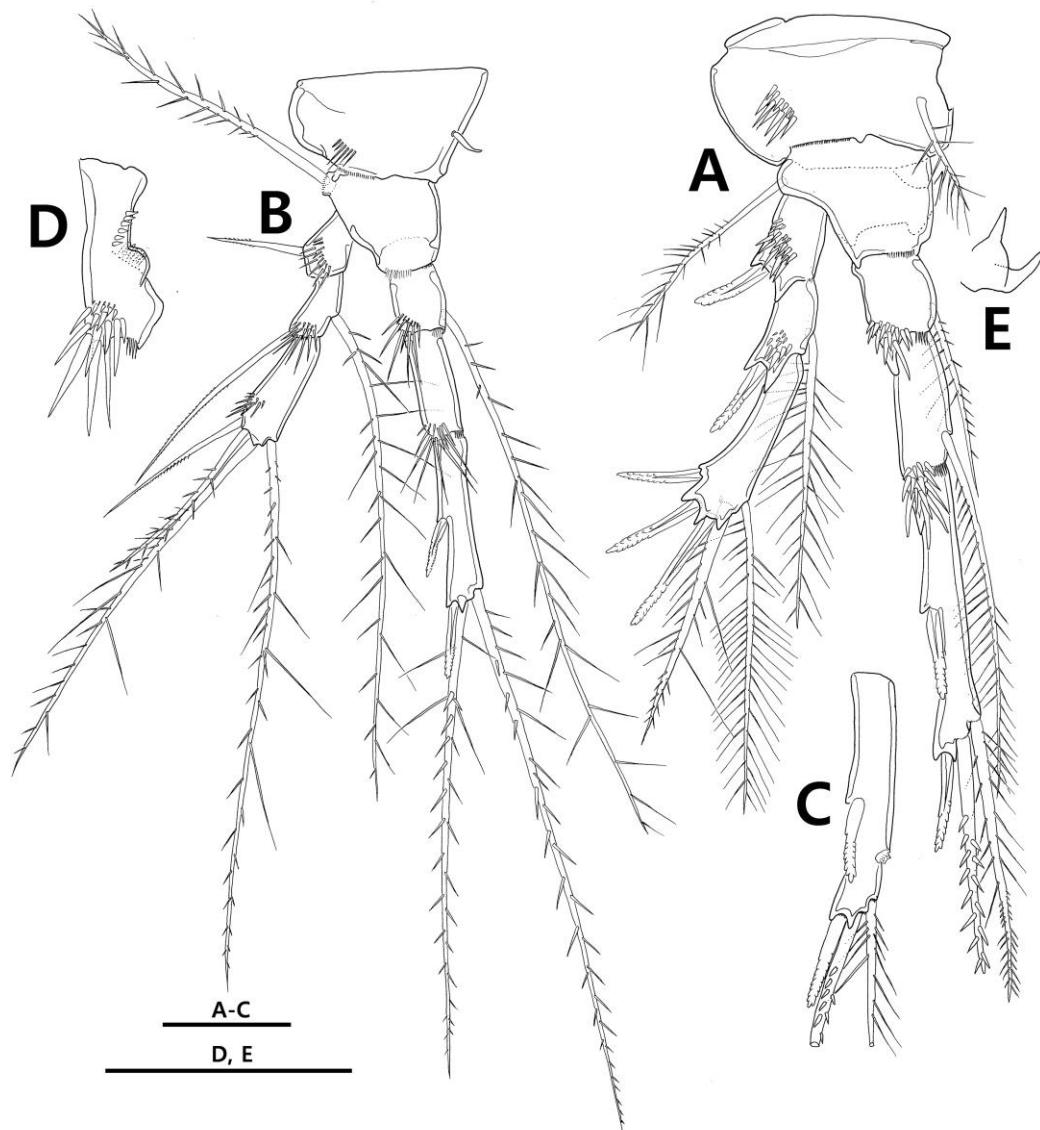
**Fig. 16.** *Scuttolana* sp. nov., female. A, antennule; B, antenna. Scale bar: 100  $\mu\text{m}$ .



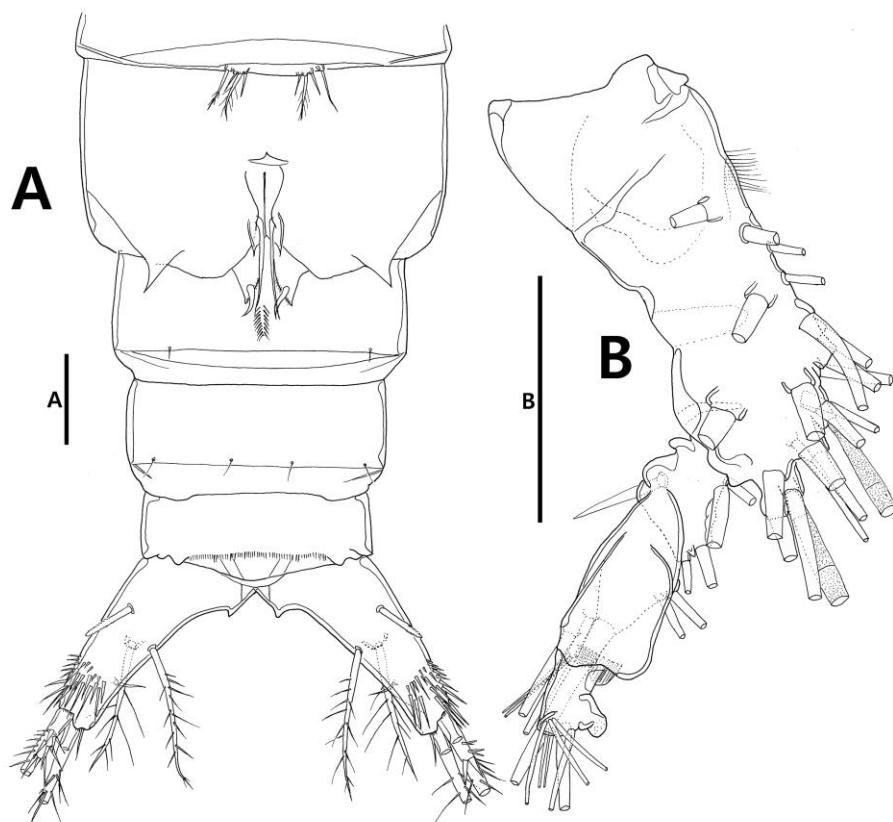
**Fig. 17.** *Scottolana* sp. nov., female. A, labrum; B, mandible; C, maxillule; D, maxilla; E, maxilliped. Scale bar: 100  $\mu\text{m}$ .



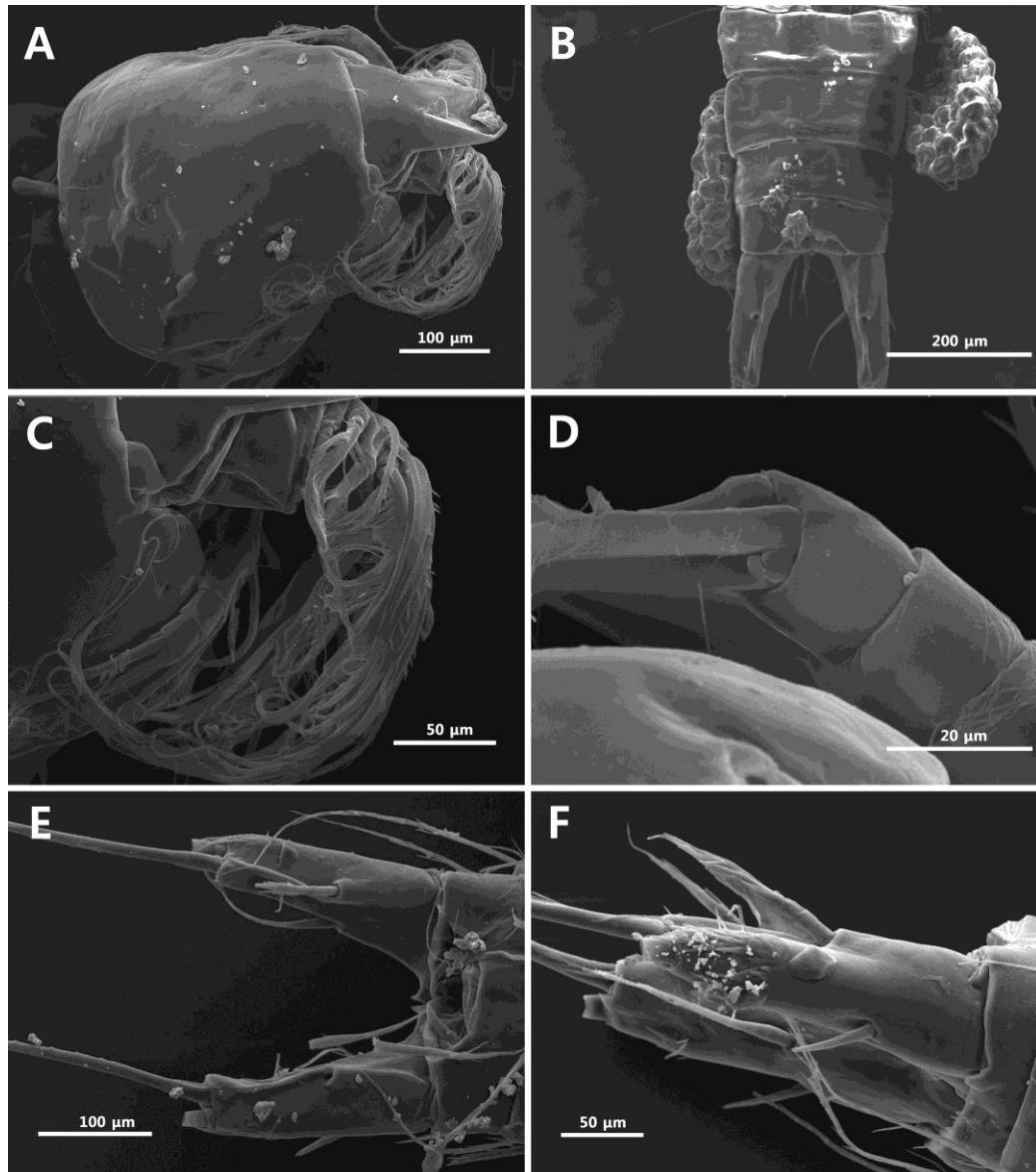
**Fig. 18.** *Scottolana* sp. nov., female. A, P1; B, P2; C, conical projection on the posterior surface of P2 basis. Scale bars: 100  $\mu$ m.



**Fig. 19.** *Scottolana* sp. nov., female (A, B): A, P3; B, P2. Male (C-E). C, P3 enp-3; D, P4 enp-2; E, projection on the posterior surface of P3 basis. Scale bars: 100  $\mu$ m.



**Fig. 20.** *Scuttolana* sp. nov., male. A, urosome, ventral; B, antennule. Scale bars: 100  $\mu\text{m}$ .



**Fig. 21.** Sanning electron micrographs of *Scottolana* sp. nov., female. A, cephalosome, dorsal; B, urosomite, dorsal; C, antennule and antennary exopod; D, distal and penultimate segments of antennary exopod; E, caudal rami, dorsal; F, caudal rami, ventral.

**Infraorder Podogennonta Lang, 1944****Superfamily [as yet unnamed in Wells (2007)]****Family Harpacticidae Dana, 1846 장수노벌레 과****한국산 장수노벌레 과(Harpacticidae)의 속에 대한 검색표(Chang 2010)**

1. 제 2 촉각의 외지는 3 마디로 구성된다; 제 4 흉지 내지의 두 번째 마디는 내측강모를 가지지 않는다 ..... 호랑장수노벌레 속 *Tigriopus*
  - 제 2 촉각의 외지는 1 마디 혹은 2 마디로 구성된다; 제 4 흉지 내지의 두 번째 마디는 내측강모를 가진다 ..... 2
2. 제 2-4 흉지 외지의 첫 번째 마디는 강모를 가진다 ..... 납작장수노벌레 속 *Zaus*
  - 제 2-4 흉지 외지의 첫 번째 마디는 가시를 가진다 ..... 3
3. 암컷의 제 1 촉각은 7 마디로 구성되어 있다 ..... 어리장수노벌레 속 *Harpacticella*
  - 암컷의 제 1 촉각은 9 마디로 구성되어 있다 ..... 장수노벌레 속 *Harpacticus*

**Genus *Harpacticus* Milne-Edwards, 1840 장수노벌레 속****모식종: *Harpacticus chelifer* (Müller, 1776)****한국산 장수노벌레 속(Harpacticus)의 종에 대한 검색표(Chang 2010)**

1. 제 2 흉지 내지의 두 번째 마디에 1 개의 강모를 가진다; 제 5 흉지의 기내지 표면에 잔가시열을 가지지 않는다 ..... 2
- 제 2 흉지 내지의 두 번째 마디에 2 개의 강모를 가진다; 제 5 흉지의 기내지 표면에 잔가시열을 가진다 ..... 장수노벌레 *H. uniremis*

2. 제 2 흉지 내지의 세 번째 마디에 5 개의 강모를 가진다 .....

왜장수노벌레 *H. nipponicus*

- 제 2 흉지 내지의 세 번째 마디에 3 개의 강모를 가진다 ..... *H. compsonyx*

### 5. *Harpacticus uniremis* Kröyer, 1842 장수노벌레

*Harpacticus uniremis* Kröyer, 1842, p. 43, fig. 1a-p (cited from Lang, 1948); Wilson, 1932, p. 186, fig. 126; Lang, 1948, p. 321, fig. 150; Lang, 1965, p. 108, fig. 55; Itô, 1971, p. 235, fig. 2-14; Song & Chang, 1993, p. 210; Yoo & Lee, 1995, p. 37, fig. 4A-B; Chang, 2009b, p. 173, pls. 7A, 22A-C, fig. 64; Chang, 2010, p. 43, fig. 17.

**관찰재료:** 10♀♀, 3♂♂, 전남 무안군 현경면 해운리(모래갯벌) 2012.2.22; 5♀♀, 2♂♂, 전남 완도군 금일도 연지리(잘피밭), 2012.5.20; 5♀♀, 전남 고흥군 금산면 어전리, 거금도(해조류) 2012.5.9; 4♀♀, 2♂♂, 경남 통영시 한산면 용호리, 용초도, 2014.3.24; 3♀♀, 2♂♂, 전남 신안군 비금면 수대리, 비금도, 2015.4.6; 16♀♀, 전남 완도군 보길면 부황리, 보길도(light trap), 2015.4.14; 2♀♀, 쉬미항, 전남 진도군 진도읍 산원리, 2015.5.1; 2♀♀, 전남 해남면 화산면 평호리, 2015.5.2; 2♀♀, 1♂, 충남 태안군 안면읍 승언리, 안면도, 꽃지해수욕장(조수웅덩이), 2015.10.30; 9♀♀, 전남 여수시 화양면 이목리, 2016.5.29.

**분포:** 한국, 일본, 이집트, 알제리, 유럽, 북아메리카.

**고찰:** 이 종은 우리나라의 해수 및 기수역 지역에서 가장 흔히 채집되는 종들 중 하나이다. 본 연구에서는 장수노벌레(*Harpacticus uniremis*)가 사질, 니질, 해조류 등 다양한 서식지에서 채집, 확인되었다.

### 6. *Harpacticus nipponicus* Itô, 1976 왜장수노벌레

*Harpacticus nipponicus* Itô, 1976, p. 448, figs. 1-14; Song & Chang, 1993, p. 204, figs. 2-3; Song & Chang, 1995, p. 69; Chang, 2009b, p. 175, fig. 65; Chang, 2010, p. 45, fig. 18.

**관찰재료:** 5♀♀, 제주 제주시 우도면 서광리, 서빈백사, 2014.6.24; 2♀♀, 제주 서귀포시 안덕면 화순리, 화순해수욕장(사질), 2014.6.25; 2♀♀, 1♂, 삼척시 근덕면 궁촌리, 궁촌항, 2014.9.16; 1♀, 경남 남해군 상주면 양아리, 소량마을, 2014.7.29; 1♀, 전남 여수시 신덕동(해조류), 2015.5.16; 2♀♀, 충남 보령시 웅천읍 관당리, 무창포해수욕장, 2016.08.17.

**분포:** 한국, 일본.

**고찰:** 이 종은 장수노벌레(*Harpacticus uniremis*)와 함께 우리나라의 연안과 기수역에 분포하는 광염성 종으로 알려져 있다(Chang 2010). 본 연구에서는 왜장수노벌레(*H. nipponicus*)의 출현빈도와 서식밀도는 장수노벌레보다 훨씬 낮게 나타났다.

### Genus *Zaus* Goodsir, 1845 납작장수노벌레 속

모식종: *Zaus spinatus* Goodsir, 1845

#### 한국산 납작장수노벌레 속(*Zaus*)의 종에 대한 검색표(Chang 2010)

1. 제 2 흉지의 내지 두 번째 마디에 1 개의 내측강모를 가진다..... 2
  - 제 2 흉지의 내지 두 번째 마디에 2 개의 내측강모를 가진다.....  
.....튼튼납작장수노벌레 *Z. robustus*
2. 제 2 흉지의 내지 세 번째 마디에 1 개의 내측강모를 가진다.....  
.....*Z. wonchoelleei*
  - 제 2 흉지의 내지 세 번째 마디에 2 개의 내측강모를 가진다.....  
.....한털납작장수노벌레 *Z. unisetosus*

### 7. *Zaus unisetosus* Itô, 1974 한털납작장수노벌레

*Zaus unisetosus* Itô, 1974, p. 570, figs. 12–14; Song & Chang, 1993, p. 216, fig. 8; Lee et al., 2012, p. 43, figs. 27–30.

**관찰재료:** 8♀♀, 전남 고흥군 금산면 어전리, 거금도(해조류), 2012.5.9; 2♀♀, 울산 을주군 서생면 나사리, 나사해수욕장(해조류), 2012.5.17; 4♀♀, 강원 양양군 현남면 남애리, 2014.6.16; 3♀♀, 경북 영덕군 축산면 경정리, 2014.9.17; 1♀, 전남 진도군 임회면 죽림리, 2015.5.2; 4♀♀, 전남 여수시 신덕동(해조류), 2015.5.16; 2♀♀, 경북 포항시 남구 동해면 입암리, 2015.5.19.

**분포:** 한국, 일본.

**고찰:** 본 연구에서 이 종은 동해안과 남해안의 해조류에서 주로 채집되었다. 우리나라의 해조류에 서식하고 있는 갈고리노벌레 중에서 가장 우점하는 종들 중 하나로 알려져 있다(Song & Chang 1993; Lee et al. 2012).

### Genus *Tigriopus* Norman, 1869 호랑장수노벌레 속

모식종: *Tigriopus brevicornis* (Müller, 1776)

#### 한국산 호랑장수노벌레 속(*Tigriopus*)의 종에 대한 검색표

1. 제 4 흉지 내지의 세 번째 마디에 2 개의 강모를 가진다; 수컷 제 5 흉지 외지에 5 개의 흉지를 가진다; 수컷 제 2 흉지 내지 두 번째 마디에 손잡이모양의 구조(knob)를 갖지 않는다 .....호랑장수노벌레 *T. japonicus*
- 제 4 흉지 내지의 세 번째 마디에 3 개의 강모를 가진다; 수컷 제 5 흉지 외지에 4 개의 흉지를 가진다; 수컷 제 2 흉지 내지 두 번째 마디에 손잡이모양의 구조(knob)를 갖는다 .....모난호랑장수노벌레 *T. angulatus*

## 8. *Tigriopus japonicus* Mori, 1938 호랑장수노벌레

*Tigriopus japonicus* Mori, 1938, p. 294, pl. IX (cited from Itô, 1969); Itô, 1969, p. 58, figs. 1, 2; Song & Chang, 1993, p. 210, figs. 2–3; Chang, 2009b, p. 186, fig. 73, pls. 7C, 23B, C; Chang, 2010, p. 57, figs. 24.

**관찰재료:** 10♀♀, 4♂♂, 경북 포항시 남구 구룡포읍 장길리(해조류), 2013.8.5; 12♀♀, 7♂♂, 경북 경주시 감포읍 전촌리(해조류) 2013.8.5; 11♀♀, 6♂♂, 남해 미조면 송정리(모래사장), 2013.10.4; 2♀♀, 전남 여수시 만흥동 만성리(해조류), 2014.3.31; 3♀♀, 전남 진도군 지산면 가학리, 2015.5.2.

**고찰.** 우리나라 근해에서 호랑장수노벌레 속(*Tigriopus*)에는 현재 2 종, 호랑장수노벌레(*T. japonica*)와 모난호랑장수노벌레(*T. angulatus*)가 보고되어 있다(Song & Chang 1993; Chang 2009b; Chang 2010; Kim 2013). 이 속에 위치한 종들의 암컷들은 서로 구별하기 힘들지만, 이 두 종은 제 4 흉지 외지의 세 번째 마디에 존재하는 내측강모의 수에 의해 손쉽게 구별될 수 있다. 호랑장수노벌레에서는 제 4 흉지 외지의 세 번째 마디에 2 개의 내측강모를 가지고 있지만, 모난호랑장수노벌레는 이 마디에 3 개의 내측강모를 가진다.

본 연구에서는 호랑장수노벌레가 우리나라 연안지역의 갯벌, 암반 조간대의 해조류, 그리고 조수웅덩이에서 서식하는 것을 확인하였다. 반면, Chang (2009b; 2010)은 순수 담수역인 석회동물에서도 한번 채집된 점으로 보아 이종을 광염성종으로 추정하였다. 환경변화가 심한 조수웅덩이에서도 서식하고, 배양이 쉽게 된다는 점에서 호랑장수노벌레는 독성실험, 배양실험 등 여러 생물학 분야에서 실험종으로 이용되고 있다. 한편, 분자생물학적 연구(Jung et al. 2006; Ki et al. 2009)에 따르면, 현재의 호랑장수노벌레는 여러 종, 또는 여러 아종으로 구분될 가능성이 있다.

## Genus *Harpacticella* Sars, 1908 어리장수노벌레 속

모식종: *Harpacticella inopinata* Sars, 1908

한국산 어리장수노벌레 속(*Harpacticella*)의 종에 대한 검색표(Chang 2010; Lee et al. 2014)

1. 대악의 기절은 1 개의 강모를 가진다; 제 2 흉지의 외지는 내지와 길이가 유사하다..... 2  
- 대악의 기절은 2 개의 강모를 가진다; 제 2 흉지의 외지는 내지보다 길이가 길다..... 바다어리장수노벌레 *H. oceanica*
2. 암컷 제 5 흉지의 외지는 길이가 폭보다 조금 더 길다..... 3  
- 암컷 제 5 흉지의 외지는 길이가 폭의 2 배 이상이다 .....  
..... 파라독스어리장수노벌레 *H. paradoxa*
3. 암컷 제 5 흉지의 외지에 6 개의 강모를 가진다..... *H. jejuensis*  
- 암컷 제 5 흉지의 외지에 7 개의 강모를 가진다... 어리장수노벌레 *H. itoi*

### 9. *Harpacticella oceanica* Itô, 1977 바다어리장수노벌레

*Harpacticella oceanica* Itô, 1977, p. 61, figs. 1–11; Song & Chang, 1993, p. 211, figs. 5–6;  
Song & Chang, 1995, p. 69; Chang, 2009b, p. 184, fig. 71; Chang, 2010, p. 54, fig. 23.

**관찰재료:** 1♀, 전남 여수시 남면 우학리, 금오도(해조류), 2015.5.13; 1♀, 충남 보령시 오천면 장고도리, 장고도(light trap), 2015.5.23; 2♀♀, 전남 고흥군 근산면 신평리, 거금도, 2015.7.14; 1♂, 충남 서천군 서면 도둔리, 춘장대해수욕장, 2016.8.17.

**분포:** 한국, 일본.

**고찰:** 바다어리장수노벌레(*Harpacticella oceanica*)는 Itô (1977)에 의하여 일본의 오가사와라제도에서 최초 보고된 이후, 우리나라에서도 서식하고 있는 것이 확인되었다(Song & Chang 1993, 1995; Chang 2009b, 2010). 일본산 시료는 조하대 환경에서 채집되었지만, 우리나라에서는 주로 담수의 영향을 미치는 조간대 웅덩이나 해안 습지, 또는 제주도 해안의 용천수에서 채집되었다. 그러나 본 연구에서는 우리나라의 과거 기록들과 달리 해양의 서식지에서만 이 종이 채집, 확인되었다.

#### 10. *Harpacticella itoi* Chang & Kim, 1991 어리장수노벌레

*Harpacticella itoi* Chang & Kim, 1991, p. 73, figs. 1–3; Song & Chang, 1993, p. 211; Chang & Yoon, 2007, p. 63; Chang, 2009b, p. 181, pls. 7B, 23A, figs. 69–70; Chang, 2010, p. 48, figs. 19–20.

**관찰재료:** 1♀, 전남 해남 문내면 예락리, 임하고, 2015.5.3; 3♀♀, 전북 고창군 해리면 금평리(기수역), 2015.5.7; 2♀♀, 대포항, 제주 서귀포시 대포동, 대포항(light trap), 2015.5.22; 2♀♀, 전남 광양시 광양읍 도월리, 2016.4.26.

**분포:** 한국(기수역), 일본.

**고찰.** 이 종은 해수보다는 담수의 영향이 크게 미치는 기수역에 서식하는 것으로 알려져 있으나(Chang, 2009b, 2010), 본 연구에서는 해수역인 제주도 대포항에서 채집, 확인 되었다.

**Superfamily [as yet unnamed in Wells (2007)]**

**Family Pseudotachidiidae Lang, 1936**

**Subfamily Danielsseniinae Huys & Gee in Huys et al., 1996**

### 한국산 Danielsseniinae 아과의 속의 대한 검색표

1. 제 2-4 흉지 외지의 첫 번째 마디는 내측강모 1 개를 가진다; 제 4 흉지 내지의 세 번째 마디는 내측강모 1 개를 가진다..... *Fladenia*  
- 제 2-4 흉지 외지의 첫 번째 마디는 내측강모를 가지지 않는다; 제 4 흉지 내지의 세 번째 마디는 내측강모 2 개를 가진다..... *Sentiropsis*

### Genus *Fladenia* Gee & Huys, 1990

모식종: *Fladenia robusta* (Sars, 1921)

#### 11. *Fladenia* sp. nov. (Figs. 22–26)

**Type locality.** Off Hansando Island ( $34^{\circ}46'17.4''N$ ,  $128^{\circ}27'46.9''E$ ), Tongyeong-si, Gyeongsangnam-do, Korea.

**Type material examined.** Holotype: 1♀ dissected on a slide. Paratypes: 3♀♀, each dissected on each slide; 2♀♀, preserved together in 99% ethanol. All material was collected from the type locality on 24 March 2014.

**Description. Female.** Habitus (Fig. 22A, B) slightly flattened dorsoventrally, gradually tapering towards posterior end, without constriction between prosome and urosome; total length about 600 µm, measured from anterior margin of rostrum to posterior margin of caudal ramus; maximum width in dorsal view about 170 µm measured at posterior part of cephalothorax; prosome:urosome length ratio about 2.1 in lateral view. Body surface with several sensilla and pores.

Rostrum (Fig. 22C) large, broad, fused at base to cephalothorax, slightly longer than width; anterior margin rounded, smooth.

Cephalothorax (Fig. 22A, B) about 1/3 of total body length; surface with 1 single sensillume, 9 pairs of sensilla, 1 pair of spinules, and 3 pairs of pores; ventrolateral margin with 4 pairs of sensilla. P2-bearing somite with row of spinules near posterior margin. P3-bearing somite slightly smaller than preceding one, with 1 row of stout spinules on dorsal surface. P4-bearing somite with 1 row of stout spinules on dorsal surface. P5-bearing somite small, with 1 row of stout spinules. Genital double-somite (Fig. 2A, B) separate laterally and ventrally, but fused dorsally; dorsal surface with 2 pairs of stout spinules; ventral surface with 1 pair of spinule and 1 pair of stout spinules; genital field with single plate and median copulatory pore; P6 represented by 1 plumose seta. Fourth urosomite with 1 pair of stout spinular dorsally and 1 row of stout spinules. Penultimate somite with pseudoperculum dorsally, 1 spinular row ventrally, and 1 pair of stout spinular group ventrolaterally. Anal somite with median cleft bearing 2 rows of small spinules dorsally; posterior margin with 3 pairs of spinular rows ventrally and laterally.

Caudal rami (Fig. 23A, B) small, about 1.3 times as wide as long in dorsal view; ventral surface with 1 row of spinules; lateral surface with 1 row of stout spinules dorsally and 2 small spinules ventrally. Seta I very small, setule-like, inserted at outer lateral margin halfway and ventrally. Seta II slender, as long as length of caudal ramus, inserted on dorsal surface innerly and distally. Seta III slender, longer than seta II, situated near seta II. Terminal setae IV and V well-developed, covered with minute spinules partially; seta IV shorter than seta V. Seta VI about 3 times as long as seta II, inserted distally at inner corner. Seta VII tri-articulated at base, inserted on dorsal surface medially and distally.

Antennule (Fig. 23C) 6-segmented, short. First segment with 2 rows of spinules and 1 plumose seta. Second segment largest, with 1 bare, 2 plumose, and 7 pinnate setae. Third segment with incomplete suture on surface, peduncle at outer distal corner; armature composed of 13 setae (10 bare, 1 plumose, 2 long pinnate) and 1 aesthetasc. Fourth segment small, with 2 bare, 2 long plumose, and 3 large spinulose setae. Fifth segment with 6 bare and 1 large plumose setae, and 1 aesthetasc.

Antenna (Fig. 24A). Coxa small. Allobasis elongate, with 1 spinulose seta and 1 spinular row on abexopodal margin. Exopod 3-segmented; proximal segment elongate, with 1 spinulose seta; middle segment smallest, with 1 spinulose seta; distal segment elongate, as long as proximal segment, with 1 spinulose seta on lateral margin, 1 spinulose and 1 plumose

setae on apical margin, and 1 spinular row on surface. Endopod 1-segmented, as long as allobasis, with 3 stout and 1 slender setae, and 2 spinular rows on surface; distal armature composed of 1 stout spinulose, 4 geniculate, 1 small bare, and 1 plumose setae.

Labrum (Fig. 23D) trapezoid in shape, with 1 row of spinules on anterior surface, 2 rows of spinules on posterior surface, and 1 pair of serrate frills on distal margin.

Mandible (Fig. 24B). Gnathobase well-developed, armed with 3 multicuspid teeth, 3 unicuspid teeth, 1 pinnate seta, and several accessory spinules. Palp consisting of basis, exopod, and endopod; basis broad, covered with spinules, and possessing 4 spinulose setae distally; exopod 1-segmented, elongate, with 2 plumose setae on lateral margin, 3 plumose setae on apical margin, and 1 spinular row on surface; endopod about twice as long as exopod, with 3 spinulose setae on lateral margin, and 5 bare setae near apical margin.

Maxillule (Fig. 24C). Praecoxa with 1 spinular row on outer margin and 1 spinular row on surface; arthrite well-developed, with 9 spines on distal margin and 2 setae on anterior surface. Coxal endite with 6 elements distally. Basal endite with 4 pinnate setae and 1 small produce bearing 1 seta. Exopod 1-segmented, slightly longer than width, with 3 plumose setae and 1 spinular row. Endopod 1-segmented, small, with 1 plumose and 2 bare setae.

Maxilla (Fig. 24D). Syncoxa with 1 row of spinules proximally on outer margin, 1 row of small spinules on surface, and possessing 3 endites; each endite with 3 stout setae distally. Allobasal endite with 1 stout claw, 1 plumose seta, and 2 bare setae. Endopod 1-segmented, small, with 1 plumose and 3 bare elements.

Maxilliped (Fig. 24E). Syncoxa elongate, with 1 group of spinules proximally and 2 rows of spinules distally, and possessing 1 long and 1 small spinulose setae subdistally. Basis largest, with 1 spinular row on surface and 1 seta on palmer margin. Endopod 1-segmented, claw-like, reaching to proximal end of basis.

P1 (Fig. 25A). Intercoxal sclerite wide. Coxa with several spinular rows on anterior surface. Basis smaller than coxa, with 1 pore and 1 spinular row on anterior surface, 1 spinular row on inner margin, and 1 spinular rows on distal margin, and possessing 1 spinulose inner spine and 1 spinulose outer seta. Exopod 3-segmented; each segment armed with long spinules along outer and distal outer corner; exp-1 with 1 spinulose outer spine; exp-2 with 1 spinulose spine on outer margin, 1 small plumose seta on inner margin, and 1 pore on anterior surface; exp-3 with 3 spinulose spines, of which distal one smaller than middle one, on outer margin,

and 1 spinulose spine and 1 plumose seta on apical margin. Endopod 2-segmented; each segment armed with spinules along outer and distal margins; enp-1 slightly longer than width, with 1 serrate seta on inner margin and 1 pore on anterior surface; enp-2 elongate, about 2.5 times as long as preceding one, with 1 spinulose outer spine distally, 2 spinulose apical elements, 1 plumose inner seta proximally, and 1 surface pore distally.

P2 (Fig. 25B). Intercoxal sclerite wide; distal margin U-shaped and proximal margin triangular; each side of distal margin with 1 row of setules. Coxa slightly larger than that of P1, with several spinular rows on anterior and posterior surfaces. Basis smaller than coxa, with 1 spinular row on base of outer seta and 2 spinular rows on distal margin, and 1 pore on anterior surface. Exopod 3-segmented; exp-1 and exp-2 each armed with spinules along outer and distal outer corner, and exp-3 with several spinules near base of outer spines; exp-1 with 1 spinulose outer spine and 1 small inner seta; exp-2 with 1 spinulose outer spine and 1 plumose inner seta; exp-3 longest, with 3 spinulose outer spines, 2 spinulose apical setae, and 2 plumose inner setae; each surface of exp-2 and exp-3 with 1 tube pore on anterior surface. Endopod 3-segmented, longer than exopod; enp-1 with 1 spinular row on outer margin and anterior surfaces, respectively, 2 stout spinules at outer distal corner, and 1 small stout seta (spine-like and bearing setule) on inner margin; enp-2 longer than preceding one, with 1 row of stout spinules on outer margin, several setules on inner margin, and 1 plumose inner seta; enp-3 longest, with 2 spinules and 1 spinulose spine on outer margin, 2 spinulose setae on apical margin, and 2 setules and 1 plumose seta on inner margin; enp-2 and enp-3 each with 1 pore on anterior surface.

P3 (Fig. 26A) as P2 except for plumose outer seta on basis.

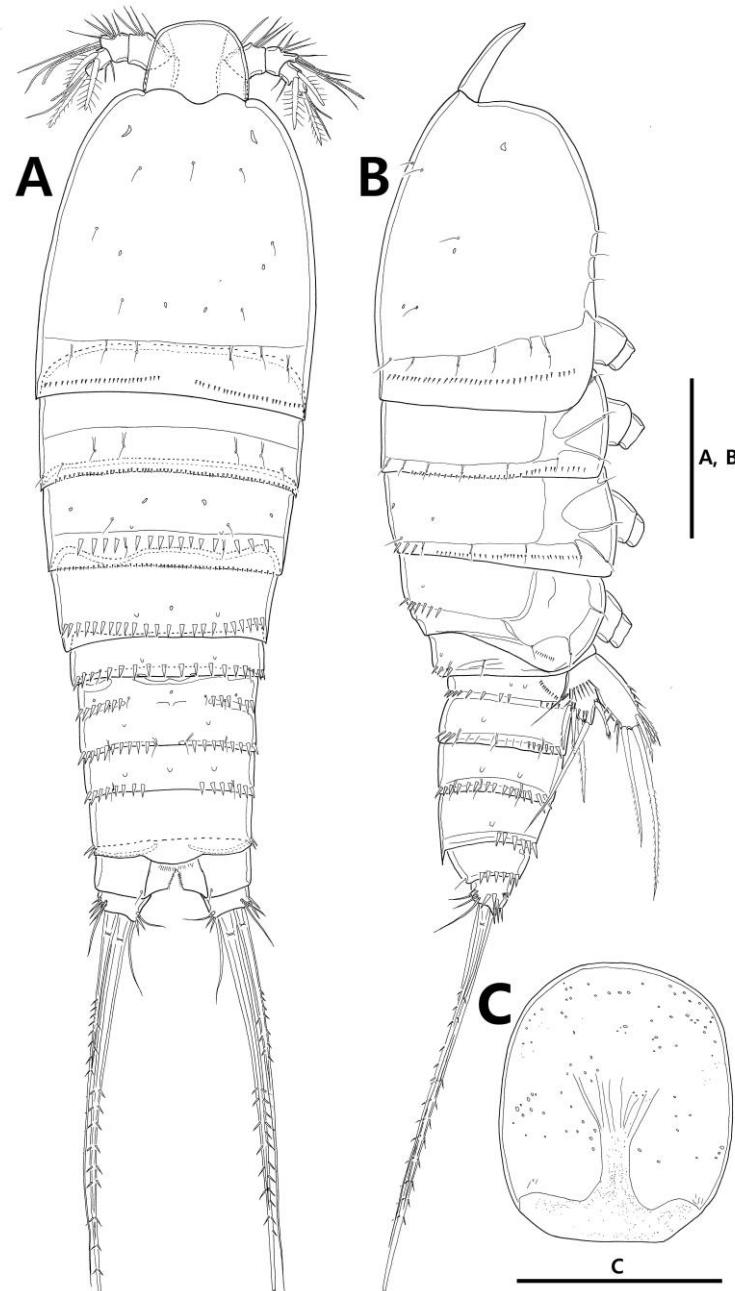
P4 (Fig. 26B) as P3 except for exp-3, enp-1, and enp-3. Proximal inner seta on exp-3 well-developed and serrate distally. Inner seta on enp-1 slender and serrate distally. Enp-3 smaller than those of P2 and P3, with inner seta inserted halfway.

P5 (Fig. 25C). Intercoxal sclerite small. Exopod and baseoendopod fused partially. Baseoendopod wide, with 1 tube pore near outer margin distally and 1 slender outer seta. Endopodal lobe well-developed, with 1 pore and 2 tube pores on anterior surface, and 1 pore on posterior surface; outer and inner margins each with several spinules; apical margin with 2 long pinnate setae; inner margin with 3 pinnate setae, of which middle one smallest and serrate distally. Exopod reaching to 3/4 of endopodal lobe, with 3 groups of spinules and 5

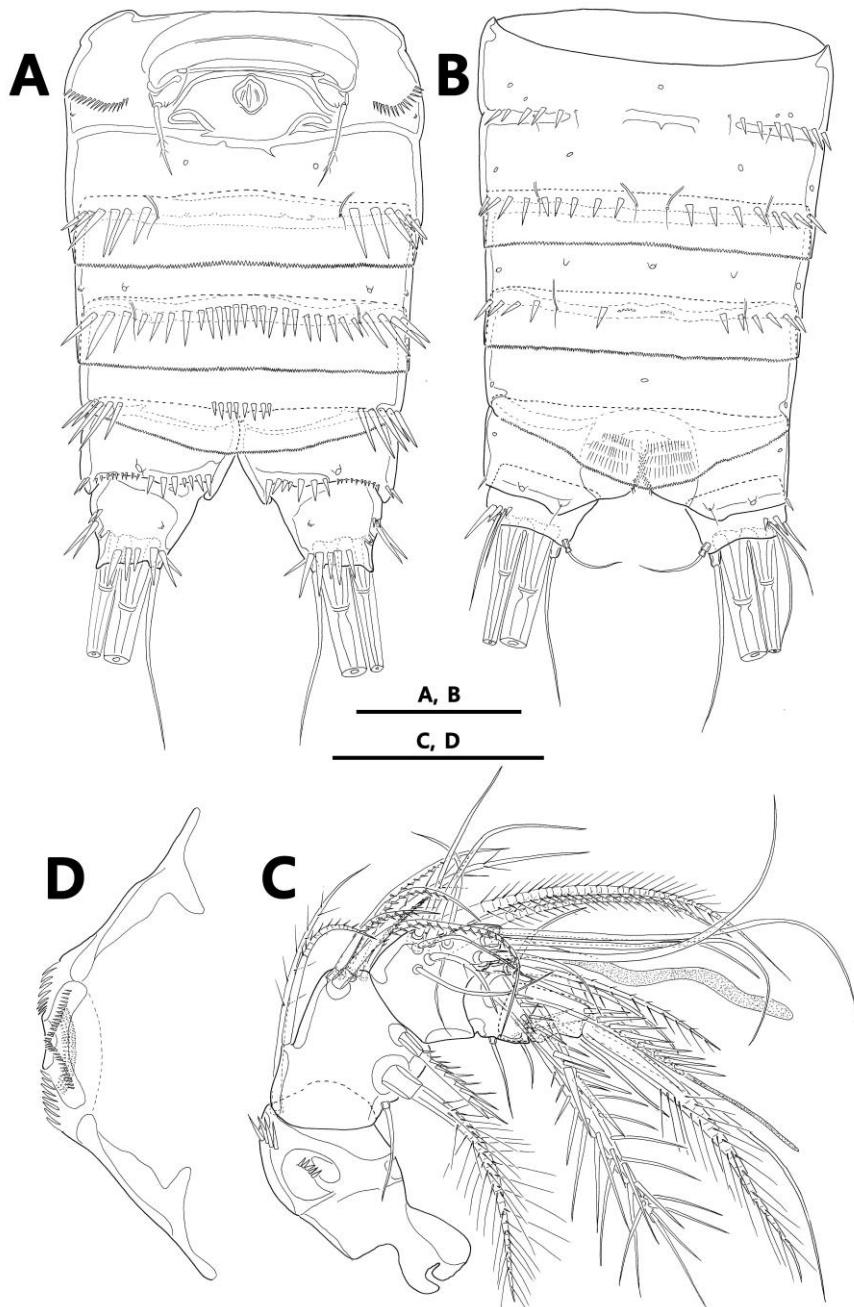
setae; of which innermost seta serrate distally, second inner seta longest, third inner seta stout, pinnate, half the length of second inner seta, second outer seta smallest, pinnate, and outermost seta pinnate as long as innermost seta.

**Male.** Unknown.

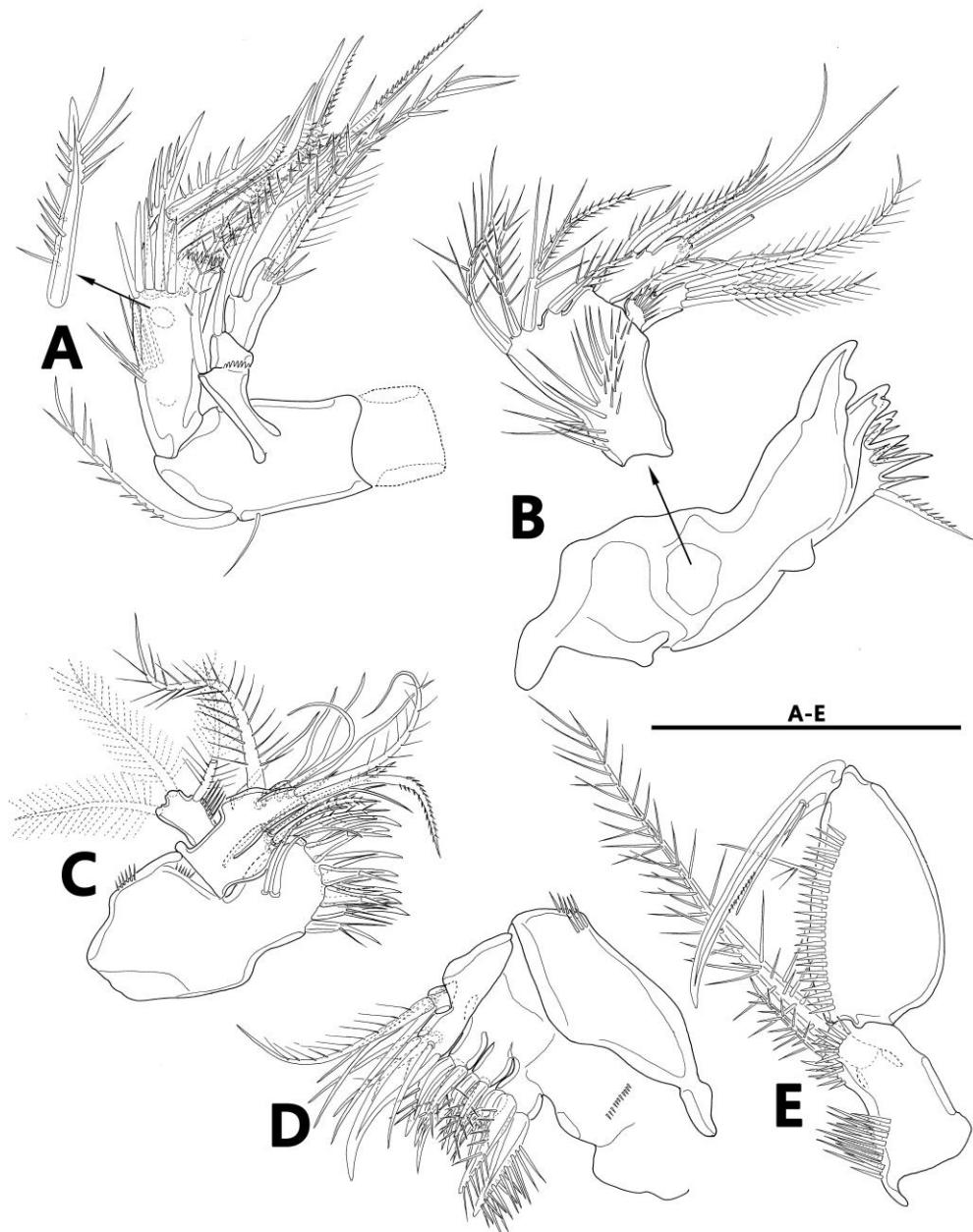
**Remarks.** This species belongs to the monotypic genus *Fladenia* Huys & Gee, 1990 by the following female characteristics combined: (1) the 5-segmented antennule; (2) the mandibular exopod half as long as endopod; (3) the maxillipedal endopod with 2 accessory setae; (4) the distal outer spine on P1 exp-3 shorter than middle outer spine; (5) the P1 enp-2 with 1 inner seta inserted proximally; (6) the P2-P3 enp-1 with 1 spine-like seta; (7) fusion of the female P5 baseoendopodal lobe and exopod. *Fladenia* sp. nov. from Korean waters is clearly distinguished from *F. robusta* (Sars, 1921), the type species of the genus, by the P5 endopodal lobe with 5 setae (vs. 4 setae in *F. robusta*) and the P2-P3 enp-3 with 1 seta (vs. 2 setae in *F. robusta*).



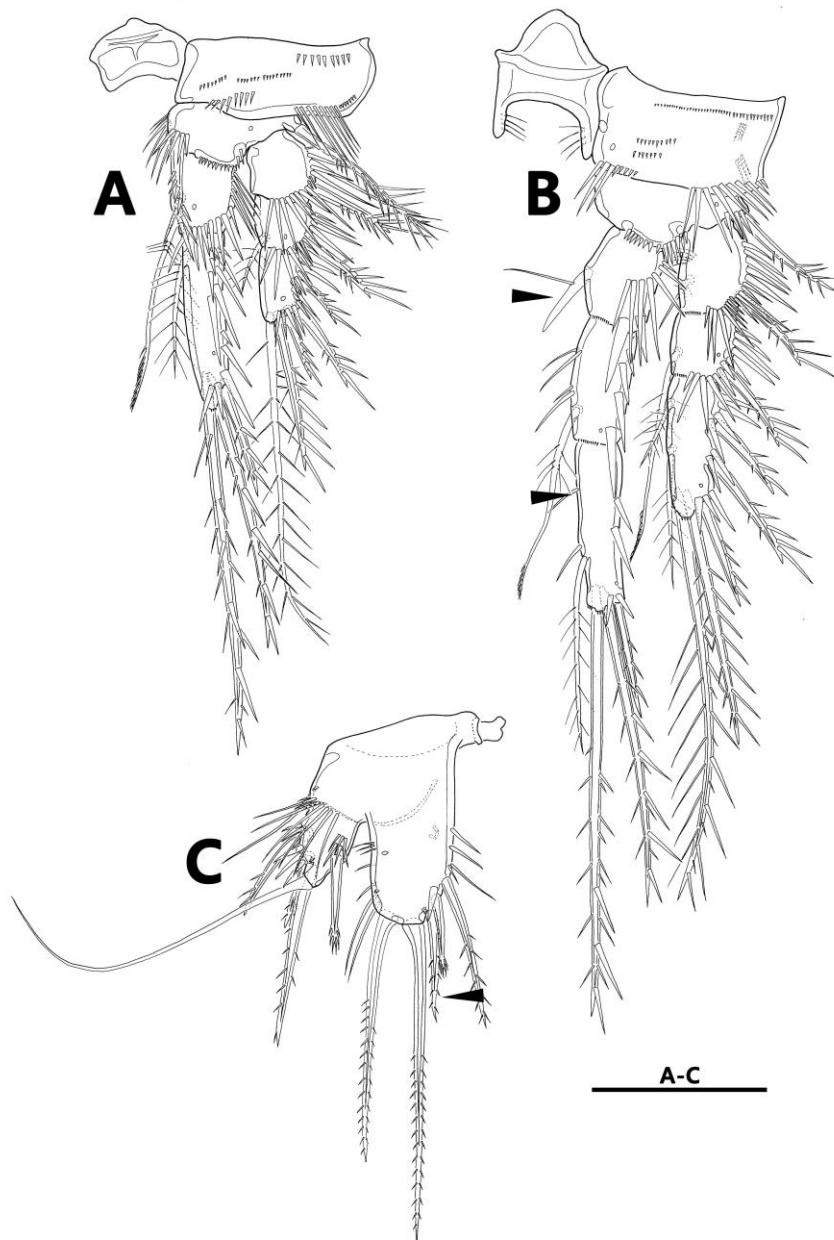
**Fig. 22.** *Fladenia* sp. nov., female. A, habitus, dorsal; B, habitus, lateral; C, rostrum. Scale bars: 50 µm (C); 100 µm (A, B).



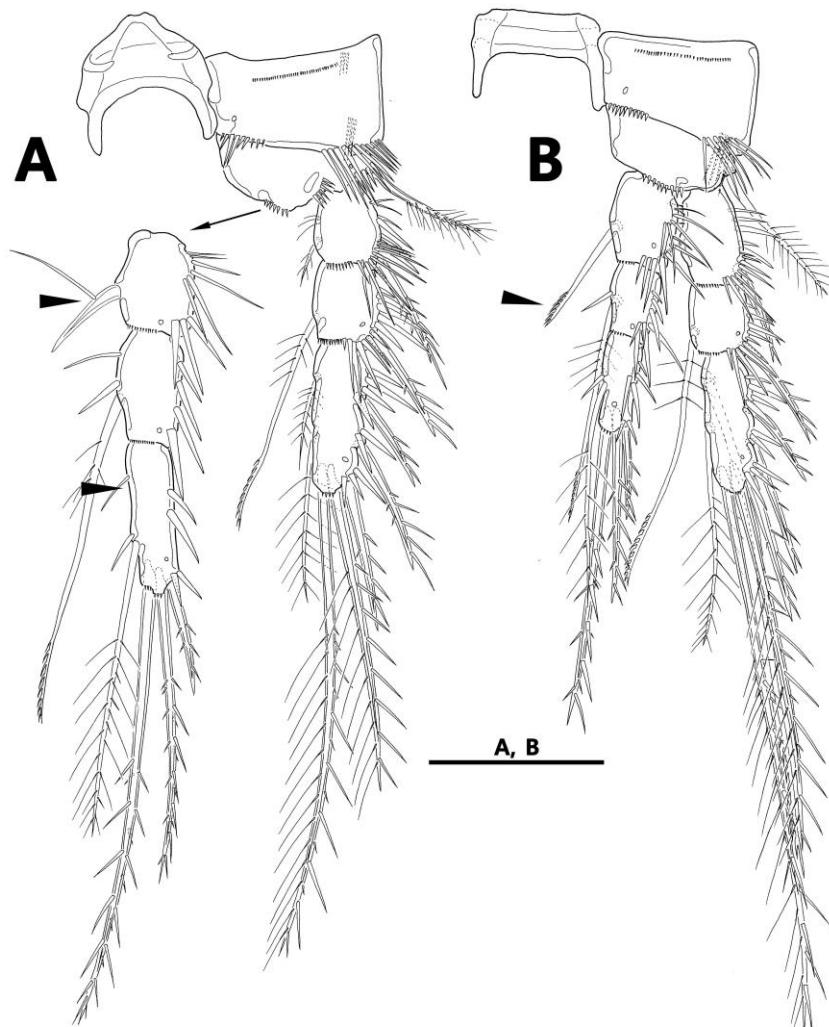
**Fig. 23.** *Fladenia* sp. nov., female. A, urosome, dorsal; B, urosome, ventral; C, antennule; D, labrum. Scale bars: 50  $\mu$ m.



**Fig. 24.** *Fladenia* sp. nov., female. A, antennule; B, mandible; C, maxillule; D, maxilla; F, maxilliped. Scale bar: 50  $\mu\text{m}$ .



**Fig. 25.** *Fladenia* sp. nov., female. A, P1; B, P2; C, P5. Scale bar: 50  $\mu\text{m}$ . Arrow heads indicate the distinct morphological feature of *Fladenia* sp. nov.



**Fig. 26.** *Fladenia* sp. nov., female. A, P3; B, P4. Scale bar: 50  $\mu\text{m}$ . Arrow heads indicate the distinct morphological feature of *Fladenia* sp. nov.

**Genus *Sentiopsis* Huys and Gee, 1996**

**모식종:** *Sentiopsis minuta* (Coull, 1969)

**12. *Sentiopsis coreana* Kim, Lee & Huys, 2011**

*Sentiopsis coreana* Kim et al., 2011, p. 180, figs. 1–9.

**관찰재료:** 5♀♀, 4♂♂, 제주 제주시 한립읍 협재리, 협재해수욕장(사질), 2014.6.26;  
5♀♀, 제주 서귀포시 안덕면 화순리, 화순해수욕장(사질), 2014.6.25.

**분포:** 한국.

**고찰:** *Sentiopsis coreana* 는 베트남에서 보고된 *S. vietnamensis* 와 형태적으로 가장 유사하지만, 몸 크기, 두흉절의 장식, 헛항문판, 미차, 큰턱의 외지, 제 1 흉지 외지의 두 번째 마디, 제 2 흉지 외지의 세 번째 마디, 제 4 흉지 외지의 두 번째 마디, 그리고 제 5 흉지의 외지에서 미세한 차이를 나타낸다(Kim et al. 2011). 본 연구에서 이 종은 제주도에서만 채집되었으며, 원기재문과 형태학적 특징이 잘 일치하였다.

**Family Parasteneliidae Lang, 1936 부요정노벌레 과****Genus *Parastenhelia* Thompson & Scott, 1903 부요정노벌레 속**

**모식종:** *Parastenhelia hornelli* Thompson & Scott, 1903

**한국산 부요정노벌레 속(*Parastenhelia*)의 종에 대한 검색표**

1. 암컷 제 5 흉지 외지는 서양배모양(pyriform)이다; 제 1 흉지의 내지 첫 번째 마디에 있는 내측강모는 매우 길다..... 배부요정노벌레 *P. pyriformis*

- 암컷 제 5 흉지 외지는 난형이다; 제 1 흉지의 내지 첫 번째 마디에 있는 내측강모는 짧다..... *P. spinosa*

### 13. *Parastenhelia spinosa* (Fischer, 1860)

*Harpacticus spinosus* Fischer, 1860, p. 665, pl. 21, figs. 51–53, pl. 22, figs. 66 (cited from Lang, 1948).

*Parastenhelia spinosa*: Lang, 1948, p. 588, fig. 240: 1; Vervoort, 1964, p. 180, figs. 64c, 66–70.

*Parastenhelia spinosa* f. *littoralis*: Yoo & Lee, 1995, p. 41, fig. 13.

**관찰재료:** 17♀♀, 7♂♂, 경상남도 남해군 남면 석교리, 월포해수욕장(모래사장), 2013.10.4; 1♀, 제주시 애월읍 곽지리, 곽지해수욕장, 2014.6.26.

**분포:** 범세계적.

**고찰:** 이 종은 범세계적으로 분포하는 것으로 알려져 있지만, 각 지역의 개체들은 제 2 촉각의 외지에 존재하는 강모의 수, 제 2 흉지 내지의 두 번째 마디의 강모수, 제 3 흉지 외지의 첫 번째 마디의 강모수, 제 4 흉지 외지의 첫 번째와 두 번째 마디의 강모수, 제 4 흉지 내지의 세 번째 마디의 강모수, 암수의 제 5 흉지 외지에 존재하는 강모수, 그리고 수컷 제 5 흉지 외지의 마디수 등의 형질들에서 서로 차이를 나타낸다(Song et al. 2003). 오늘날의 갈고리노벌레류의 분류학적 관점을 고려할 때, *Parastenhelia spinosa*에 관한 분류학적 검토가 시급하다고 판단된다. 한편, Yoo & Lee (1995)에 의하여 기록된 한국산 시료는 제 1 흉지에서 과거 기록들과 서로 잘 일치하였으나, 그들의 불충분한 기재로 인하여 암수 모두의 제 5 흉지는 비교가 불가능 하였다.

### 14. *Parastenhelia pyriformis* Song, Kim & Chang, 2003 배부요정노벌레

*Parastenhelia pyriformis* Song et al., 2003, p. 221, figs. 1–4; Lee et al., 2012, p. 153, figs. 106–110.

**관찰재료:** 16♀♀, 1♂, 전남 신안군 신용리, 압해도(갯벌), 2012.4.6; 1♂, 충남 태안군 이원면 관리, 음포해수욕장, 2012.7.22; 1♀, 전남 무안군 현경면 해운리, 함평만(사질, 니질), 2013.4.18; 2♀♀, 경남 거제시 사등면 사곡리, 사곡해수욕장(사질), 2013.7.2; 5♀♀, 전북 부안군 변산면 대항리, 새만금 방조제, 2014.8.13; 10♀♀, 전남 해남군 송지면 송호리, 송호해변(해조류), 2015.5.1; 10♀♀, 인천 중구 운서동, 영종도, 용유해수욕장, 2016.6.3.

**분포:** 한국.

**고찰:** 이 종은 Song et al. (2003)에 의하여 제주도와 승봉도에서 채집된 시료를 바탕으로 우리나라에서 최초로 보고되었다. 본 연구에서는 서해안의 갯벌뿐만 아니라 사질 및 해조류를 걸러 채집한 샘플에서도 배부요정노벌레가 채집, 확인되었다.

#### Family Dactylopusiidae Sars, 1905 발톱장수노벌레 과

##### 한국산 발톱장수노벌레 과(Dactylopusiidae)의 속에 대한 검색표

1. 제 1 촉각은 5 마디로 이루어져 있다 ..... *Paradactylopoida*  
- 제 1 촉각은 6-8 마디로 이루어져 있다 ..... 발톱장수노벌레 *Dactylopusia*

##### Genus *Dactylopusia* Norman, 1903 발톱장수노벌레 속

**모식종:** *Dactylopusia tisboides* (Claus, 1863)

##### 한국산 발톱장수노벌레 속(Dactylopusia)의 종에 대한 검색표

1. 제 1 촉각은 6 마디로 이루어져 있다 ..... *D. pauciarticulata*  
- 제 1 촉각은 8 마디로 이루어져 있다 ..... *D. falcifera*

**15. *Dactylopusia pauciarticulata* Chang & Song, 1997b**

*Dactylopusia pauciarticulata* Chang & Song, 1997b, p. 297, figs. 1–2.

**관찰재료:** 2♀♀, 충남 태안군 소원면 모항리, 만리포해수욕장, 2012.6.23; 1♀, 제주 제주시 한립읍 협재리, 협재해수욕장(사질), 2014.2.7; 2♀♀, 전남 여수시 신덕동(해조류), 2015.4.25.

**분포:** 한국.

**고찰:** 발톱장수노벌 속(*Dactylopusia*)의 종들은 제 1 촉각이 7–9 마디로 이루어져 있지만, *D. pauciarticulata* 는 제 1 촉각이 6 마디로 이루어져 있는 유일한 종이다(Chang & Song 1997b).

**Genus *Paradactylopoida* Lang, 1948**

**모식종:** *Paradactylopoida latipes* (Boeck, 1865)

**16. *Paradactylopoida koreana* Chang & Song, 1997b**

*Paradactylopoida serrata* sensu Yoo & Lee, 1995, p. 41, fig. 10.

*Paradactylopodia koreana* Chang & Song, 1997b, p. 299, figs. 3–4.

**관찰재료:** 3♀♀, 인천 강화군 삼산면 매음리, 석모도, 민머루해수욕장, 2012.7.4; 2♀♀, 1♂, 인천 강화군 내가면 황청리, 황청리선착장(갯벌), 2012.7.7; 4♀♀, 전남 신지면 대평리(갯벌), 신지도, 2012.7.19; 2♀♀, 전남 완도군 금일면 연지리(잘피밭), 금일도, 2012.7.20; 2♀♀, 경남 거제시 남부면 갈곶리(해조류), 2014.5.18; 1♀, 곽지해수욕장, 제주시 애월읍 곽지리(해조류), 2014.6.26; 5♀♀, 전남 해남군 송지면 송호리(해조류), 송호해수욕장, 2015.5.1; 1♀, 전남 해남군 화산면 평호리(해조류), 송평해변, 2015.5.1; 1♀, 전남 진도군 의신면 금갑리(해조류),

금갑해수욕장, 2015.5.2; 5♀♀, 전북 고창군 해리면 금평리, 2015.5.7; 2♀♀, 전남 여수시 신덕동(해조류), 2015.5.16; 2♀♀, 경북 포항시 남구 동해면 입암리, 2015.5.29; 3♀♀, 부산시 기장군 일광면 학리(해조류), 일광해수욕장, 2015.7.28; 2♀♀, 전북 군산시 비응도동(암반, 해조류), 2016.8.17; 1♀, 충남 서천군 서면 도둔리, 춘장대해수욕장, 2016.08.17; 2♀♀, 충남 보령시 응천읍 관당리, 무창포해수욕장, 2016.08.17

**분포:** 한국.

**고찰:** 수컷의 제 2 흉지 내지에서 성적이형을 나타내는 것은 *Paradactylopoida* 속의 중요한 특징이며, 그 형질상태에 따라 속의 종들은 서로 구별될 수 있다. Chang & Song (1997)은 우리나라의 시료가 위의 형질에서 *P. serrata* 와 차이를 나타내는 것을 확인하고 신종으로 (*P. koreana*) 보고하였으며, Yoo & Lee (1995)의 *P. serrata* Lang, 1965 를 동정이명 처리하였다. 이 종은 제 1 촉각의 세 번째 마디, 제 1 소악의 외지에 존재하는 강모수, 수컷의 제 5 흉지 외지에 존재하는 강모에서도 *P. serrata* 와 차이를 보인다.

### Family Hamondiidae Huys, 1990 하몬드장수노벌레과

#### Genus *Ambunguipes* Huys, 1990 양발톱노벌레 속

**모식종:** *Ambunguipes rufocincta* (Brady, 1880)

##### 17. *Ambunguipes rufocincta* (Brady, 1880) 붉은양발톱노벌레

*Thalestris rufocincta* Brady, 1880, p. 125, pl. 57, figs. 1–9.

*Rhynchothalestris rufocincta*: Sars, 1905, p. 120, pls. 73–74; Sewell, 1940, p. 184; Lang, 1948, p. 523, fig. 214: 2; Vervoort, 1962, p. 420, figs. 10–11; Yeatman, 1976, p. 207, figs. 22–26.

*Ambunguipes rufocincta*: Huys, 1990, p. 94, figs. 24–33; Song et al., 1999, p. 197, figs. 6–7;  
Lee et al., 2012, p. 49, figs. 31–32.

**관찰재료:** 1♂, 전남 고흥군 금산면 어전리(해조류), 거금도, 2012.5.9; 3♀♀, 1♂,  
전남 신안군 흑산면 가거도리(해조류, 수심 5m), 가거도, 2013.7.30; 1♀, 전남  
완도군 금일면 일정리, 금일도(해조류), 2014.6.30; 1♀, 송호해수욕장, 전남 해남군  
송지면 송호리, 일정항(해조류), 2015.5.1; 3♀♀, 전남 여수시 남면 우학리, 금오도,  
2015.5.13; 1♀, 경북 울릉군 울릉읍, 울릉도(잘피밭), 2016.6.17.

**분포:** 한국, 인도태평양, 지중해, 흑해, 유럽, 캐리브해, 버뮤다.

**고찰:** Huys (1990)은 Hamondiidae 와 Ambunguipedidae 를 새로이 설정하였으나,  
Willen (2000)은 이 두 과 모두를 Rhychothalestridae 의 동종이명으로 처리하였다.  
그 이후, Boxshall & Halsey (2004)는 제1족각의 첫번째 마디에 강모를 가지지 않는  
점, 수컷의 제2흉지 내지의 형질 등을 이 두 과의 공유파생형질로 여기고 둘 중  
처음으로 기록된 Hamondiidae 로 동종이명처리하였다. 그 결과 이 종은 현재  
Hamondiidae 에 위치하고 있다.

### Superfamily Thalestroidea Sars, 1905

#### Family Miraciidae Dana, 1846 놀랑장수노벌레 과

##### 한국산 놀랑장수노벌레 과(Miraciidae)의 속에 대한 검색표

1. 두흉부 앞쪽에 한 쌍의 커다란 각질총 렌즈를 가진다 .....  
.....놀랑장수노벌레 속 *Miracia*  
- 두흉부 앞쪽에 한 쌍의 커다란 각질총 렌즈를 가지지 않는다.....2
2. 제 1 촉각의 첫 번째 마디는 강모를 가지지 않는다; 미자는 폭에 비해서  
11 배 정도 길다 .....큰별노벌레 속 *Macrosetella*

-	제 1 측각의 첫 번째 마디는 강모를 가진다; 미차는 폭에 비해서 3 배 이하 정도 길다 .....	3
3.	제 5 흉지 기내지는 엽을 가지지 않는다.....	4
-	제 5 흉지 기내지는 잘 발달된 엽을 가진다.....	8
4.	제 5 흉지 외지는 돌기 형태로 길게 신장되어 있다; 큰턱의 내지는 일반적인 강모들을 가진다 ..... 발톱요정노벌레 속 <i>Onychostenhelia</i>	
-	제 5 흉지 외지는 일반적인 형태이다; 큰턱의 내지는 매우 긴 강모들을 가진다 .....	5
5.	제 1 흉지 내지는 3 마디로 이루어져 있다..... <i>Stenhelia</i>	
-	제 1 흉지 내지는 2 마디로 이루어져 있다.....	6
6.	이마뿔의 말단 가장자리에 잔가시열을 가진다 ..... <i>Itostenhelia</i>	
-	이마뿔의 말단 가장자리에 잔가시열을 가지지 않는다 .....	7
7.	제 5 흉지 기내지에는 3 개의 강모만을 가지며, 가장 안쪽 강모는 다른 두 강모와 멀리 떨어져 있다 ..... <i>Willensteinhelia</i>	
-	제 5 흉지 기내지에는 4 개의 강모를 가지며, 서로 인접해 있다 .....	
	..... <i>Wellstenhelia</i>	
8.	제 2–4 흉지 외지의 세 번째 마디는 2 개의 가시들을 가진다 .....	
	..... 갈래장수노벌레 속 <i>Schizopera</i>	
-	제 2–4 흉지 외지의 세 번째 마디는 3 개의 가시들을 가진다 .....	9
9.	제 2 흉지 내지의 첫 번째 마디는 내측강모를 가진다 .....	10
-	제 2 흉지 내지의 첫 번째 마디는 내측강모를 가지지 않는다 .....	16
10.	제 3 흉지 내지의 세 번째 마디는 5 개의 강모를 가진다 .....	11
-	제 3 흉지 내지의 세 번째 마디는 6 개의 강모를 가진다 .....	13
11.	제 1 흉지 내지의 각 마디들은 길이가 비슷하다 .....	
	..... 신쌍낭장수노벌레 속 <i>Sinamphiascus</i>	

- 제 1 흉지 내지의 두 번째 마디는 다른 마디들에 비해 길이가 현저히 짧다 ..... 12
- 12. 미차의 길이는 그 너비에 비하여 현저히 길다 ..... *Typhlamphiascus*
  - 미차의 길이는 그 너비보다 짧다 .....
  - ..... 둥근쌍낭장수노벌레 속 *Bulbamphiascus*
- 13. 제 1 흉지의 외지는 내지보다 약간 짧다 ..
  - ..... 손다리쌍낭장수노벌레 속 *Dactylopodamphiascopsis*
- 제 1 흉지의 외지는 내지보다 현저히 짧다 ..... 14
- 14. 제 1 흉지 외지의 두 번째 마디는 다른 마디들에 비하여 길게 신장되어 있다 ..... 세모뿔장수노벌레 속 *Amonardia*
  - 제 1 흉지 외지의 각 마디들은 길이가 비슷하다..... 15
- 15. 제 3 흉지 외지의 세 번째 마디는 최대 2 개의 강모를 가진다.....
  - ..... 쌍낭장수노벌레 속 *Sarsamphiascus*
- 제 3 흉지 외지의 세 번째 마디는 3 개의 강모를 가진다 ..... *Amphiascus*
- 16. 제 3 흉지 내지의 두 번째 마디는 2 개의 내측강모를 가진다 ..
  - ..... 두주머니장수노벌레 속 *Diosaccus*
- 제 3 흉지 내지의 두 번째 마디는 1 개의 내측강모를 가진다 ..... 17
- 17. 수컷, 제 2 흉지 내지 두 번째 마디는 가시형태로 변형된 내측강모를 가진다 ..... 나도쌍낭장수노벌레 속 *Paramphiascella*
  - 수컷, 제 2 흉지 내지 두 번째 마디는 일반적인 내측강모를 가진다 ..
    - ..... 부쌍낭장수노벌레 속 *Amphiascoides*

### Subfamily *Diosaccinae* Sars, 1906

Genus *Diosaccus* Boeck, 1873 두주머니장수노벌레 속

모식종: *Diosaccus tenuicornis* (Claus, 1863)

### 18. *Diosaccus ezoensis* Itô, 1974 에조두주머니장수노벌레

*Diosaccus ezoensis* Itô, 1974, p. 611, figs. 33–36; Song et al., 1999, p. 194, figs. 4–5; Lee et al., p. 105, figs. 69–73.

**관찰재료:** 1♀, 전남 고흥군 금산면 어전리, 거금도(해조류) 2012.5.9; 1♀, 1♂, 부산시 기장군 일광면 학리(해조류), 일광해수욕장, 2012.5.18; 6♀♀, 6♂♂, 울산시, 을주군 서생면 진하리(해조류), 솔개해수욕장, 2012.5.18; 1♀, 경남 남해군 남면 석교리, 두곡해수욕장, 2013.10.4; 5♀♀, 경남 통영시 산양읍 미남리, 2014.3.21; 1♀, 전남 완도군 금일도(light trap), 2015.3.18; 4♀♀, 전남 진도군 진도읍 산월리, 쉬미항, 2015.5.1; 2♀♀, 전남 여수시 남면 우학리, 금오도, 2015.5.13.

**분포:** 한국, 일본.

**고찰:** 우리나라의 암반조간대에 서식하고 있는 해조류에서 흔히 출현하는 종이다(Lee et al. 2012). 한국산 시료들은 일본의 원기재문(Itô 1974)과 전체적으로 서로 잘 일치하고 있으나, 암컷 제 5 흉지 외지에 존재하는 강모의 길이와 수컷 제 2 흉지 내지 세 번째 마디의 바깥 가장자리의 장식 유무에서 서로 차이를 나타내는 것으로 알려져 있다(Song et al. 1999). 이와 더불어 본 저자는 수컷 제 2 흉지 내지 세 번째 마디의 말단 가장자리에 존재하는 강모의 길이가 두 지역의 시료들간에 서로 차이를 나타내는 것을 인식하였다. 놀람장수노벌레과의 일부 속(예, *Paramphiascella*)의 경우 이 마디의 형질 상태는 종을 구별할 수 있는 형질로 여겨지고 있으므로, 이에 대한 분류학적 검토가 필요하다.

**Genus *Sarsamphiascus* Huys, 2009**

**모식종:** *Sarsamphiascus minutus* (Claus, 1863)

**19. *Sarsamphiascus kawamurai* (Ueda & Nagai, 2005)**

*Amphiascus kawamurai* Ueda & Nagai, 2005, p. 249, figs. 1–5; Chang 2009a, 216, figs. 2–3;

Chang, 2009b, p. 199, pl. 8A, fig. 81; Chang, 2010, p. 67, fig. 29.

*Sarsamphiascus kawamurai* Huys, 2009, p. 71.

**관찰재료:** 2♀♀, 전남 완도군 금일면 연지리, 금일도(잘피밭), 2013.7.22; 1♀, 1♂,  
충남 태안군 원북면 방갈리, 민어도, 2012.6.23; 2♀♀, 전남 여수시 신덕동(해조류),  
2015.5.16.

**분포:** 한국, 일본.

**고찰:** Sars (1905)는 *Dactylopus* Claus, 1863 (= *Dactylopusia* Norman, 1903) 속에 위치하고 있던 3 종, 즉 *D. longirostris* Claus, 1863, *D. minutus* Claus, 1863, 및 *D. debilis* Giesbrecht, 1881으로 구성된 *Amphiascus* 속을 새로 설정하였다. 그러나 그는 이 속의 모식종을 설정하지 않았는데, 이러한 문제점을 발견한 Nicholls (1941)에 의하여 *A. longirostris* (Claus, 1863)가 이 속의 모식종으로 지정되었다. 한편, Lang (1944)는 *Paramphiascopsis* 속을 새로 세우며, 속의 모식종으로 *D. longirostris* (= *A. longirostris*)를 지정하였다. 그 결과, *D. longirostris* 는 2 개의 속 *Amphiascus* 와 *Paramphiascopsis* 의 모식종으로 지정된 것이다. 이러한 분류학적 문제점을 해결하기 위하여 Huys (2009)는 *Paramphiascopsis* 속을 *Amphiascus* 속의 junior synonym 으로 처리하였으며, 모식종과 형질의 차이를 보이는(즉, *Paramphiascopsis* 속의 범주에 속하지 않는) 종들을 새로운 속 *Sarsamphiascus* 으로 배치하였다.

## Genus *Schizopera* Sars, 1905 갈래장수노벌레 속

모식종: *Schizopera longicauda* Sars, 1905

### 한국산 갈래장수노벌레 속(*Schizopera*)의 종에 대한 검색표

1. 제 3-4 흉지 내지 첫 번째 마디에 내측강모를 가지지 않는다 ..... 2
  - 제 3-4 흉지 내지 첫 번째 마디에 내측강모를 가진다 ..... 3
2. 제 2 흉지 외지 세 번째 마디는 짧은 우상강모를 가진다; 제 3-4 흉지 내지 세 번째 마디는 2 개의 강모/가시를 가진다 ..... *S. gangneungensis*
  - 제 2 흉지 외지 세 번째 마디는 길고, 빗살모양의 강모를 가진다; 제 3-4 흉지 내지 세 번째 마디는 3 개의 강모/가시를 가진다.....  
.....민짜갈래장수노벌레 *S. neglecta*
3. 제 2-4 흉지 외지 두 번째 마디에 내측강모를 가진다 ..... 4
  - 제 2-4 흉지 외지 두 번째 마디에 내측강모를 가지지 않는다 ..... 5
4. 미차의 길이는 그 너비의 약 1.4 배 정도이며, 안쪽 가장자리는 완만하다 ..... *S. daejinensis*
  - 미차의 길이는 그 너비의 약 1.3 배 정도이며, 안쪽 가장자리는 볼록한 편이다 ..... 갈래장수노벌레 *S. clandestina*
5. 미차의 길이는 그 너비의 약 2.3 배 정도이다 ..... *S. yeonghaensis*
  - 미차의 길이는 그 너비의 약 1.1 배 정도이다 ..... *S. sindoensis*

### 20. *Schizopera clandestina* (Klie, 1924) 갈래장수노벌레

*Amphiascus clandestinus* Klie, 1924, p. 335, figs. 1-6; Pesta, 1932, p. 63, fig. 69.

*Schizopera subterranea* Lang, 1948, p. 752, fig. 305: 7.

*Schizopera clandestina*: Kunz, 1937, p. 100, pl. 3, fig. 15; Lang, 1948, p. 748, fig. 304;  
Borutzky, 1952, p. 120; Noodt, 1953, p. 11, figs. 22-26; Dussart, 1967, p. 197, fig. 72;

Tai & Song, 1979, p. 192, fig. 101 ;Chang, 2009b, p. 190, figs. 75–76; Chang, 2010, p. 60, figs. 25–26.

**관찰재료:** 1♀, 인천 강화군 내가면 황청리(갯벌), 2012.7.7; 1♀, 전북 부안군 벤산면 대항리, 새만금 방조제, 2014.8.13; 1♀, 전남 해남군 송지면 산정리(갯벌), 2015.5.1; 1♀, 전남 완도군 금일읍 화목리, 금일도, 2016.5.1.

**분포:** 한국, 중국, 북아프리카, 유럽.

**고찰:** 이 종은 전세계적으로 분포하고 있는 것으로 알려져 있다(Karanovic & Cho 2016). 중국과 우리나라에서 보고된 개체는 Klie (1924)의 원기재문과 꼬리강모 V에서 차이를 나타낸다. 유럽산 개체는 이 강모의 근저부에서 현저히 부풀어 있는 부분을 가지고 있다.

## 21. *Schizopera yeonghaensis* Karanovic & Cho, 2016

*Schizopera yeonghaensis* Karanovic & Cho, 2016, p. 10, figs. 4–6, 16A.

**관찰재료:** 3♀♀, 강원 고성군, 토성면 교암리(기수역), 문암해수욕장, 2015.7.20

**분포:** 한국.

**고찰:** 이 종은 다음과 같은 특징들에 의하여 우리나라에 기록된 다른 갈래장수노벌레 속의 종들과 쉽게 구분할 수 있다: (1) 제 3–4 흉지 내지 첫 번째 마디에 내측강모를 가진다; (2) 제 2–4 흉지 외지 두 번째 마디에 내측강모를 가지지 않는다; (3) 미차의 너비에 대한 길이의 비가 약 2.3 배이다. 이 종은 동해안의 기수역에서 서식하고 있는 것으로 판단된다.

**Genus *Amphiascoides* Nicholls, 1941 부쌍낭장수노벌레 속**

모식종: *Amphiascoides debilis* (Giesbrecht, 1881)

**22. *Amphiascoides coreanus* Lee, Soh & Suh, 2007 한국부쌍낭장수노벌레**

*Amphiascoides coreanus* Lee et al., 2007, p. 279, figs. 1–7; Lee et al., 2012, p. 91, figs. 58–64.

**관찰재료:** 10♀♀, 경남 남해군 상주면 상주리(사질; 모식산지), 상주해수욕장, 2013.10.4; 15♀♀, 5♂♂, 전남 여수시 화양면 이목리(잘피밭), 2016.5.29.

**분포.** 한국.

**고찰:** 부쌍낭장수노벌레 속(*Amphiascoides*)은 나도쌍낭장수노벌레 속(*Paramphiascella*)과 매우 유사하지만, 수컷 제 2 흉지 내지의 성적이형의 형질상태에 따라 서로 구분할 수 있다. 부쌍낭장수노벌레 속의 종들은 변형된 내지 두 번째 마디에 3 개의 보통 강모를 가지고 있지만, 나도쌍낭장수노벌레 속의 종들은 이 마디에 두껍게 변형된 강모를 하나 이상 가지고 있다.

부쌍낭장수노벌레 속의 종들은 제 4 흉지 내지의 마지막 마디에 존재하는 강모의 수에 따라 두 그룹으로 나뉠 수 있다(Lotufo & Fleeger 1995). 한국부쌍낭장수노벌레(*A. coreanus*)는 이 마디에 7 개의 가시/강모를 가지는 그룹에 속하며, 매우 짧고 둥글납작한 꼬리강모 IV 와 V, 그리고 제 3 흉지 내지의 마지막 마디에 존재하는 강모의 수 등의 특징의해 이 그룹의 다른 종들과 쉽게 구분될 수 있다(Lee et al. 2007).

**Genus *Dactylopodamphiascopsis* Lang, 1944 손다리쌍낭장수노벌레 속**

모식종: *Dactylopodamphiascopsis latifolius* (Sars, 1909)

**23. *Dactylopodamphiascopsis latifolius* (Sars, 1909) 넓은잎손다리장수노벌레**

*Amphiascus latifolius* Sars, 1909, p. 28, pl. 7(cited from Song et al., 1999); 1911, p. 379, pl. 16.

*Dactylopodamphiascopsis latifolius*: Lang, 1948, p. 672, fig. 272; Chislenko, 1977, p. 248, pl. 7, figs. 9–10; Song et al., 1999, p. 189, figs. 1–3; Lee et al., 2012, p. 101, figs. 66–68.

**관찰재료:** 3♀♀, 부산시 기장군 일광면 학리(해조류), 일광해수욕장, 2012.5.18; 5♀♀, 제주 제주시 우도면 서광리(해조류), 서빈백사, 2014.6.24; 6♀♀, 제주시 한림읍 협재리(해조류), 협재해수욕장, 2014.6.25; 2♀♀, 제주시 서귀포시 강정동, 2014.6.25; 1♀, 1♂, 전남 완도군 금일면 장경리(해조류), 금일도, 2014.6.30; 1♀, 경북 울진군 울진읍 연지리, 2014.9.17; 1♀, 경상남도 거제시 남부면 갈곶리, 2014.10.21; 2♀, 경북 경주시 감포읍 전촌리(해조류), 2015.5.18; 1♀, 경북 포항시 남구 동해면 입암리(해조류), 2015.5.19; 2♀♀, 경북 울릉군 울릉읍 독도리, 독도(해조류, 수심 5m), 2016.6.23.

**분포:** 한국, 노르웨이, 아이스랜드, 북미.

**고찰:** 손다리쌍낭장수노벌레 속(*Dactylopodamphiascopsis*)은 제 1 흉지 외지 두 번째 마디가 매우 길게 발달되어 있어(내지 첫 번째 마디의 길이보다 조금 짧음) 다른 놀람장수노벌레속의 종들과 쉽게 구분될 수 있다. 현재 이 속은 넓은잎손다리장수노벌레(*D. latifolius*)만이 기록되어 있다.

Song et al. (1999)은 이 종을 처음으로 우리나라에 보고하였는데, 한국산 개체들은 제1흉지 외지, 암컷 제5흉지, 수컷 제2흉지 내지의 형질상태에서 Sars (1909)의 원기재문과 서로 차이를 나타낸다고 보고하였다.

## Genus *Amonardia* Lang, 1944 세모뿔장수노벌레 속

모식종: *Amonardia similis* (Claus, 1866)

### 한국산 세모뿔장수노벌레 속의 종에 대한 검색표

1. 제 1 흉지 외지 세 번째 마디에 5 개의 강모/가시를 가진다.....  
.....한국세모뿔장수노벌레 *A. coreana*
- 제 1 흉지 외지 세 번째 마디에 4 개의 강모/가시를 가진다.....  
.....세모뿔장수노벌레 *A. normani*

### 24. *Amonardia normani* (Brady, 1872) 세모뿔장수노벌레

*Dactylopus normani* Brady, 1872, p. 411, pl. 20, figs. 13–17 (cited from Lang 1948).

*Amonardia normani*: Lang, 1948, p. 677, figs. 269: 4, 273: 2; Dinet, 1971, p. 750, pl. 2;  
Apostolov & Marinov, 1988, p. 165; Song & Chang, 1995, p. 72, fig. 5; Chang, 2009b,  
p. 196, fig. 79; Chang, 2010, p. 65, fig. 28.

**관찰재료:** 1♀, 전남 완도군 금일도 연지리(잘피밭), 금일도, 2012.7.20; 1♀,  
경남거제시 사등면 사곡리(해조류), 사곡해수욕장, 2013.7.2; 1♀, 제주시 한림읍  
협재리(해조류), 협재해수욕장, 2014.6.26; 3♀♀, 부산시 기장군 일광면  
학리(해조류), 일광해수욕장, 2015.7.28; 1♀, 전남 완도군 금일면(light trap),  
금일도, 2015.3.18; 1♀, 충남 서천군 서면 도둔리, 춘창대해수욕장, 2016.8.17.

**분포:** 한국, 영국, 노르웨이, 스웨덴, 독일, 프랑스, 불가리아, 아르헨티나.

**고찰:** 이 종은 제 1 흉지 외지 세 번째 마디에 존재하는 강모의 수에 따라  
한국세모뿔장수노벌레(*Amonardia coreana*)와 손쉽게 구별할 수 있다.  
세모뿔장수노벌레는 이 마디에 4 개의 강모를 가지고 있으나,  
한국세모뿔장수노벌레는 5 개의 강모를 가진다.

**25. *Amonardia coreana* Song, Rho & Kim, 2007 한국세모뿔장수노벌레**

*Amonardia coreana* Song et al., 2007a, p. 69, figs. 1–7; Lee et al., 2012, p. 86, figs. 55–57.

**관찰재료:** 1♀, 전남 고흥군 금산면 어전리(해조류), 거금도, 2012.5.9; 1♀, 부산시 기장군 일광면 학리(해조류), 일광해수욕장, 2012.5.18; 2♀♀, 1♂, 울산시 을주군 서생면 진하리(해조류), 솔개해수욕장, 2012.5.18; 4♀♀, 울산시 동구 일산동(light trap), 일산해수욕장, 2015.5.17; 2♀♀, 경북 포항시 남구 동해면 입암리, 2015.5.19.

**분포:** 한국.

**고찰:** 이 속의 종들은 제 1 흉지 외지 마지막 마디에 존재하는 강모수에 따라 두 그룹으로 나눌 수 있다(Lang 1948, 1965). 이 종은 5 개의 강모를 가지는 그룹에 속하며, 이 그룹의 종들 중 California에서 보고된 *Amonardia perturbata* Lang, 1965 와 가장 유사하다(Song et al. 2007). 그러나 이 두 종은 암컷 제 1 촉각, 큰턱의 내지, 제 1 소악, 제 1 흉지 외지의 두번째 마디, 암컷 제 6 흉지, 수컷 제 2 흉지의 내지의 형질상태에서 서로 차이를 보인다(Song et al. 2007).

**Genus *Amphiascus* Sars, 1905**

**모식종:** *Amphiascus longirostris* (Claus, 1863)

**26. *Amphiascus* sp. nov. (Figs. 27–31)**

**Type locality.** Off Gageodo Island ( $34^{\circ}3'45.17"N$ ,  $125^{\circ}5'41.51"E$ ), Gageodo-ri, Heuksan-myeon, Sinan-gun, Jeollanam-do, South Korea.

**Materials examined.** Holotype: 1 female dissected and mounted in lactophenol solution on a slide. Allotype: 1 male dissected and mounted in lactophenol solution on slides. Paratypes: 2 females were dissected on several slides and 2 females preserved in a vial with 99 % ethanol solution.

**Description. Female.** Urosome (Fig. 28E, F) composed of P5 bearing-somite, genital double-somite, and 3 free urosomites. Genital double-somite incompletely separated laterally by subcuticular ridge, but fused dorsally and ventrally; genital somite with 2 pairs of spinular groups on dorsolateral surface, 1 pair of spinular group on ventrolateral surface, and several rows of minute spinules and 4 pairs of sensilla on dorsal surface; first abdominal somite with 3 rows of spinules on lateral surface and 3 pairs of sensilla on surface; hyaline frill armed with minute spinules. Genital field (Fig. 28F) with paired genital apertures covered by vestigial P6; copulatory pore obscured by oval-shaped bulb; P6 composed of 1 small plumose, 1 sender, and 1 long pinnate setae. Urosomite 4 (Fig. 28E, F) about 0.5 times as long as width; dorsal surface with several rows of minute spinules, and 1 pore; ventral surface with 2 pairs of tube pores; lateral surface with 4 rows of stout spinules; posterior border with 3 pairs of sensilla; hyaline frills armed with minute spinules posteriorly. Urosomite 5 longer than preceding one; dorsal surface with 1 pore and several rows of minute spinules; lateral surface with 1 row of stout spinules posteriorly; ventral surface with 1 pair of tube pores; pseudoperculum well-developed, W-shaped; hyaline frills armed with minute spinules. Anal somite about 0.6 times as long as preceding one; dorsal surface with deep cleft medially, 2 pairs of spinules, and 1 pair of sensilla; lateral surface with 1 row of spinules; posterior surface with 1 row of minute spinules and 1 pair of tube pore; posterior margins armed with spinules laterally and ventrally.

Rostrum (Fig. 27A) well-developed, triangular in shape, tapering anteriorly, defined at base; each lateral margin with 1 sensillum subdistally; dorsal surface with 1 tube pore subdistally.

Caudal ramus (Fig. 28E, F) about 1.5 times as broad as long; dorsal surface with 1 tube pore; outer and inner margins, each with several spinules; posterior margin with 1 slender tube pore ventrally; with 7 setae: seta I stout, serrate, and as long as caudal rami; seta II elongate, naked; seta III slender, naked, and slightly longer than seta II; terminal setae IV and V well-developed; seta VI slender, bare, and slightly longer than seta II; seta VII tri-articulated at its base, nearly as long as seta II.

Antennule (Fig. 27A) 8-segmented; segment 1 with 1 tube pore on dorsal surface and 3 rows of spinules along anterior margin; segment 2 longest, swollen medially; segment 5 shortest; segments 4 and 8, each with aesthetasc fused to neighboring seta basally. Setal formula as follows: 1-[1], 2-[11], 3-[8], 4-[4 + ae], 5-[2], 6-[3], 7-[4], 8-[7 + ae].

Antenna (Fig. 27B). Coxa small. Basis fused to first segment of endopod, forming allobasis, which separated by incomplete suture; proximal segment small, with 6 rows of spinules; distal segment elongate, with 1 abexopodal seta. Exopod 3-segmented; proximal segment elongate, with 1 pinnate seta distally; middle segment small, without seta; distal segment with 1 spinular row subdistally and 4 pinnate (1 lateral, 3 apical) setae. Endopod 1-segmented, slightly shorter than allobasis; abexopodal margin with 2 rows of spinules and 2 stout pinnate spines; with subdistally 2 setae, and 4 oblique frills; distal armature composed of 1 small pinnate spine, 4 geniculate setae, and 2 slender pinnate setae (of which one fused to innermost geniculate seta at base).

Labrum (Fig. 27C) hexagonal; distal margin armed with 2 rows of stout spinules; lateral margin, each with 2 slender tube pores; posterior surface with several groups of small spinules.

Mandible (Fig. 28A). Coxa well-developed, with 1 protrusion on inner margin. Gnathobase armed with 7 cuspid teeth, several spinules, and 1 pinnate seta. Palp composed of basis, exopod, and endopod. Basis broad, with 5 groups of spinules on surface and 1 row of setules along lateral margin proximally. Exopod 2-segmented; proximal segment elongate, with 1 lateral and 1 subdistal plumose setae; distal segment shorter than preceding one, with 2 apical setae. Endopod broad, bilobate; inner lobe small, with 1 pinnate, 1 bare setae on apical margin; outer lobe with 6 bare setae along apical margin.

Maxillule (Fig. 28B). Praecoxa with 2 rows of spinules along outer margin; arthrite well-developed, armed with 6 serrate and 1 pinnate spines, and 2 spinulose setae along distal margin, 1 row of spinules on lateral margin, and 2 parallel setae on anterior surface. Coxal endite small, with 1 stout pinnate and 2 bare setae on distal margin; surface with 1 row of spinules subdistally. Basis with 2 rows of spinules on anterior surface, 1 row of spinules on lateral margin; posterior surface with 1 slender seta near small peduncle and 1 slender seta near distal margin; small peduncle with 1 pinnate and 1 slender setae apically; distal armature composing of 1 stout pinnate, 1 bare, and 1 pinnate setae. Exopod 1-segmented, elongate, with 1 row of setules along lateral margin and 2 plumose setae on distal margin. Endopod 1-segmented, with 1 row of setules along lateral margin, and 2 lateral and 2 apical setae.

Maxilla (Fig. 28C). Syncoxa large, with 2 rows of setules and 1 row of spinules along outer margin; with 3 endites: proximal endite with 3 plumose setae, of which distal one fused to endite at its base; middle endite with 2 spinulose setae; distal endite with 3 spinulose setae.

Allobasis drawn out into claw-like process; anterior surface with 1 row of spinules and 1 slender and 1 stout setae; posterior surface with 3 setae; claw-like process armed with spinules. Endopod 2-segmented; proximal segment with 1 long pinnate seta; distal segment with 2 pinnate and 2 bare setae.

Maxilliped (Fig. 28D). Praecoxa small, with 1 row of setules along lateral margin. Coxa with 4 rows of spinules on surface, and 3 pinnate and 1 bare setae at distal corner. Basis elongate 1 row of small spinules on outer margin medially; palmar margin armed with 3 rows of spinules, with 2 setae. Endopod slender, with 1 pinnate stout spine, 1 small spine, and 1 spinule on apical margin, and 1 pinnate and 1 naked setae on lateral margin subdistally.

P1 (Fig. 29A). Coxa large, rectangular; anterior surface with 5 spinular rows; posterior surface with few minute spinule; outer distal corner with 1 row of long spinules; inner margin with row of setules. Basis with 1 outer and 1 inner pinnate spines, each with 1 row of spinules near base; inner margin with 1 row of setules; distal margin convex, with 1 row of spinules; anterior surface with tube pore near outer spine. Exopod 3-segmented; each segment armed with outer spinules; exp-1 with 1 outer spine; exp-2 with 1 outer spine and 1 inner plumose seta; exp-2 and exp-3 with 1 row of inner setules, respectively; exp-3 with 3 outer spines and 2 apical setae. Endopod 3-segmented; enp-1 elongate, exceeding end of exopod, with 1 row of small spinules on outer margin proximally, 1 row of spinules and 1 serrate seta on inner margin, and 2 rows of spinules on distal margin; enp-2 smallest, with few outer spinules, 1 tube pore, and 1 plumose inner seta; enp-3 about 2.5 times as long as preceding one, with few spinules along outer margin, 1 pinnate spine and 1 geniculate seta on distal margin, and 1 slender seta on inner margin.

P2–P4 (Fig. 29B–D). Coxa large, with 7–8 rows of spinules on anterior and posterior surfaces. Basis with 1 row of setules except for P4 on inner margin and 1 tube pore on anterior surface; outer element spine-like in P2 and setule-like in P3 and P4; distal margin with 1 row of minute spinules. Both rami 3-segmented; endopods of P2 and P3 slightly shorter than exopod, while endopod of P4 distinctly short, exceeding end of exp-2; outer margins of both rami armed with spinules; exp-2 with 1 tube pore; exp-3 with 1 tube pore except for P2; enp-1 and enp-3, each with 1 tube pore.

Setal formula of P1–P4 as follows.

	Exopod	Endopod
P1	0.1.023	1.1.120
P2	1.1.223	1.2.121
P3	1.1.323	1.2.321
P4	1.1.323	1.1.221

P5 (Fig. 29E). Baseoendopod wide; outer peduncle with 1 row of spinules on surface and 1 long bare seta; endopodal lobe extending to half of exopod, with 1 tube pore distally and 5 pinnate setae. Exopod oval, with 4 pinnate and 2 naked setae; outer margin with 1 row of spinules and 1 slender tube pore; inner margin with 3 rows of spinules; anterior surface with 1 tube pore; distal margin with V-shaped groove.

**Male.** Sexual dimorphism in urosome, antennule, P1 basis, P2 endopod, P5, and P6.

Urosome (Fig. 30A–C), genital somite not fused with first abdominal somite. Genital somite with 2 asymmetry plates, each representing P6 composed of 1 small pinnate and 2 bare setae.

Antennule (Fig. 31A) 11-segmented, haplocer; segment 1 with 3 rows of spinules and 1 pore; segment 5 largest, with 1 peduncle; segments 5–7 with setae bearing split tip; segments 7 and 8 partially fused; segment 8 with 1 spine. Setal formula as follows: 1-[1], 2-[11], 3-[7 + ae], 4-[2], 5-[8 + ae], 6-[2], 7-[2], 8-[1], 9-[1], 10-[4], 11-[7 + ae].

P1 basis (Fig. 30D) with 2 additional spines on inner margin.

P2 enp-2 (Fig. 31B) modified; inner margin with 1 small pinnate and 1 long plumose setae; distal margin with 1 stout process, 1 long spine, and 1 elongate peduncle; peduncle on distal margin with 1 long plumose seta laterally and 1 pinnate seta apically. Outer spine on exp-2 modified stoutly.

P5 (Fig. 30E). Baseoendopod fused medially; outer peduncle with 1 row of spinules and 1 tube pore on surface, and 1 bare seta on apical margin. Endopodal lobe triangular in shape, reaching to half of exopod, with 1 tube pore on surface distally and 2 pinnate setae on distal margin; each lateral margin armed with spinules. Exopod about 1.5 times as long as width, with 5 pinnate and 1 bare setae; outer margin armed with spinules, with 1 tube pore; inner margin armed with setules; anterior surface with 2 tube pores.

**Remarks.** Lang (1944) erected the genus *Paramphiascopsis* Lang, 1944 and designated *Dactylopus longirostris* Claus, 1863 (=*Amphiascus longirostris*) as the type species of the genus, however, he didn't know that Nicholls (1941) had already designated this species as the type of *Amphiascus* Sars, 1905. Recently, Huys (2009) rearranged *Amphiascus* and *Paramphiascopsis* species that remained in such taxonomic problems. He transferred all the species of *Paramphiascopsis* to *Amphiascus*, and erected a new genus *Sarsamphiascus* Huys, 2009 to receive all the previous *Amphiascus* species (see Huys 2009).

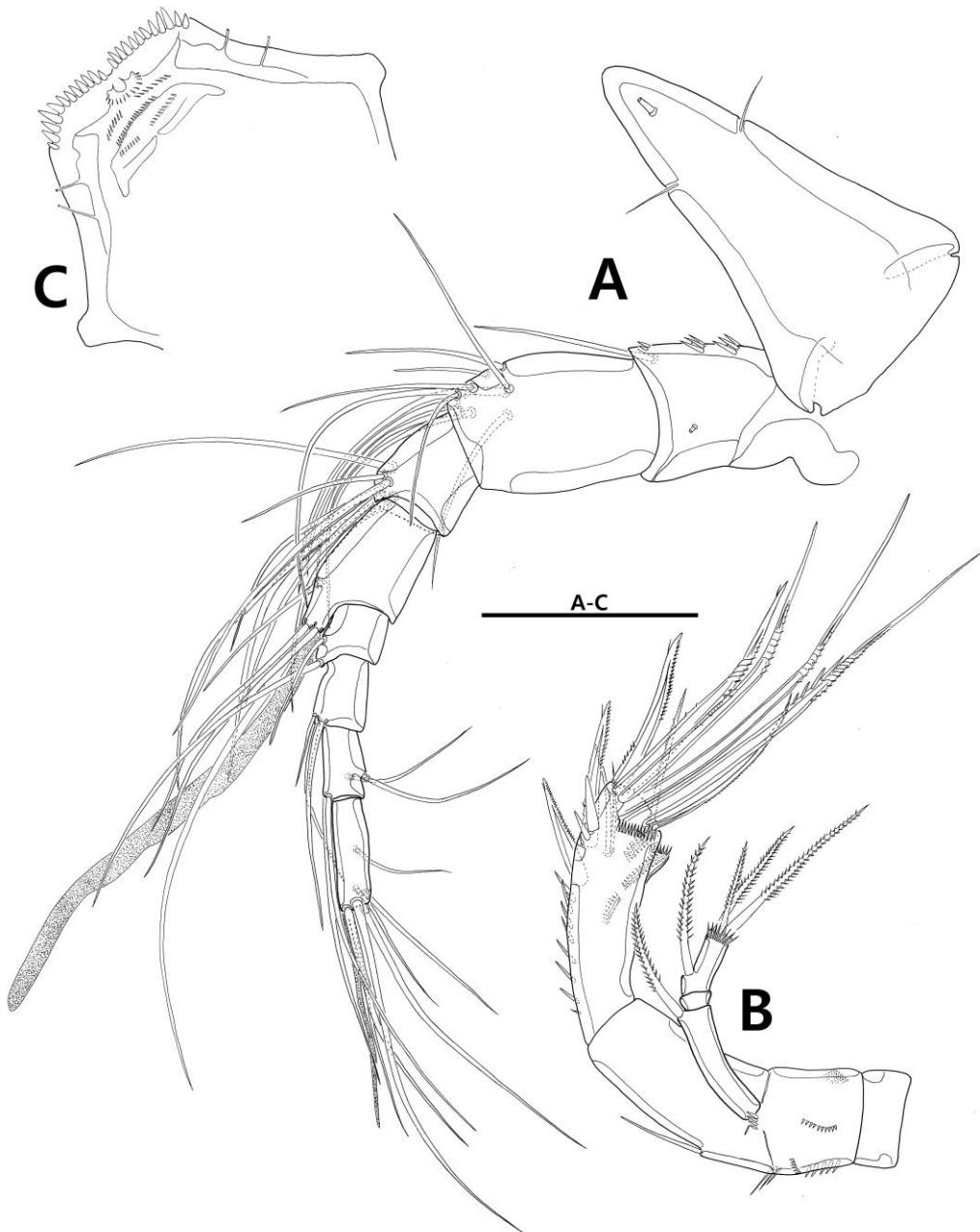
To date, the genus *Amphiascus* includes eight valid species, and they can be subdivided into two convenient groups by whether the terminal caudal setae is conspicuously swollen near base or not (Hicks 1986): the first group bearing swollen caudal seta includes three species, *A. longirostris* (Claus, 1863), *A. giesbrechti* Sars, 1906, and *A. paromolae* (Soyer, 1973); the second group bearing normal caudal setae includes five species, *A. pallidus* Sars, 1906, *A. ekmani* (Lang, 1965), *A. soyeri* (Lang, 1965), *A. triarticulatus* (Moore, 1976), and *A. waihonu* (Hicks, 1986).

*Amphiascus* sp. nov. is closely related with *A. ekmani* reported from California in having the mandibular exopod two-segmented, caudal seta V not swollen basally, and P1 enp-1 slightly exceeding to end of exopod, but it is discriminated by the following detailed characteristics: (1) the proximal segment of mandibular exopod has two setae (one subdistal and one lateral), while the lateral seta is absent in *A. ekmani*; (2) the two proximal setae on praecoxal arthrite of maxillule are stout and spinulose, while they are slender and naked in *A. ekmani*; (3) the palmar margin of maxillipedal basis has two setae, but *A. ekmani* has only one seta; (4) caudal seta III is as long as seta VI, while it is about half length of seta VI in *A. ekmani*; (5) P1 exopod is reaching to about 4/5 of P1 enp-1, while it is slightly shorter than P1 enp-1 in *A. ekmani*; (6) the innermost element on male P6 is small, about 1/3 of neighboring seta in length, but it is about half length of neighboring seta in *A. ekmani*.

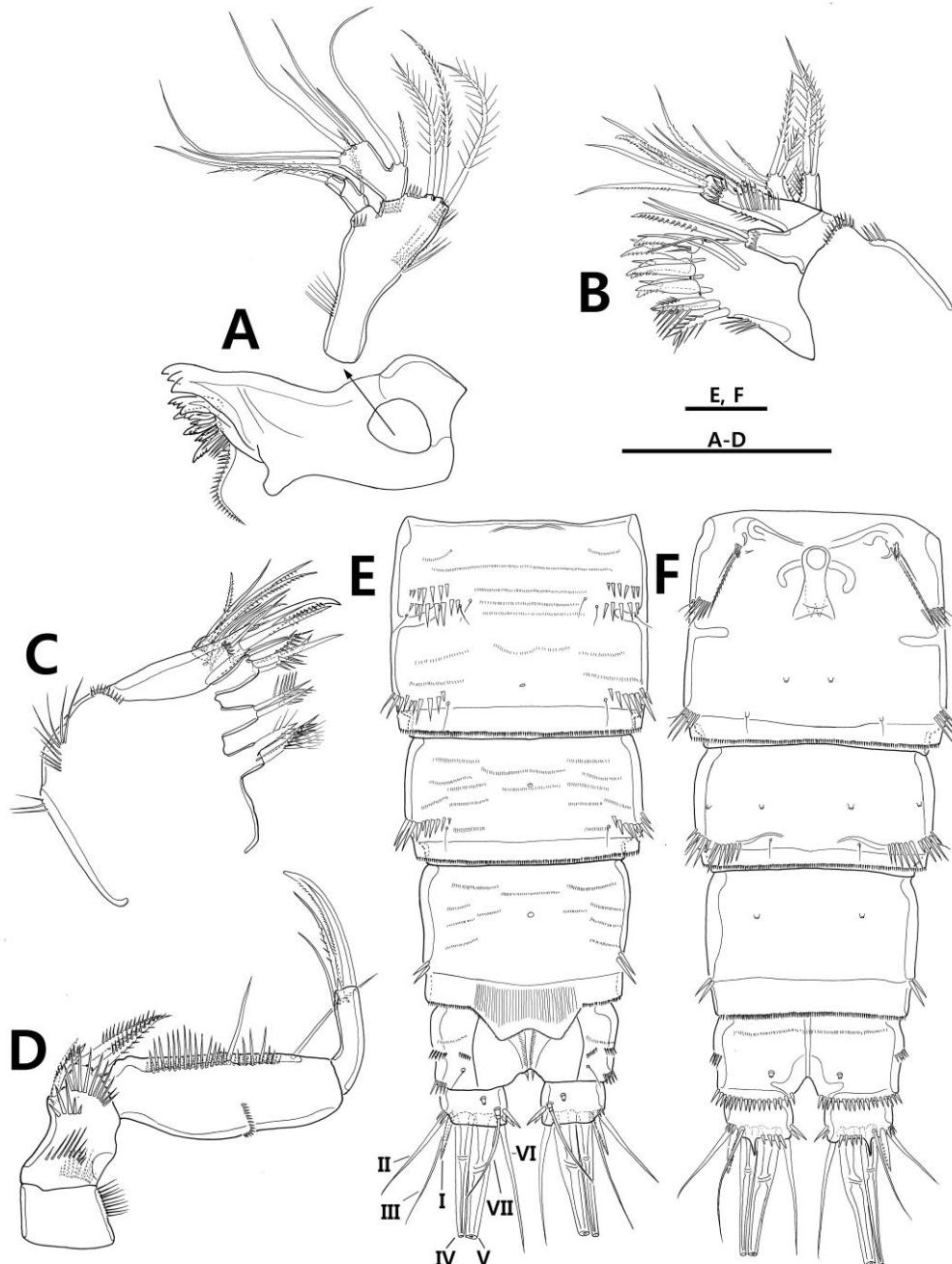
The new species also resembles *A. triarticulatus* reported from the Isle of Man. However, *A. triarticulatus* is easily distinguished from *Amphiascus* sp. nov. by the segmentation of mandibular exopod, the detailed features of elements on P5 in both sexes and P2 enp-2, and the segmentation of antennule in male.

According to the key to species provided by Hicks (1986), the detailed feature of setae on P5 in both sexes is considered as a good identification key. In female, the two innermost setae on P5 endopodal lobe are non-fid at tip in *A. giesbrechti*, *A. paromolae* and *A. triarticulatus*, and bifid in *A. longirostris*, *A. pallidus*, *A. soyeri*, *A. ekmani*, *A. waihonu* and *Amphiascus* sp. nov. In male, the two innermost setae on P5 endopodal lobe are non-fid at tip in *A. longirostris*, *A. giesbrechti*, *A. pallidus* and *A. soyeri*, bifid in *A. triarticulatus*, *A. waihonu* and *Amphiascus* sp. nov., bifid or trifid in *A. paromolae*, and quadrifid in *A. ekmani*. The new species resembles *A. waihonu* in having bifid setae on P5 endopodal lobe in both sexes as mentioned above, but lateral margin of its tip is serrated uniquely.

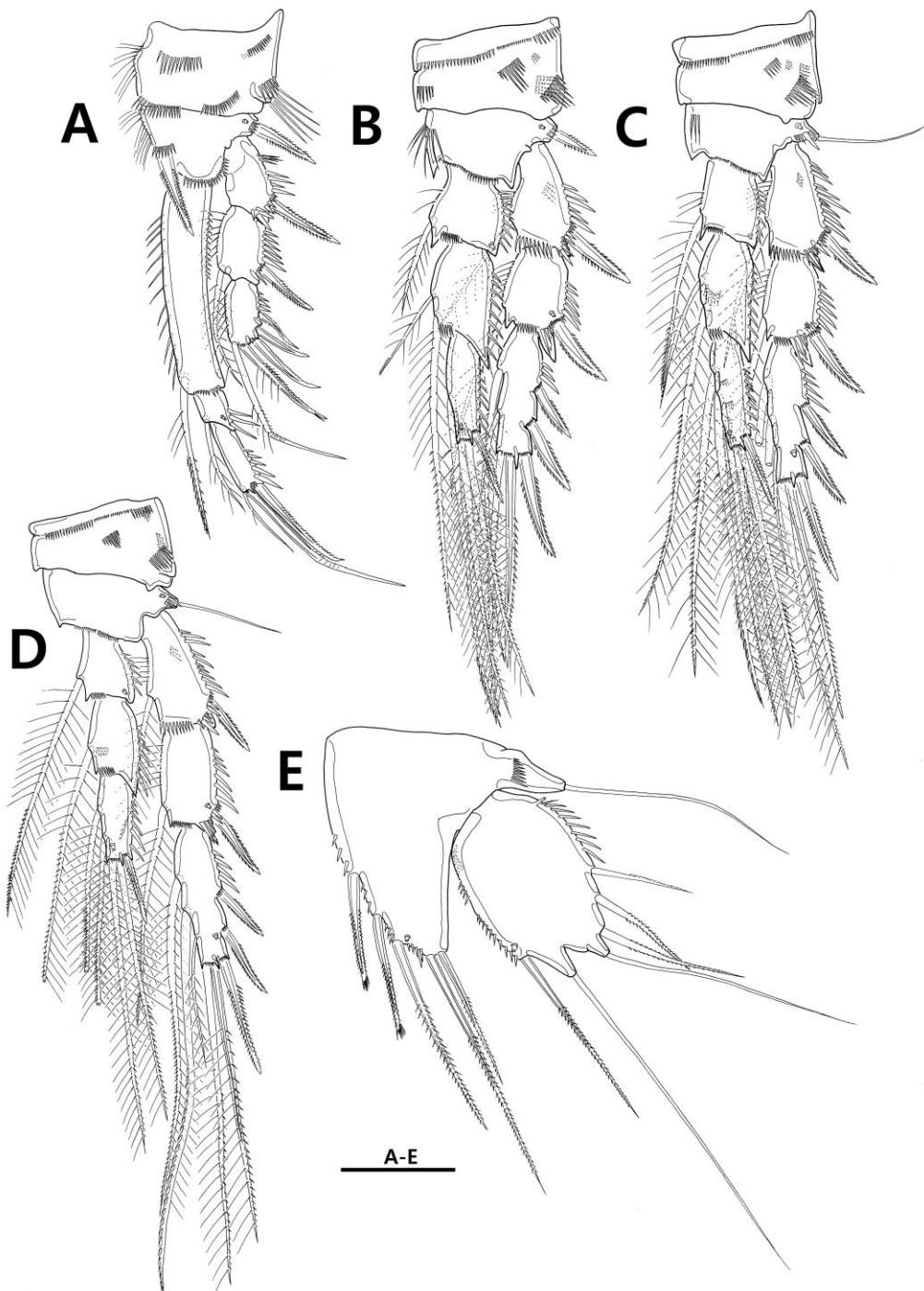
The new species represent a unique feature in antennule of male. The small setae having tri- or quadrifid tip are present at the fourth to seventh antennular segments in male. *Amphiascus ekmani* and *A. triarticulatus* have it on fifth to sixth segments, respectively. However, these setae of both species are not forked at tip.



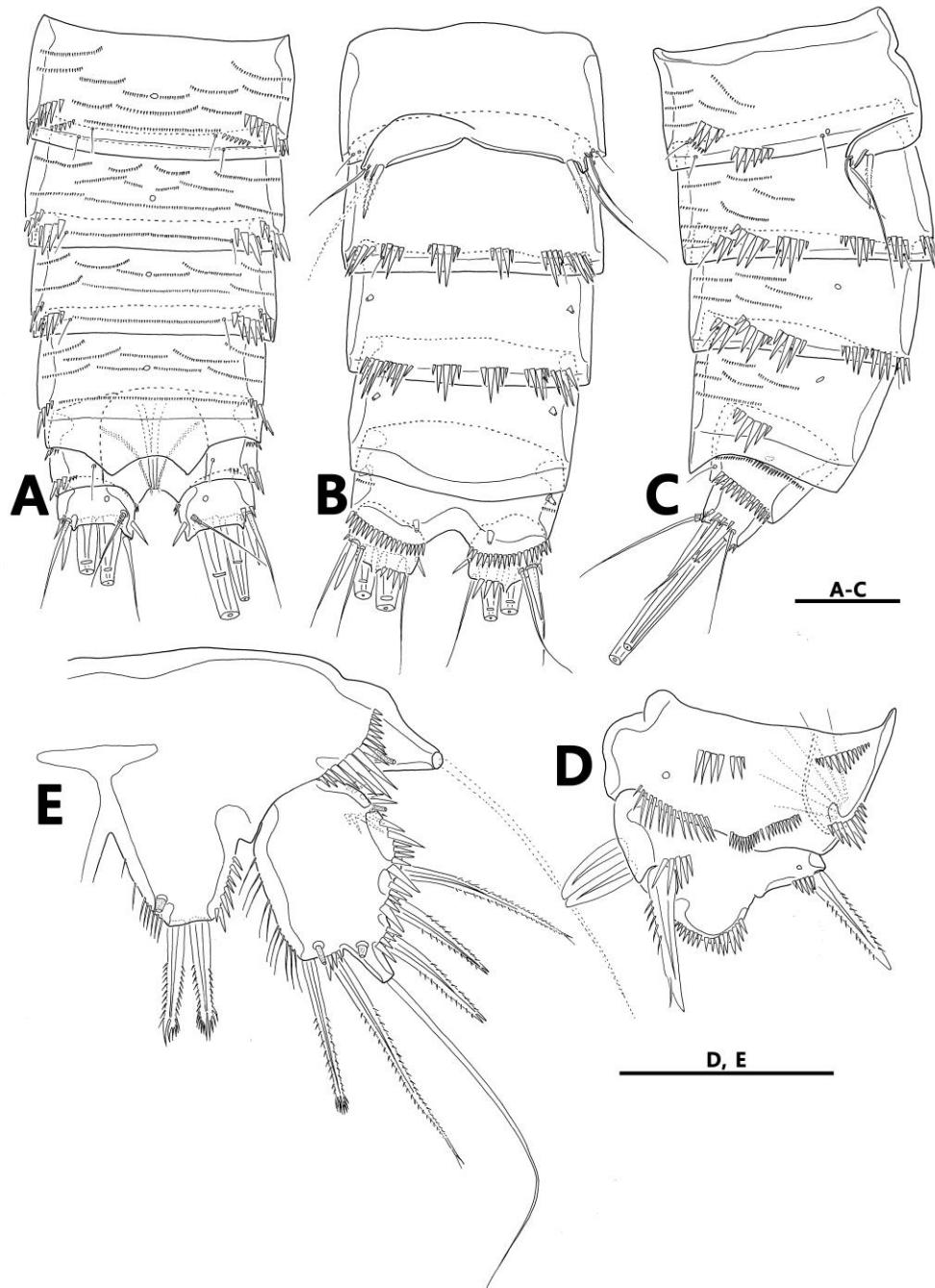
**Fig. 27.** *Amphiascus* sp. nov., female. A, rostrum and antennule; B, antenna; C, labrum. Scale bar: 50  $\mu$ m.



**Fig. 28.** *Amphiascus* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, maxilliped; E, F, urosome except for P5-bearing somite, dorsal (E), ventral (F). Scale bars: 50  $\mu\text{m}$  (A–D); 100  $\mu\text{m}$  (E, F).



**Fig. 29.** *Amphiascus* sp. nov., female. A, P1; B, P2; C, P3; D, P4; E, P5. Scale bar: 50  $\mu$ m.



**Fig. 30.** *Amphiascus* sp. nov., male. A–C, urosome, dorsal (A), ventral (B), lateral (C); D, protopod of P1; E, P5. Scale bars: 50 µm (D, E); 100 µm (A–C).

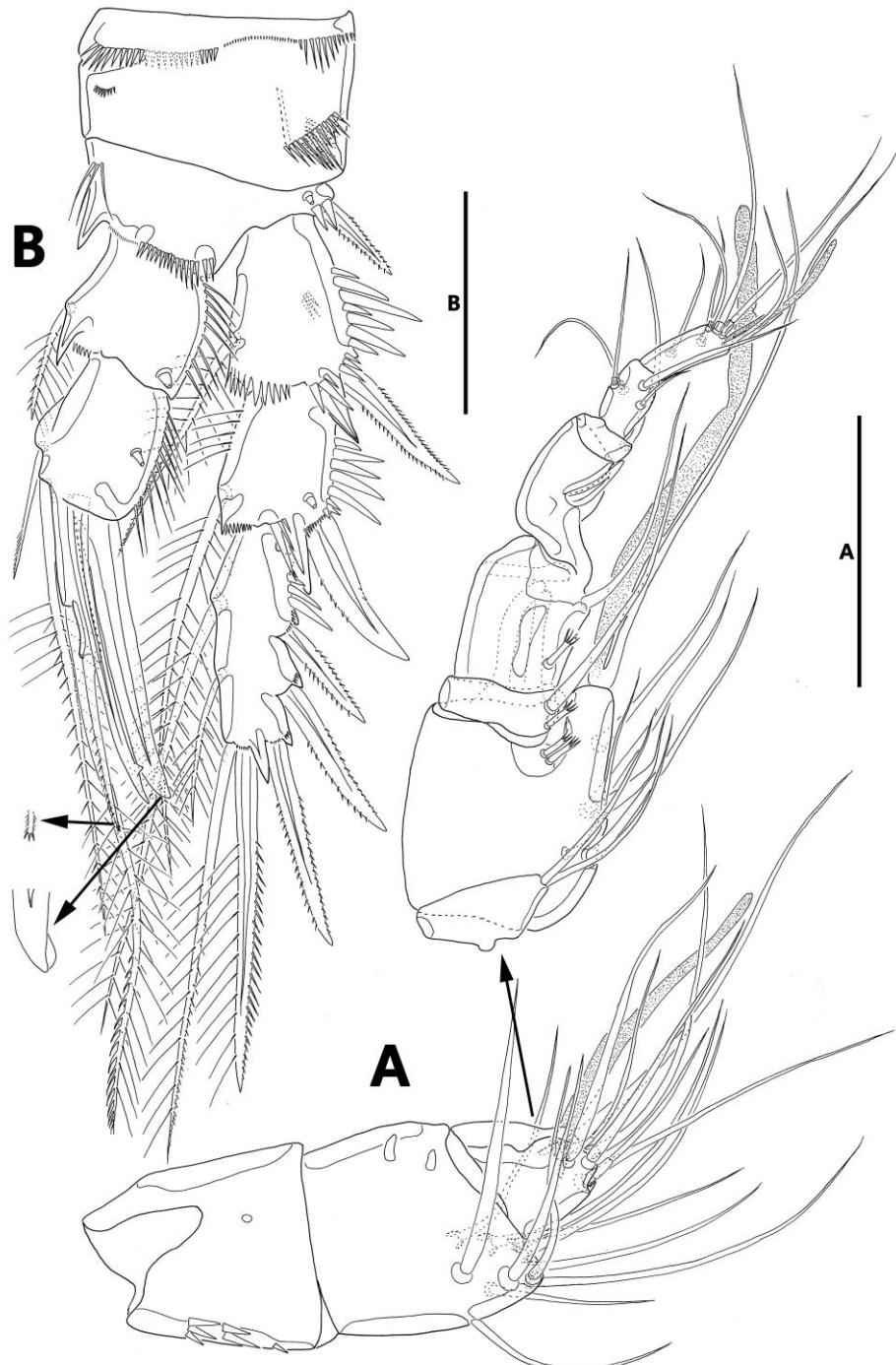


Fig. 31. *Amphiascus* sp. nov., male. A, antennule; B, P2. Scale bars: 50  $\mu\text{m}$ .

**Genus *Bulbamphiascus* Lang, 1944 둥근쌍낭장수노벌레 속****모식종:** *Bulbamphiascus imus* (Brady, 1872)**한국산 둥근쌍낭장수노벌레 속(*Bulbamphiascus*)의 종에 대한 검색표**

1. 암컷 제 5 흉지 외지의 바깥 가장자리에 존재하는 강모 중 말단강모는 조금 부풀어 있다; urosomite 3의 배면에 잔가시열을 가지지 않는다.....  
.....가시둥근쌍낭장수노벌레 *B. spinulosus*
- 암컷 제 5 흉지 외지의 바깥 가장자리에 존재하는 강모 중 말단강모는 매우 부풀어 있다; urosomite 3의 배면에 잔가시열을 가진다 .....  
.....*Bulbamphiascus* sp. nov.

**27. *Bulbamphiascus spinulosus* Mu & Gee, 2000 가시둥근쌍낭장수노벌레**

*Bulbamphiascus spinulosus* Mu & Gee, 2000, p. 115, figs. 8D–10D; Lee et al., 2012, p. 99,  
fig. 65.

**관찰재료:** 1♀, 제주 서귀포시 남원읍 위미리, 위미항(light trap), 2015.6.18; 3♀♀,  
전남 여수시 화양면 이목리(잘피밭), 2016.4.10.

**분포:** 한국, 중국.

**고찰:** Mu & Gee (2000)는 둥근쌍낭장수노벌레 속(*Bulbamphiascus*)의 모식종인 *B. imus* (Brady, 1872)를 재기재하면서 처음으로 수컷 제 2 흉지 저절의 성적이형을 발견하였다. 반면, 중국에서 채집된 두종, *B. plumosus* Mu & Gee, 2000 과 *B. spinulosus* Mu & Gee, 2000 의 이러한 성적이형이 나타내지 않았다. 이들은 제 2 흉지 저절의 성적이형을 속을 나눌 수 있는 형질로 판단하여 추후에 중국산 종들이 새로운 속으로 옮겨질 것으로 예상하였다. 또한, Mu & Gee (2000)는 둥근쌍낭장수노벌레 속의 종들은 후체부의 장식들이 종 내에서 매우 일관성이

있다는 것을 관찰하여, 이러한 미세한 차이점을 종을 구분할 수 있는 형질로 판단하였다.

## 28. *Bulbamphiascus* sp. nov. (Figs. 32–39)

**Type locality.** Off Jangsado Island ( $34^{\circ}42'48.2''\text{N}$ ,  $128^{\circ}33'39.18''\text{E}$ ), Hansan-myeon, Tongyeong-si, Gyeongsangnam-do, South Korea

**Materials examined.** Holotype: ♀, dissected and mounted in lactophenol solution on slides. Allotype: ♂, dissected and mounted in lactophenol solution on slides. Paratypes: 1♀, dissected on several slides.

**Description. Female.** Habitus (Fig. 32A, B) elongate, fusiform, without conspicuous boundary between prosome and urosome; total length 996.2–1,084.0  $\mu\text{m}$  (mean = 1,040.1; n = 2) measured from anterior margin of rostrum to posterior margin of caudal rami. Rostrum (Fig. 32A, B) elongate, tapering anteriorly, defined at base, with 1 pair of sensilla subdistally.

Prosome (Fig. 32A, B) shorter than urosome in length; length ratio of prosome:urosome about 1.0:1.2 in lateral view. Cephalothorax ornamented with several paired sensilla dorsally and laterally, 2 pores dorsally. Pedigerous somites ornamented with several paired sensilla dorsally and laterally; length ratio of each somite about 3.3:2.9:1.0 in dorsal view

Urosome (Figs. 32A, B; 33A, B; 34C) 5-segmented. P5-bearing somite small, with 3 pairs of sensilla. Genital double-somite divided by dorsal and lateral sutures, but fused ventrally; length ratio to wide about 1.3:1.0; genital somite with 4 pairs of sensilla on dorsal surface, and 4 pairs of spinules on ventrolateral surface; first abdominal somite with 2 pairs of sensilla on dorsal surface, 2 sensilla and 1 row of spinules on ventral surface, and 1 row of spinules and 1 sensillum on lateral surface. Urosomite 4 with 1 pair of pores and 2 sensilla on dorsal surface, 2 pairs of pores, 1 row of spinules, and 1 pair of sensilla on ventral surface, and 1 set of spinules on lateral surface. Genital field with 2 paired apertures covered by P6 anteriorly and 1 copulatory pore obscured by oval-shaped bulb. Urosomite 5 slightly shorter than preceding one, with weak-developed pseudoperculum; dorsal surface with 2 pores; ventral surface with 1 pair of pores anteriorly, 1 pore medially, and 2 rows of spinules posteriorly; ventrolateral surface with 1 row of spinules. Anal somite with median cleft, 1 pair of sensilla on dorsal surface, 1 pair of pores and 1 pair of spinular row on ventral surface, and 1 group

of spinules and 1 row of spinules on lateral surface; posterior margin with 4 sets of spinules ventrally.

Caudal rami (Fig. 33C, D) short, 0.7 times as long as wide, with few spinules at outer distal corner and 7 setae: setae I small, shorter than caudal ramus; seta II bare, elongate, about 3.0 times as long as caudal rami; seta III slender, bare, shorter than seta II; terminal setae IV and V (Fig. 32C) well-developed, each with internal fracture plan, seta V about twice as long as seta IV; seta VI as long as seta II; seta VII tri-articulated basally, shorter than seta II. Posterior margin produced ventrally as tube pore.

Antennule (Fig. 34A) 8-segmented; segment 1 with 2 rows of spinules on anterior margin; segment 2 longest, swollen; segment 7 shortest; segments 4 and 8 aesthetasc fused to seta basally. Setal formula as follows: 1-[1], 2-[11], 3-[7], 4-[4 + ae], 5-[2], 6-[4], 7-[4], 8-[7 + ae].

Antenna (Fig. 34B). Coxa small. Allobasis elongate, with incomplete suture, partially fused; proximal one with few setules near base of exopod; distal one longer than preceding one, with 1 row of spinules and 1 pinnate seta on abexopodal margin. Exopod 3-segmented; proximal one elongate with 1 pinnate seta at distal corner; middle one small, with 1 pinnate seta at distal corner; distal one slightly shorter than proximal one, with 1 lateral and 3 apical pinnate setae, and 1 group of spinules on surface. Endopod 1-segmented; abexopodal margins armed with stout spinules, bearing 2 stout spines; surface with 2 setae and 3 frills; distal margin with 1 frill; distal armature composed of 1 pinnate spine, 4 geniculate setae, and 2 pinnate setae, one of which fused to innermost geniculate seta basally.

Mandible (Fig. 35A). Gnathobase well-developed with 5 stout teeth, 2 spines, and 2 pinnate setae. Basis broad, with 4 rows of spinules on surface and 3 pinnate setae. Exopod 2-segmented; proximal one with 2 plumose setae; distal one small, with 3 apical setae, of which two fused basally. Endopod 1-segmented, broad, with 2 pinnate setae on lateral margin and 6 setae on distal margin, of which two outermost fused basally.

Maxillule (Fig. 35B). Praecoxa with 1 row of spinules; arthrite well-developed, with 2 parallel setae on anterior surface, 7 stout spines, 2 stout spinulose setae, and 1 pinnate seta along distal margin, and 1 group of spinules on lateral margin. Coxal endite small, with 1 stout and 1 slender setae. Basis with 2 groups of spinules on anterior margin, 2 setae on posterior surface, 1 row of spinules on lateral margin, and 1 small endite bearing 2 setae;

distal armature comprising of 1 stout claw-like, 1 pinnate, and 1 spinulose setae. Exopod 1-segmented, with 2 plumose setae apically and 1 row of setules laterally. Endopod 1-segmented, with 1 lateral and 3 distal plumose setae, and 1 row of lateral setules.

Maxilla (Fig. 35C). Syncoxa with 4 rows of spinules and 3 endites: proximal one small with 2 spinulose setae apically; middle one with 2 spinulose setae, distal one of which fused to endite proximally; distal one with 3 spinulose setae apically. Allobasis drawn out into strong claw armed with spinules, with 3 accessory setae and 1 row of spinules; distal margin with 1 long bare seta near endopod. Endopod 1-segmented, elongate, with 2 apical and 3 lateral setae.

Maxilliped (Fig. 35D). Praecoxa small. Coxa elongate, with 4 rows of spinules on surface, 3 pinnate and 1 bare setae at distal corner. Basis longest, with 2 rows of spinules on surface; palmar margin with 2 pinnate setae. Endopod slender, with 1 stout pinnate spine, 2 bare setae, 1 small spine.

P1 (Fig. 36A). Coxa large, with 4 rows of spinules on anterior margin, 3 spinules on posterior surface, 1 row of spinules on inner margin, and 1 row of spinules at outer distal corner. Basis smaller than preceding, with 1 pinnate inner spine and 1 outer spine-like seta, each bearing several spinules basally; distal margin produced, with 1 row of stout spinules. Exopod 3-segmented; outer margin of each segment armed with spinules; exp-1 with 1 pinnate outer spine; exp-2 with 1 pinnate outer spine, 1 plumose inner seta, and 1 row of inner setules; exp-3 with 3 pinnate outer spines and 2 geniculate apical setae. Endopod 3-segmented; outer margin of each segments armed with outer spinules; enp-1 elongate, reaching to half of exp-3, with 1 pinnate inner seta and 1 row of inner setules; exp-2 smallest, with 1 plumose inner seta; exp-3 about 2 times as long as preceding one, with 1 pinnate spine and 1 geniculate seta on distal margin, and 1 bare seta on inner margin distally.

P2–P4 (Figs. 36B, 37A, B). Coxa large, with 5 rows of spinules on surface. Basis smaller than coxa, with 1 outer seta, that of P2 spine-like; surface with 1 stout spinule near outer margin and 1 row of spinules near inner margin; distal margin with 1 row of stout spinules and 1 row of minute spinules; inner distal corner produced. Both rami 3-segmented; outer margin of each segment armed with outer spinules; endopods of P2 and P3 longer than exopod, while exopod of P4 longer than endopod; exp-1 and exp-2 armed with inner setules,

respectively; exp-2, enp-1, P3 enp-2, P3–P4 enp-3 each with 1 tube pore on anterior surface; distal seta on exp-3 small, delicate.

Setal formula of thoracic legs as follows:

	Exopod	Endopod
P1	0.1.023	1.1.120
P2	1.1.223	1.2.121
P3	1.1.223	1.1.221
P4	1.1.323	1.1.121

P5 (Fig. 36C). Baseoendopod broad, with outer peduncle bearing slender seta; endopodal lobe extending to half of exopod, with 3 lateral and 2 apical pinnate setae, and 1 tube pore. Exopod oval-shaped, about 2.3 times as long as broad, with 1 pinnate, 2 naked, and 2 bulb setae, of which distal one thickened, short.

**Male.** Sexual dimorphism in urosome, antennule, P1–P3, and P5.

Urosome (Fig. 38A–C). Genital somite not fused with first abdominal somite; ventral surface asymmetrical plate, each bearing 1 stout and 2 slender setae.

Antennule (Fig. 38D) 11-segmented, haplocer; segment 1 with several spinules on lateral margin proximally; segment 4 small, triangular in shape; segment 7 with 1 spine and 1 bulbous process; segments 7 and 8 fused partially. Setal formula as follows: 1-[1], 2-[10], 3-[8], 4-[2], 5-[6], 6-[3], 7-[2 + ae], 8-[1], 9-[1], 10-[4], 11-[7 + ae].

P1 basis (Fig. 39A) with 1 additional spine-like process near inner spine.

P2 (Fig. 39B, C). Basis with long spinules on anterior surface. Endopod 2-segmented; enp-1 with 1 row of dense spinules on anterior surface; enp-2 modified, with 3 pinnate setae on inner margin, 1 pinnate seta on apical margin, 1 stout and 1 sinuous process on subdistally.

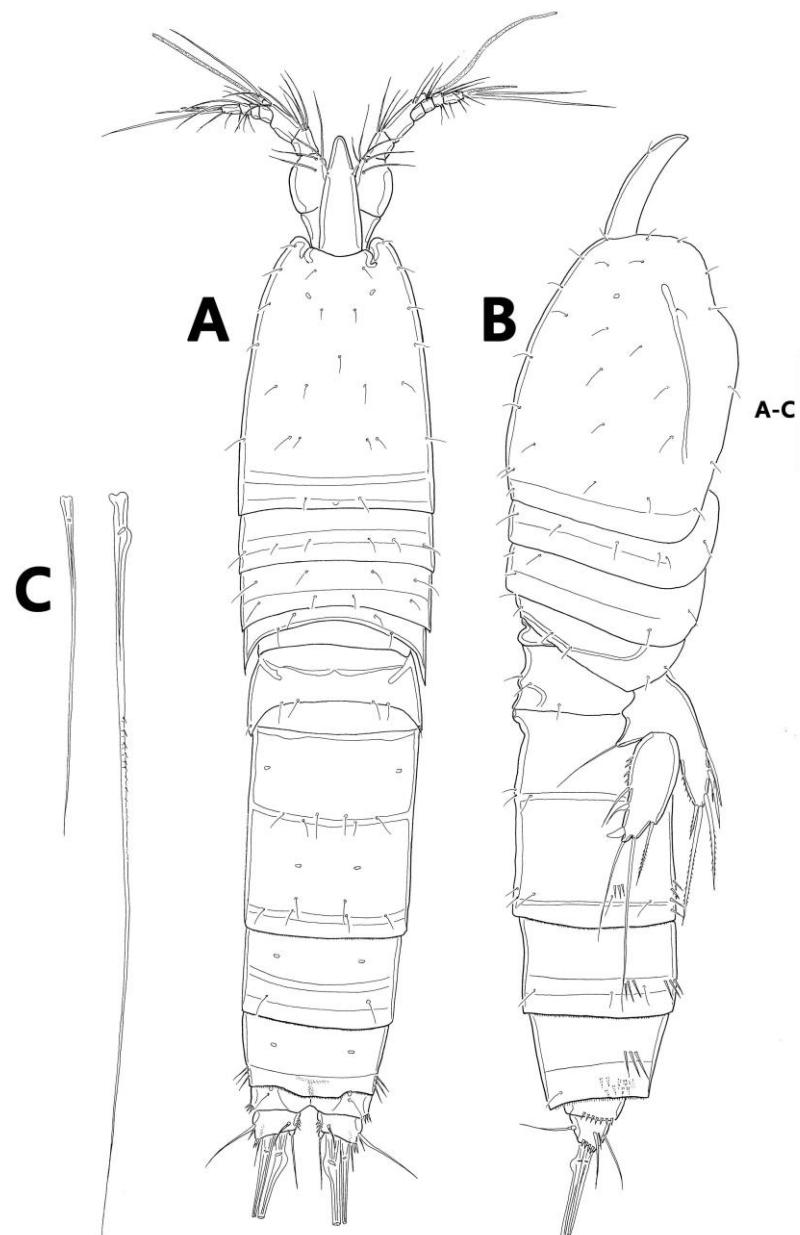
P3 (Fig. 39D). Exp-3, tube pore on anterior surface long; anterior surfaces of enp-1 and enp-2 armed with dense outer spinules.

P5 (Fig. 39E). Baseoendopod fused medially; outer peduncle with several spinules, 1 tube pore, and 1 plumose seta; endopodal lobe reaching to 2/3 of exopod, with 2 pectinate setae and several outer spinules. Exopod about 1.5 times as long as broad, with 2 pinnate setae on inner margin, 2 bulbous and 1 bare setae on outer margin, 1 bare seta on apical margin, and 1 tube pore on anterior surface apically.

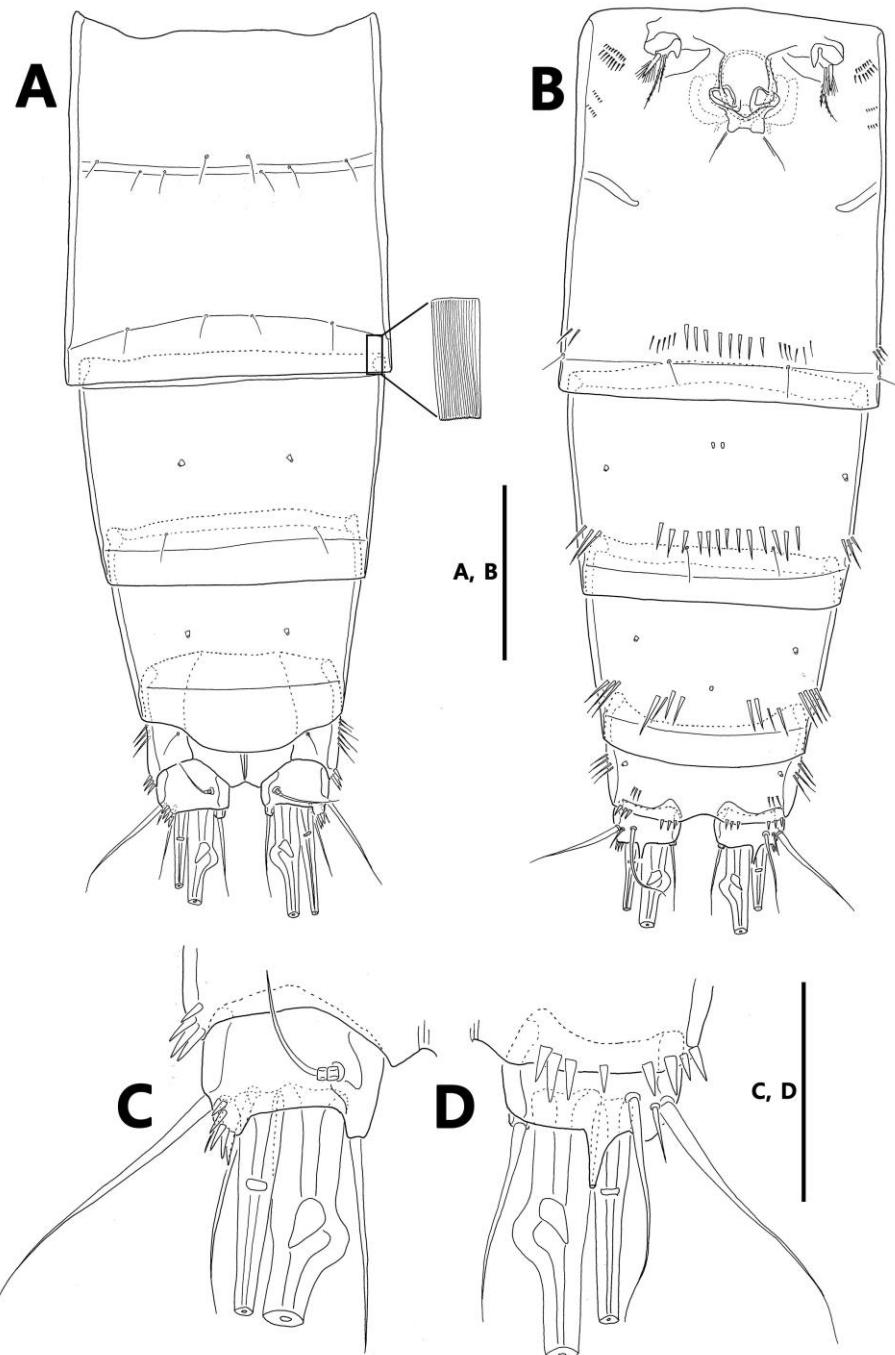
**Remarks.** Mu & Gee (2000) found out that the sexual dimorphic element, which is spine-like process, on male P2 basis in *B. imus* (Brady, 1872) is present. The similar structures was also reported from *B. denticulatus* (Thompson, 1893) (having spine-like process), *B. incus* Gee, 2005 (having T-shaped process), and *B. sciloniensis* Gee, 2005 (having T-shaped process) by Gee (2005). However, this structure was absent in their Chinese species, *B. plumosus* Mu & Gee, 2000 and *B. spinulosus* Mu & Gee, 2000, as well as *Bulbamphiascus* sp. nov. In other *Bulbamphiascus* species, the condition of this feature still remains unknown because it had been received attention by the previous authors (Sewell, 1940; Klie, 1950; Rouch, 1962; Dinet, 1971; Pallares, 1982). Nevertheless, Mu & Gee (2000) considered this sexual dimorphic structure on male P2 basis as a generic feature and suggested that *Bulbamphiascus* species representing the lack of this feature will be placed in a new genus by the further study.

Korean materials can clearly be distinguishable from other members of *Bulbamphiascus* by the ornamentation of urosomites, the length ratio of the fourth segment on antennule, the shapes of bulbous setae on the exopod of P5, the length and shape of caudal setae. Mu & Gee (2000) first noted the abdominal ornamentation as a distinguishing characteristic in the female of *Bulbamphiascus* species. The urosomites 3–5 of *Bulbamphiascus* sp. nov. are all ornamented with lateral and ventral rows of spinules, but some of these urosomites are absent or partially ornamented with spinules in *B. imus* (Brady, 1872), *B. denticulatus* (Thompson, 1893), *B. plumosus* (Mu & Gee, 2000), *B. spinulosus* (Mu & Gee, 2000), *B. incus* Gee, 2005, and *B. scilloniensis* Gee, 2005 (urosome was undescribed and illustrated in *B. chappuisi* Rouch, 1962, *B. minutus* Dinet, 1971, and *B. cibimae* Pallares, 1982). Except *B. cibimae* and *B. minutus*, others of the genus have one or two bulbous setae on the exopod of P5, where distal outer one is fused to the exopod in the case of having two bulbous setae as in *B. chappuishi* (Thompson 1893; Rouch 1962; Dinet 1971; Pallares 1982; Mu & Gee 2000; Gee 2005). In the present species, the distal outer seta is very short, stoutly bulbous and the middle outer seta is short, weak bulbous. Especially, the distal outer seta is similar in morphology to those in *B. denticulatus sensu* Sars, 1911 and *B. imus sensu* Wells & Rao, 1987. However, these two species are easily distinguished from the present new species by the presence of an apophysis at the second segment of antennule and the number of setae on the endopodal lobe of P5, respectively. The antennule of the present species is similar to that of *B. plumosus*

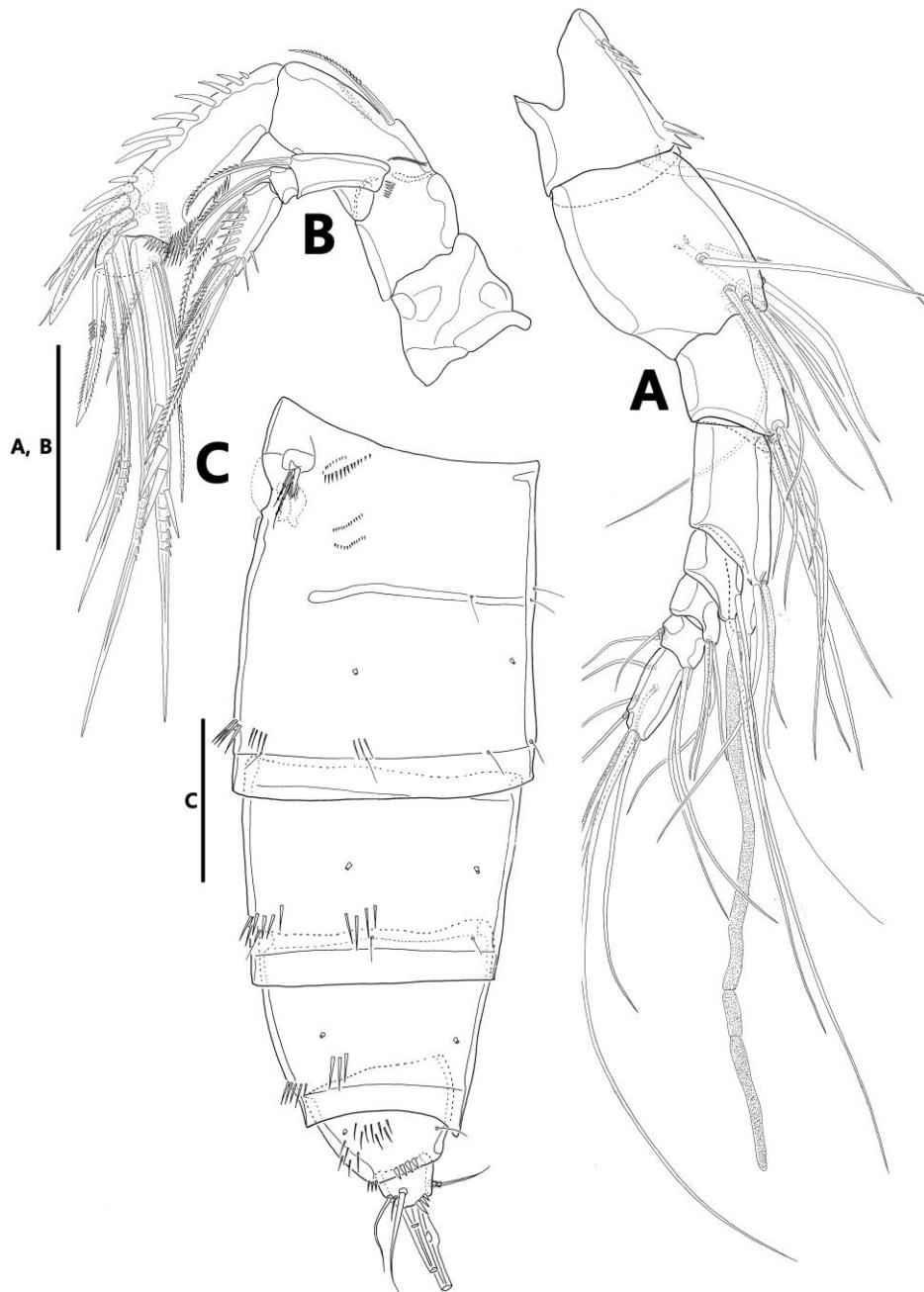
collected from the China in the length ratio to width of the fourth segment representing 1.5 (length ratios are over 2.0 in other species while it is unknown from *B. chappuishi*). The caudal seta V of *Bulbamphiascus* sp. nov. is swollen basally, similar to those in *B. incus* and *B. spinulosus* (Mu & Gee 2000; Gee 2005). However, the present new species is clearly distinguishable from the latters by the elongate caudal seta VI much longer than caudal ramus.



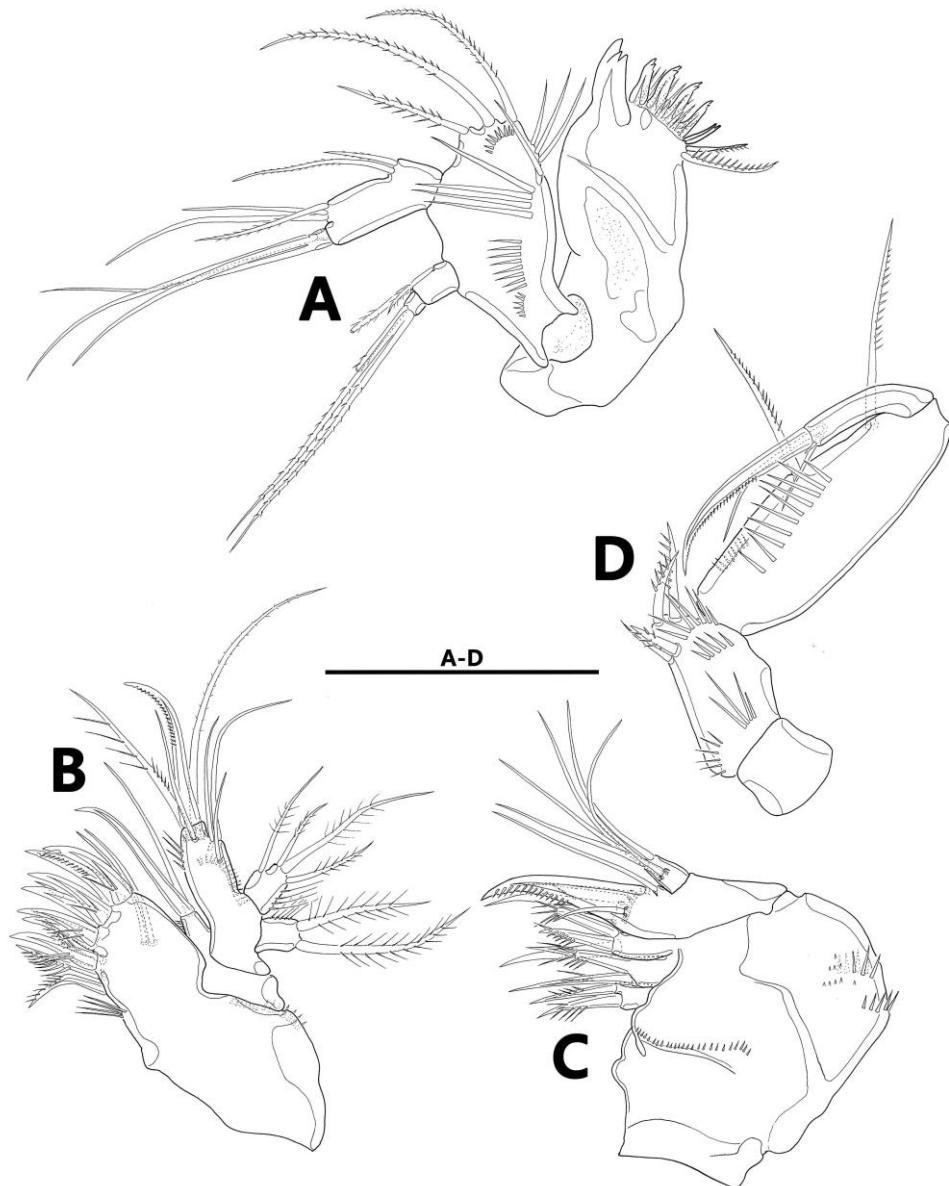
**Fig. 32.** *Bulbampeliascus* sp. nov., female. A, habitus, dorsal; B, habitus, lateral; C, terminal caudal setae IV and V. Scale bar: 100  $\mu$ m.



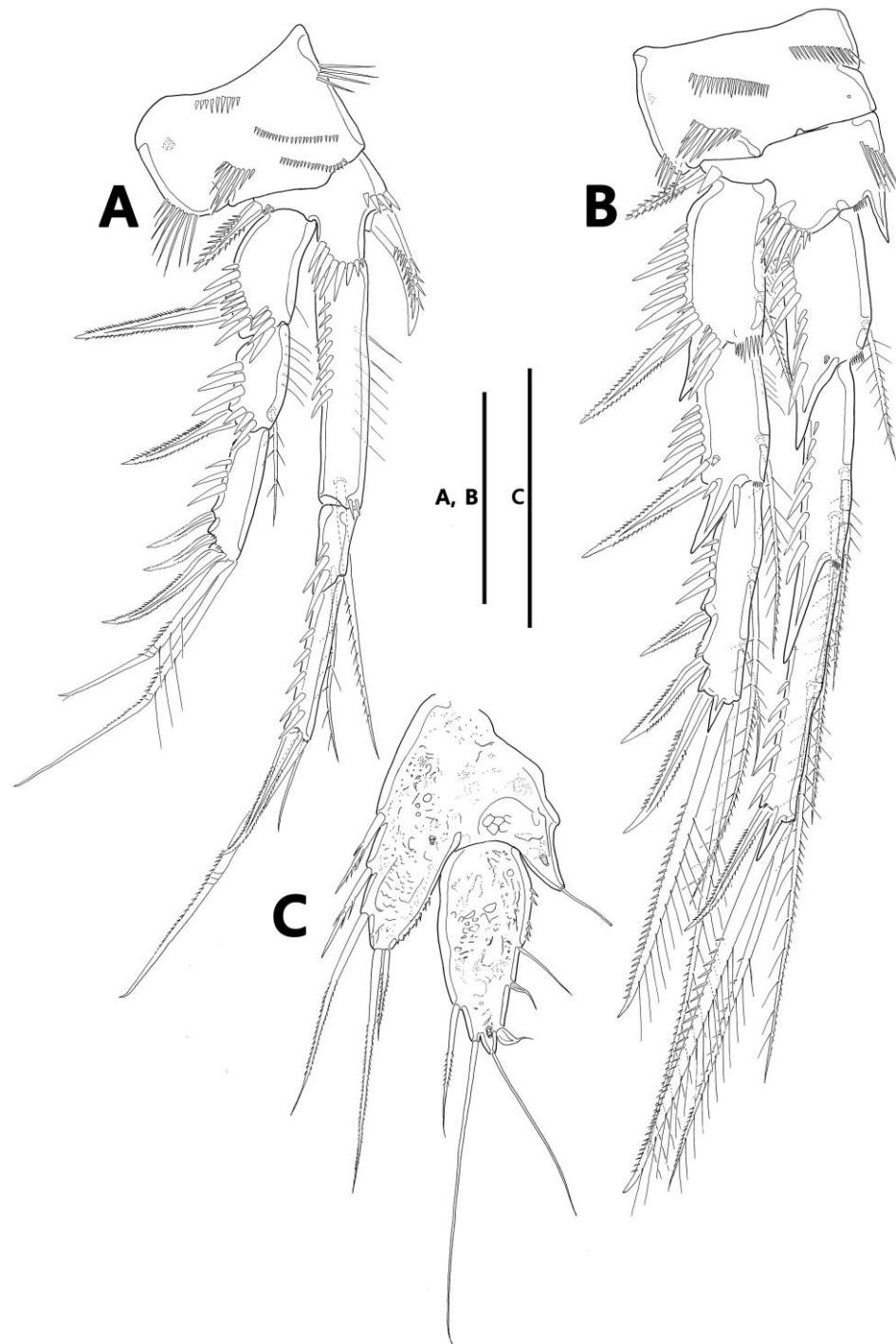
**Fig. 33.** *Bulbamphiascus* sp. nov., female. A, B, urosome excluding P5-bearing somite, dorsal (A) and ventral (B); C, D, caudal rami, dorsal (C) and ventral (D). Scale bars: 50  $\mu\text{m}$  (C, D); 100  $\mu\text{m}$  (A, B).



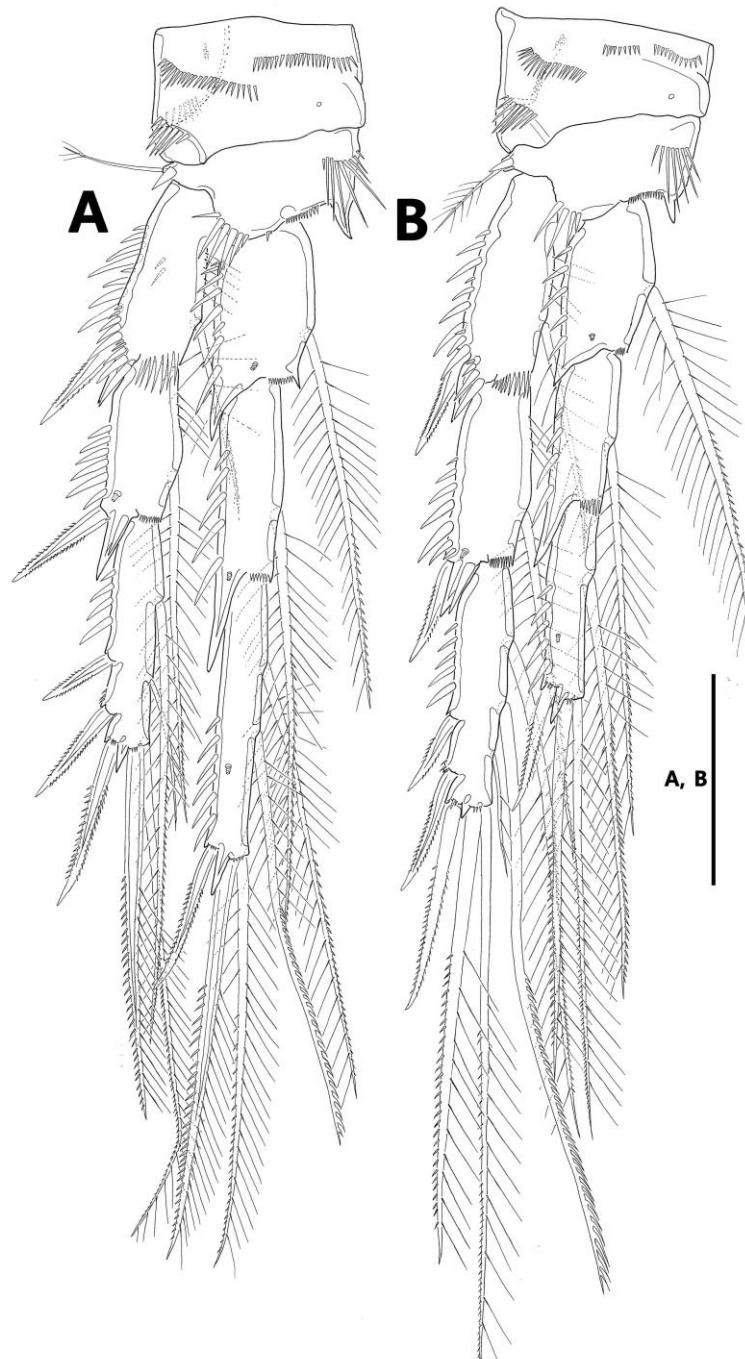
**Fig. 34.** *Bulbamphiascus* sp. nov., female. A, antennule; B, antenna; C, urosome excluding P5-bearing somite, lateral. Scale bars: 50 µm (A, B); 100 µm (C).



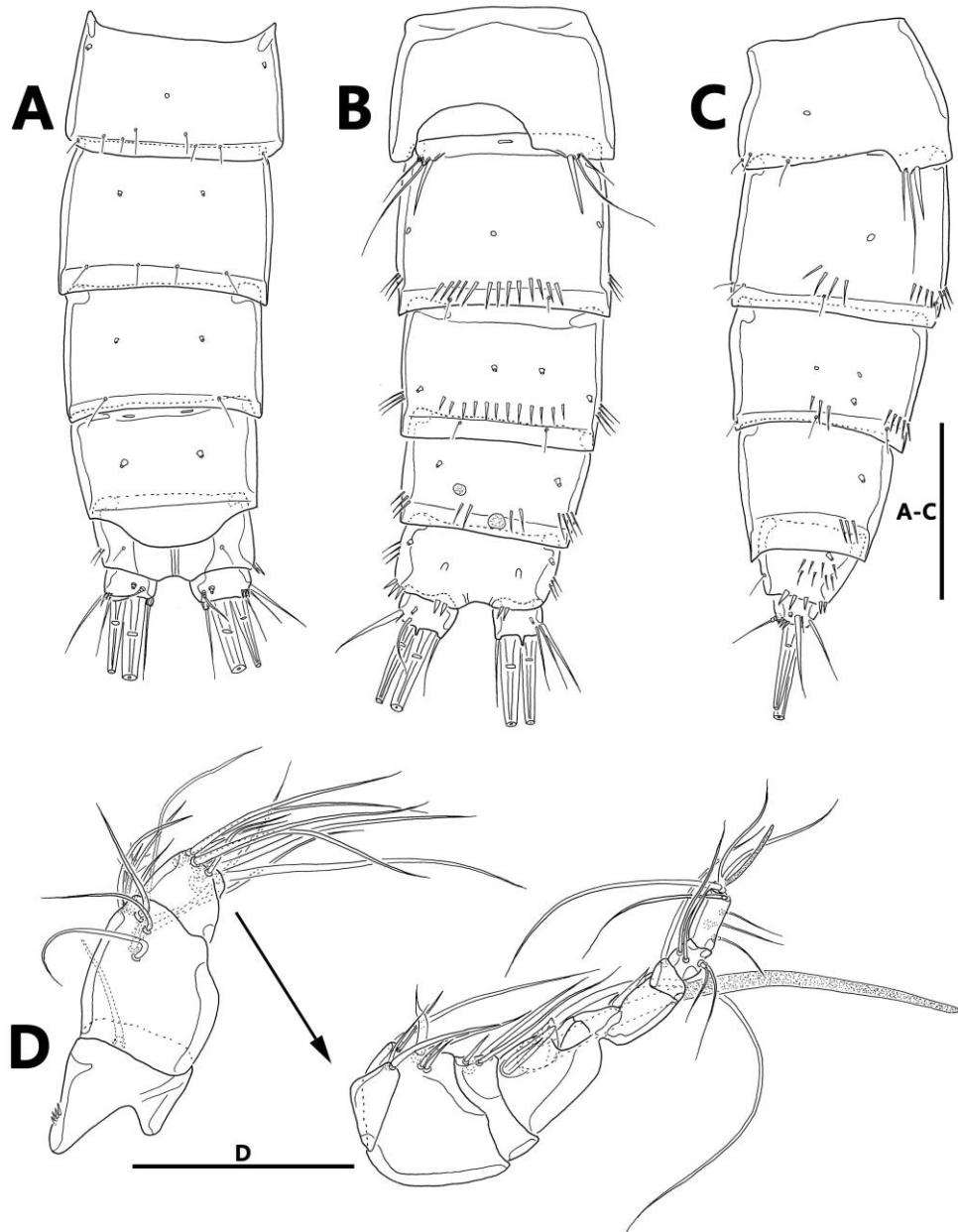
**Fig. 35.** *Bulbamphiascus* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, maxilliped. Scale bar: 50  $\mu$ m.



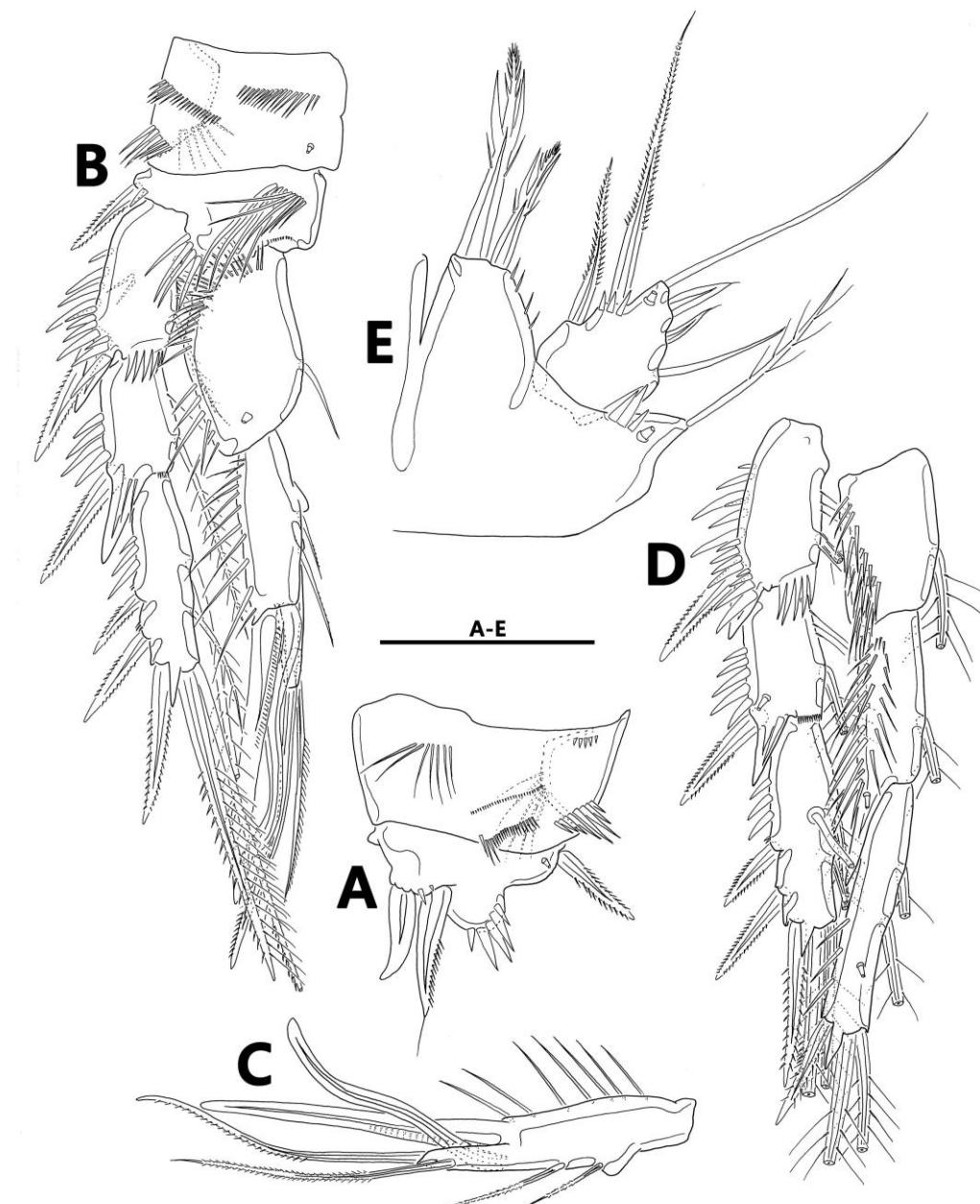
**Fig. 36.** *Bulbamphiascus* sp. nov., female. A, P1; B, P2; C, P5. Scale bars: 50  $\mu\text{m}$ .



**Fig. 37.** *Bulbamphiascus* sp. nov., female. A, P3; B, P4. Scale bar: 50  $\mu$ m.



**Fig. 38.** *Bulbamphiascus* sp. nov., male. A–C, urosome excluding P5-bearing somite, dorsal (A), ventral (B), and lateral (C); D, antennule. Scale bars: 50  $\mu\text{m}$  (D); 100  $\mu\text{m}$  (A–C).



**Fig. 39.** *Bulbamphiascus* sp. nov., male. A, protopod of P1; B, P2, anterior; C, P2 enp-2, posterior; D, both rami of P3. Scale bar: 50  $\mu$ m.

**Genus *Typhlamphiascus* Lang, 1944****모식종:** *Typhlamphiascus typhlops* (Sars, 1906)**한국산 *Typhlamphiascus* 속의 종에 대한 검색표**

1. 미차의 양 옆 가장자리는 직선이다; 제 4 흉지 내지의 세 번째 마디는 1 개의 내측강모를 가진다 ..... *Typhlamphiascus* sp. nov. 1
- 미차의 양 옆 가장자리는 불록하다; 제 4 흉지 내지의 세 번째 마디는 2 개의 내측강모를 가진다 ..... *Typhlamphiascus* sp. nov. 2

**29. *Typhlamphiascus* sp. nov. 1 (Figs. 40–46)**

**Type locality.** Off Yongchodo Island ( $34^{\circ}44'23.45''N$ ,  $128^{\circ}30'31.03''E$ ), Hansan-myeon, Tongyeong-si, Gyeongsangnam-do, South Korea.

**Materials examined.** Holotype: ♀, dissected and mounted in lactophenol solution on slides. Allotype: ♂, dissected and mounted in lactophenol solution on slides. Paratypes: 1♀, dissected on several slides.

**Description. Female.** Body (Fig. 40A, B) semicylindrical, fusiform, without conspicuous distinction between prosome and urosome; total length about 850  $\mu m$  measured from anterior margin of rostrum to posterior margin of caudal ramus; surface ornamented with paired sensilla except pre-anal somite and caudal rami. Rostrum (Fig. 41A) elongate, triangular, defined at base, reaching to end of second antennular segment, with 2 lateral sensilla medially. Cephalothorax (Fig. 40A, B) tapering anteriorly, longer than 3 prosomites combined. Genital double-somite (fused genital and first abdominal somites) 1.1 times as long as wide, separate dorsally and laterally by subcuticular suture; dorsal surface with laterally several spinules on posterior margin of each somite. Genital field (Fig. 45A, B) with separate genital apertures, each covered by vestigial P6 composed of 1 stout, short pinnate seta and 2 slender setae; copulatory pore located medially, with circular copulatory bulb. Posterior margins of genital double-somite, urosomites 4 and 5 with frill hyalines, respectively. Urosomite 4 and 5 with 18 and 6 spinules on ventral surface posteriorly, respectively. Pre-anal somite (urosomite 5)

with weak pseudoperculum dorsally. Anal somite with weak semicircular operculum bearing 1 row of spinules along its posterior margin, median deep cleft, 2 sensilla on dorsal surface, and 4 and 1 tube pores on ventral and outer lateral surface, respectively. Caudal rami (Figs. 40A, B, 45A) elongate, length ratio to wide about 3.4:1 in dorsal view, with tube pore on inner lateral margin and ventral surface posteriorly, respectively, 1 spinule at inner distal corner, 1 row of spinules on posterior margin ventrally, and 7 accessory setae posteriorly: seta I small; seta II bare, elongate shorter than caudal ramus; seta III elongate, bare, situated posteroventrally, longer than caudal ramus; terminal setae IV and V well-developed, inner margin of seta IV with set of setules; seta VI minute, slightly longer than seta I; dorsal seta VII tri-articulated, small.

Antennule (Fig. 41A) 8-segmented; segment 1 longest, with 1 patch of spinules on anterior margin and 1 tube pore on posterior margin; segment 2 with 1 tube pore on posterior margin; segment 4 with peduncle bearing 1 aesthetasc fused to seta basally; segment 5 shortest; segment 8 with 1 aesthetasc fused to setae basally; setal formula of each segments as follows: 1-[1], 2-[11], 3-[9], 4-[4 + ae], 5-[2], 6-[4], 7-[4], 8-[7 + ae].

Antenna (Fig. 41B). Coxa small. Allobasis elongate with 1 row of spinules on inner margin proximally and 1 minute abexopodal seta. Exopod 3-segmented; proximal one longest, with 1 pinnate seta; middle one smallest, without seta; distal one with 1 row of spinules on surface and 1 lateral and 3 apical pinnate setae. Endopod 1-segmented, elongate; abexopodal margin armed 4 and 2 stout spinules proximally and distally, respectively, 2 pinnate spines and 2 slender setae; distal margin armed with 1 pinnate spine, 4 geniculate setae, innermost one of which spinulose and fused to pinnate seta basally, and 1 plumose seta; inner margin with hyaline frill distally.

Mandible (Fig. 42A). Coxal gnathobase armed with 1 multicuspid, 1 bicuspid and 7 unicuspid teeth, and 1 pinnate seta fused small seta at basally, 1 row of small spinules and 4 long spinules; inner margin with 1 protrusion. Palp composed of basis, exopod and endopod; basis broad, with 3 plumose setae and several sets of spinules; endopod 1-segmented, bilobate, inner lobe with 1 small pinnate and 1 elongate bare setae, outer lobe with 8 elongate setae; exopod 2-segmented, proximal and distal segments with 1 and 2 setae, respectively.

Maxillule (Fig. 42B). Praecoxa with 2 rows of setules on outer margin and 1 row of spinules on distal margin; arthrite armed with 8 spines, 1 pinnate seta, with 1 row of setules on inner

margin and 2 parallel setae on anterior surface. Coxal endite with 2 long bare and 1 stout pinnate setae; lateral margin with 1 row of setules. Basal endite with 2 rows of spinules on anterior surface, several setules on lateral margin, 1 stout spinulose, 1 elongate, and 1 short plumose setae; small endite with 2 elongate bare setae. Both rami 1-segmented; exopod with lateral setules and 2 plumose apical setae; endopod with 1 lateral and 3 apical plumose setae.

Maxilla (Fig. 42C). Syncoxa large, with 1 row of spinules along outer margin, 1 row of small spinules on surface, and 3 endites: proximal one with 2 spinulose and 1 naked setae; middle one with 1 naked and 1 spinulose setae; distal one with 3 spinulose setae. Allobasis with 1 spinulose seta; endite with 1 row of spinules, 1 large claw-like pinnate spine, 2 naked and 1 spinulose setae, and 1 lateral peduncle bearing elongate seta. Exopod absent. Endopod 1-segmented with 6 apical setae.

Maxilliped (Fig. 42D). Syncoxa with 4 rows of spinules on surface, 1 row of setules along outer margin, and 4 spinulose setae at distal corner. Basis elongate with 1 row of long setules along outer margin; palmar margin with 2 setae and 1 row of spinules. Endopod with 1 stout claw and 2 setae.

P1 (Fig. 43A). Intercoxal sclerite small, arcuate, without ornamentation. Coxa ornamented with 6 rows of spinules on anterior surface. Basis smaller than preceding one, with 1 pinnate outer spine and 1 pinnate inner spine, and 3 rows of spinules. Exopod 3-segmented; outer margin of each segment ornamented with few spinules; exp-1 with 1 pinnate outer spine; exp-2 with 1 pinnate outer spine and 1 plumose inner seta; exp-3 with 3 pinnate outer spines and 2 apical setae. Endopod 3-segmented; enp-1 elongate, reaching to end of exopod, armed with setules on inner and outer margins, respectively, and with 1 pinnate inner seta subdistally; enp-2 smallest with few outer spinules and 1 plumose inner seta, distal margin oblique; enp-3 elongate about 2.5 times as long as preceding one, with few outer spinules distally, 1 pinnate apical spine, 1 apical and 1 small inner setae.

P2–P4 (Figs. 43B, 44A, B). Intercoxal sclerite trapezoidal, with 2 triangular process on distal margin. Coxa large, with 4 rows of spinules on anterior surface and few spinules on posterior surface. Basis with 1 pinnate spine (P2) or 1 plumose seta (P3, P4) on outer margin, with 2 rows of spinules on anterior surface; posterior margin with 1 row of spinules. Both rami 3-segmented; exopod longer than endopod in P4; all segments armed with several or row of spinules on outer margins; proximal and middle segments of both rami with frills on

distal margin; P3–P4 exp-1 with 1 tube pore on anterior surface, respectively; each segment of endopod with tube pore on anterior surface.

Setal formula of P1-P4 as follows:

	Exopod	Endopod
P1	0.1.023	1.1.120
P2	1.1.123	1.2.121
P3	1.1.123	1.1.221
P4	1.1.223	1.1.121

P5 (Fig. 45C). Baseoendopod with 1 bare outer seta; endopodal lobe reaching to half of exopod, with 3 elongate setae and 2 pinnate setae bearing bifid tip. Exopod separated from baseoendopod, length 2.7 times as long as greatest width, with 6 naked setae, three outer of which delicate and hair-like.

**Male.** Total body length (Fig. 46A) smaller than that of female, about 700 µm. Cephalothorax with 3 paired pores on dorsal surface. Urosome 6-segmented, urosomite 2 and 3 not fused; urosomite 3 and 4 with 1 row of ventral spinules, respectively; urosomite 5 with 2 sets of 3 ventral spinules.

Antennule (Figs. 45D) 9-segmented, modified for grasping as haplocer; segment 1 tapering proximally, with 1 tube pore; segments 4 and 9 with 1 peduncle bearing aesthetasc fused to bare seta basally, respectively; segment 5 smallest; segments 6 and 7 with few spine-like processes. Setal formula of each segment as follows: 1-[1], 2-[11], 3-[9], 4-[9 + ae], 5-[2], 6-[2], 7-[1], 8-[4], 9-[6 + ae].

P1, basis (Fig. 44C) with 2 chitinous lamellae.

P2 endopod (Fig. 44D). Third segment modified as common in the genus, with one plumose lateral, pinnate apical setae, one spine bearing bifid tip, and one stout process.

P5 (Figs. 46C). Each baseoendopod confluent medially; endopodal lobe reaching to half of exopod, with 2 pinnate spine bearing bifid tip; exopod elongate, with 4 naked and 2 pinnate setae; two distal setae on outer margin of exopod delicate, hair-like, but one proximal very long.

P6 (Fig. 46B) small plate, with 1 small and 2 elongate bare setae.

**Remarks.** To date, the genus *Typhlamphiascus* Lang, 1944 comprises 19 valid species with worldwide distribution (Chullasorn 2009). Por (1963) expediently divided the genus into two

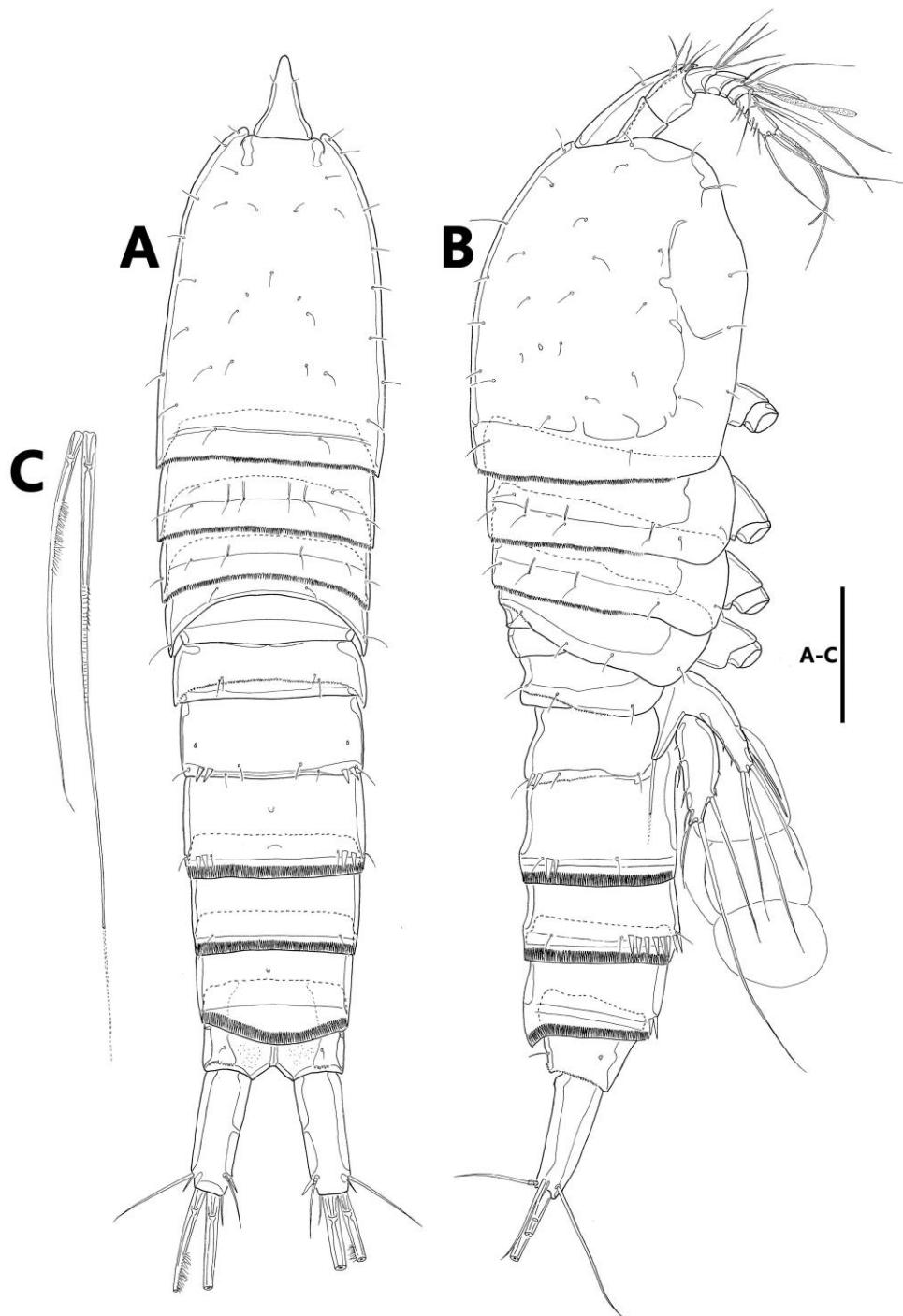
groups based on the number of inner setae on the distal endopodal segment of the fourth thoracic leg: the first group has two inner setae and the second group has one inner seta. The new species, *Typhlamphiascus* sp. nov. 1, belongs to the second group comprising *T. confusus* (T. Scott, 1902), *T. brevicornis* (Thompson & A. Scott, 1903), *T. typhlops* (Sars, 1906), *T. typhloides* (Sars, 1911), *T. lamellifer* (Sars, 1911), *T. latifurca* Por, 1968, *T. unisetosus* Lang, 1965, *T. pectinifer* Lang, 1965, *T. ovale* Wells & Rao, 1987, and *T. higginsi* Chullasorn, 2009.

Among the members of this group, *T. biementia* sp. nov. is closest to *T. confusus sensu* Sars, 1911 and *T. pectinifer* in sharing the absence of seta on second exopodal segment in antenna, the P3 enp-3 with 5 elements, and the elongate caudal rami about 3 times as long as width. However, *T. biementia* sp. nov. differs from *T. confusus* sensu Sars, 1911 in the following morphological characteristics: (1) the caudal ramus has straight inner margin contrary to the latter bearing curved inner margin in the latter; (2) the outermost seta on the female P5 endopodal lobe is very long (about 4/5 length of neighboring seta), while it is short (about 1/3 of neighboring seta in length) in the latter; (3) the caudal seta IV is furnished with delicate setules, while it is naked in the latter (4) the caudal seta III is twice as long as seta II, while it is as long as seta II in the latter; (5) the length ratio to width of male P5 exopod is smaller (1.5 : 1) than that of the latter (2.9 : 1); (6) in male P5 exopod, the seta V (outermost) is very long, longer than the length of its exopod, while it is small, about half length of its exopod in the latter. The new species is also easily distinguished from *T. pectinifer* by the relative length of P1 enp-1 reaching to end of exopod, the straight caudal rami, the absence of spinular patch at inner distal corner of caudal rami, the absence of mid spinules on ventral surface of urosome, and the innermost seta bearing non-bifid tip on male P5 exopod. In addition, the basis of male P1 has two chitinous lamellae in *Typhlamphiascus* sp. nov., while it has four ones in the *T. pectinifer*.

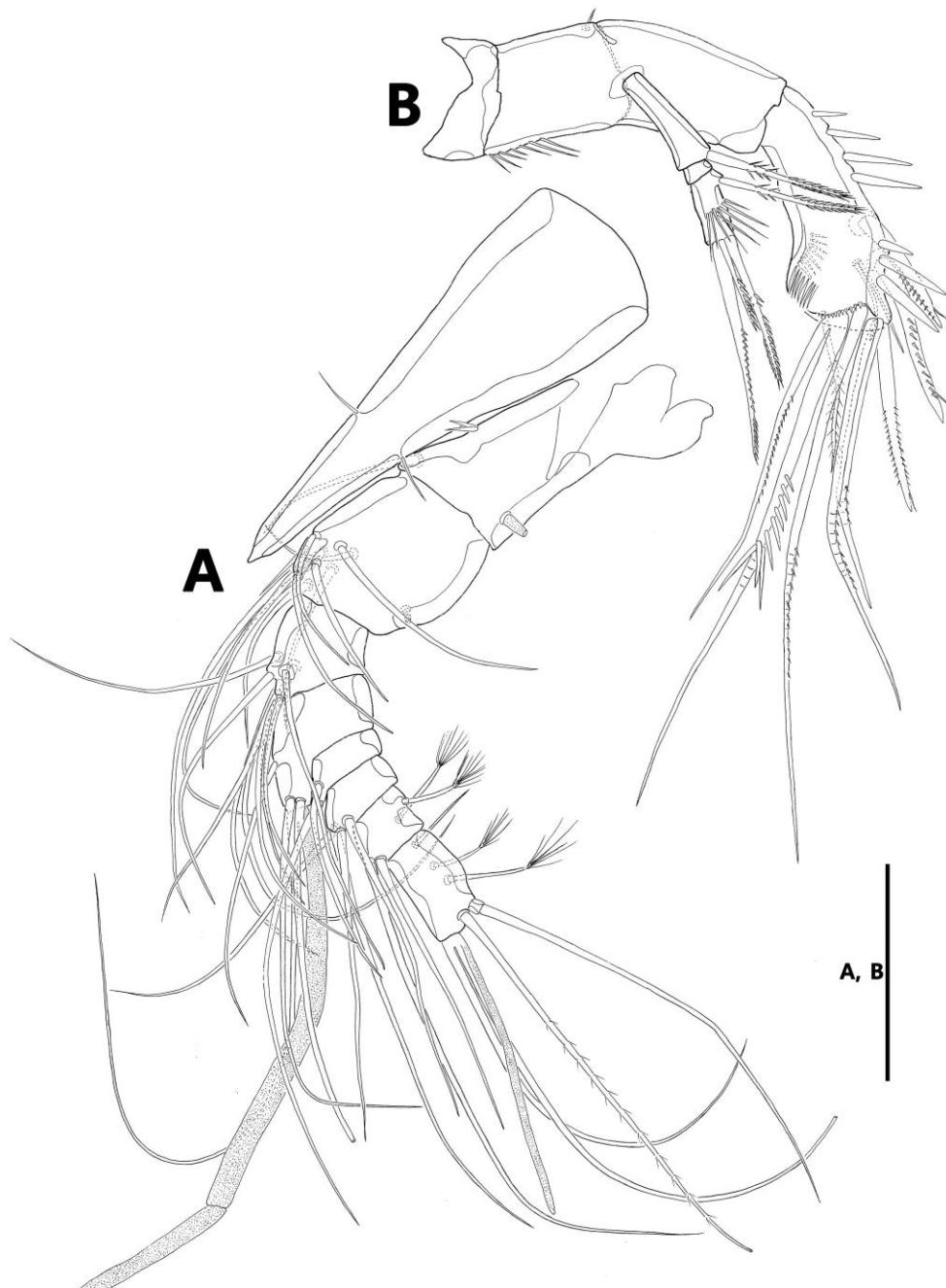
Morphological diversity of *T. confusus* was known in the characteristic features of the body size, ornamentation of urosome, caudal rami, P1 and P5. Sars (1911) reported this species in spite of the fact that he was aware the difference in the P1 and P4 between *T. confusus* sensu T. Scott's (1902) from British Isles and his material from Norway. There are discrepancies in the length to width ratios of each segment. For example, those of the P1 enp-3 and P4 enp-3 in *T. confuses* sensu T. Scott's (1902) are about 2.5 times, respectively, while these are about 5.0 and 3.7 times, respectively, in *T. confuses* sensu Sars (1911). In addition, the distinct

differences between them were also recognized in the structure of the female P5 exopod, the two inner most setae on the female P5 endopodal lobe, and the inner margin of caudal rami. These differences allude Sars' species can be regarded as a distinct species. On the other hand, Por (1963) divided *T. confusus* into three types, confusus-, gullmaricus-, erythraeicus-types, depending on the body length, rostrum, abdominal ornamentation and caudal rami. This intraspecific variability of *T. confusus* was conceded by Por (1967) and Moore (1976). However, Lang (1965) refuted Por's suggestion because his data were taken from different specimens and his analysis was restricted to a few characters. He also insisted Por's morphological evidences can be regarded as an important taxonomic value to distinguish the species. Conventionally, the differences of rostrum and caudal rami are not the intraspecific variability, but the specific characteristic in most harpacticoid species (Lang 1948; Wells 2007). Recent studies revealed that the fine ornamentation of body such as the pattern of spinule, sensilla and pore is a useful morphological characteristic to distinguishing species in some genera (Mu & Gee 2000; Karanovic & Cho 2012; Karanovic et al. 2014). In addition, Moore (1976) found out that there are differences in cephalosomatic appendages between *T. confusus* *sensu* Por (1967) and *T. confusus* *sensu* Moore (1967). Thus, it seems that two subspecies, *T. confusus erythraeicus* Por, 1963 and *T. confusus gullmaricus* Por, 1963 are distinct species and there are many species under the name of *T. confusus*.

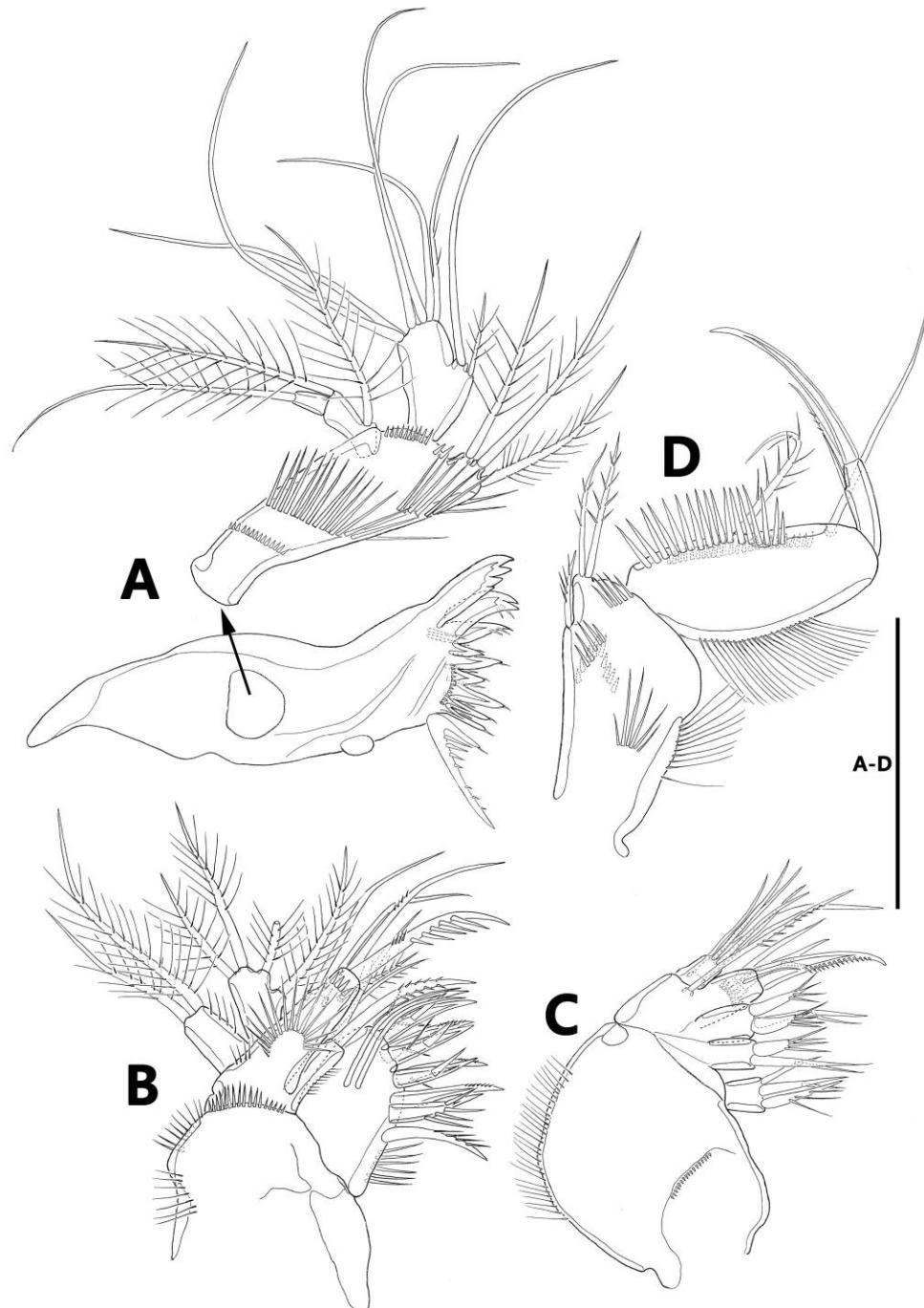
Among *T. confusus* complex, the caudal rami of *T. confusus gullmaricus* and *T. confusus* *sensu* Moore (1976) are similar to that of the new species. However, both species differ from *Typhlamphiascus* sp. nov. 1 in the relative length of setae on the female P5 exopod. *Typhlamphiascus confusus gullmaricus* is distinguishable from *Typhlamphiascus* sp. nov. 1 by the presence of three to four chitinous lamellae on male P1 basis and the elongate antennular segment longer than second one in female. *Typhlamphiascus confusus* *sensu* Moore (1976) is also discriminated from *Typhlamphiascus* sp. nov. 1 by the two element representing P6 in female (vs. three elements in *Typhlamphiascus* sp. nov. 1) and the presence of mid spinules on ventral surface of urosomite 4.



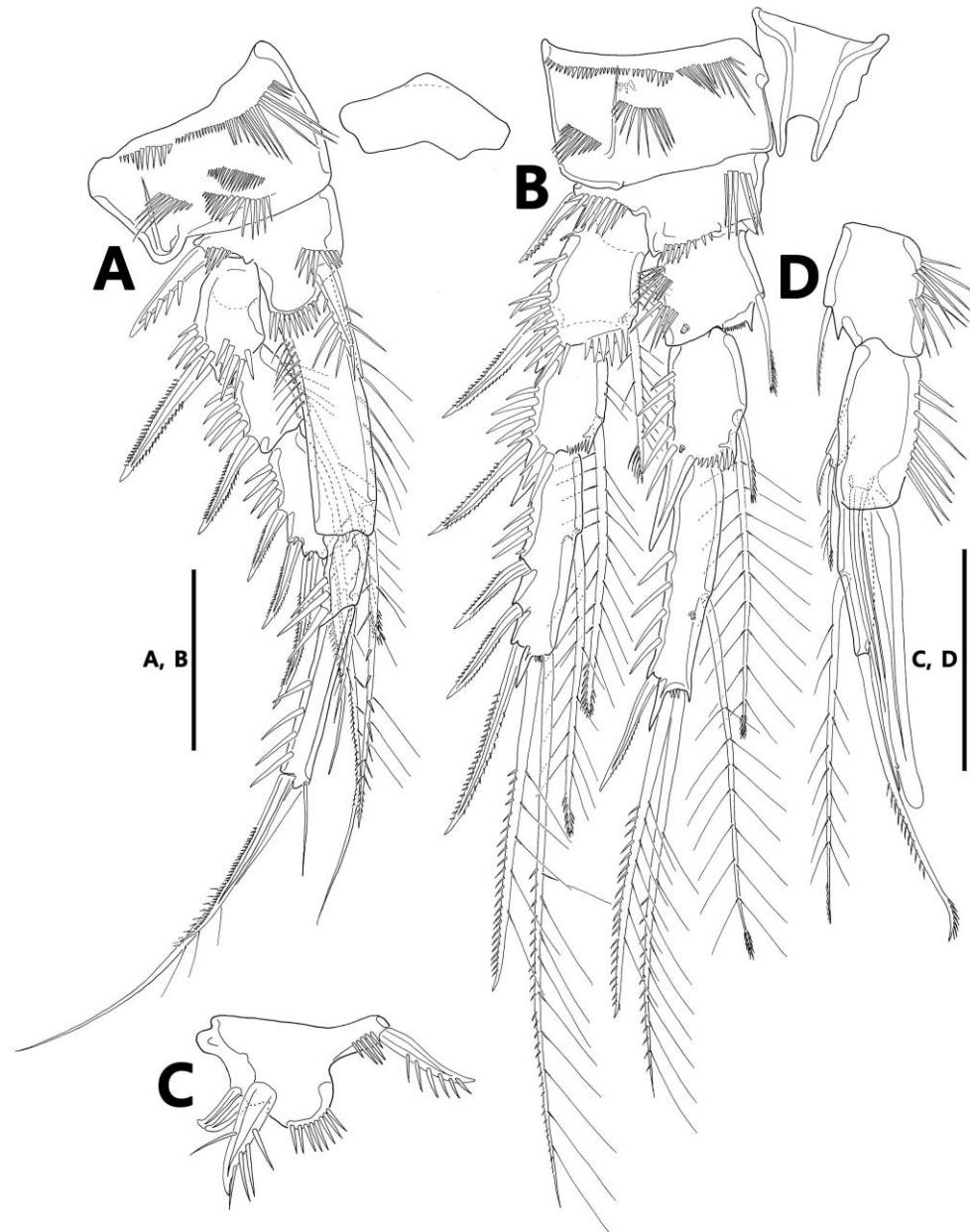
**Fig. 40.** *Typhlampionscus* sp. nov. 1, female. A, habitus, dorsal; B, habitus, lateral. Scale bar: 100  $\mu\text{m}$ .



**Fig. 41.** *Typhlamphiascus* sp. nov. 1, female. A, rostrum and antennule; B, antenna. Scale bar: 50  $\mu$ m.



**Fig. 42.** *Typhlamphiascus* sp. nov. 1, female. A, mandible; B, maxillule; C, maxilla; D, maxilliped. Scale bar: 50  $\mu\text{m}$ .



**Fig. 43.** *Typhlamlaphiascus* sp. nov. 1, female (A, B). A, P1; B, P2. Male (C, D): C, basis of P1; D, endopodite of P2. Scale bars: 50  $\mu\text{m}$ .

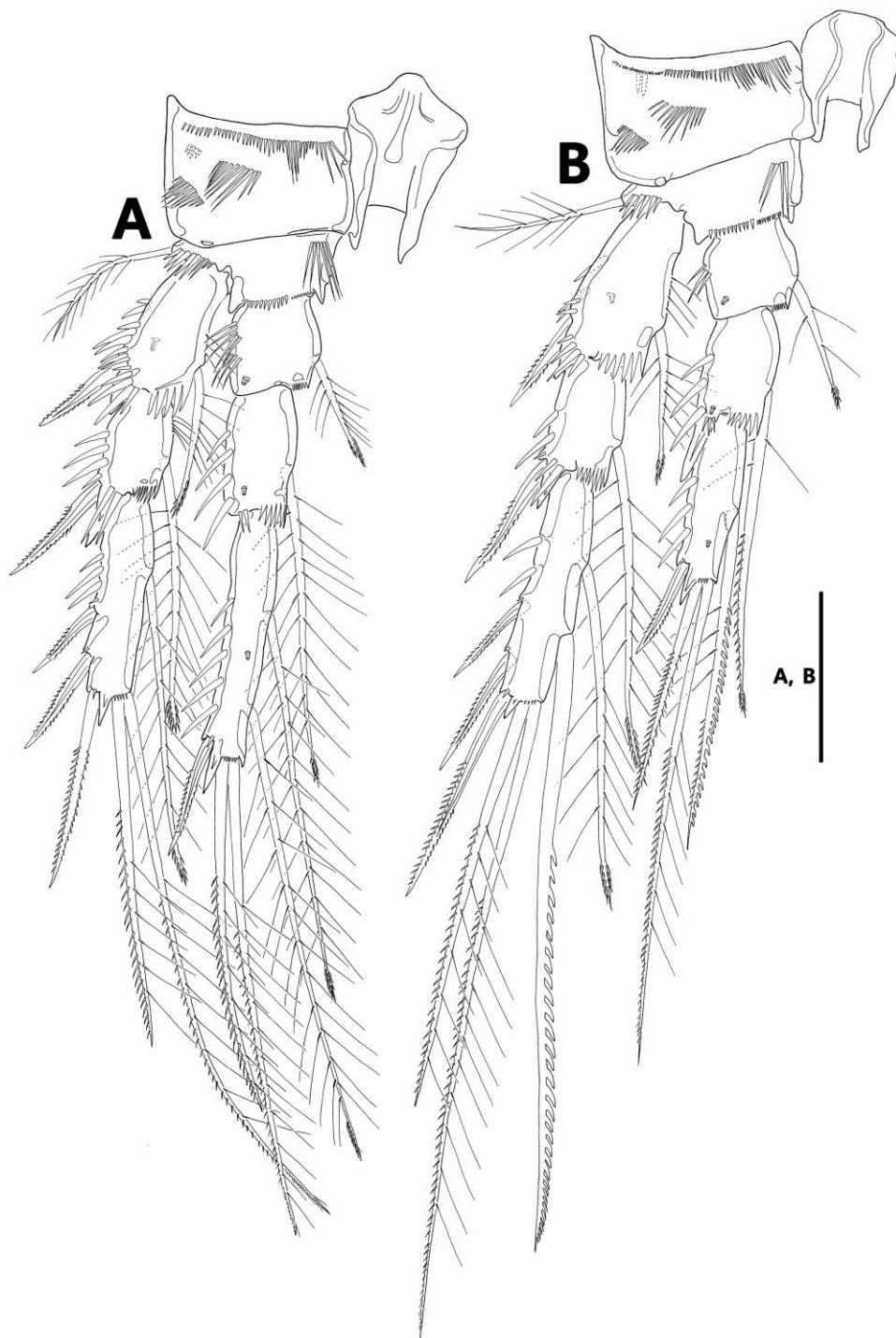
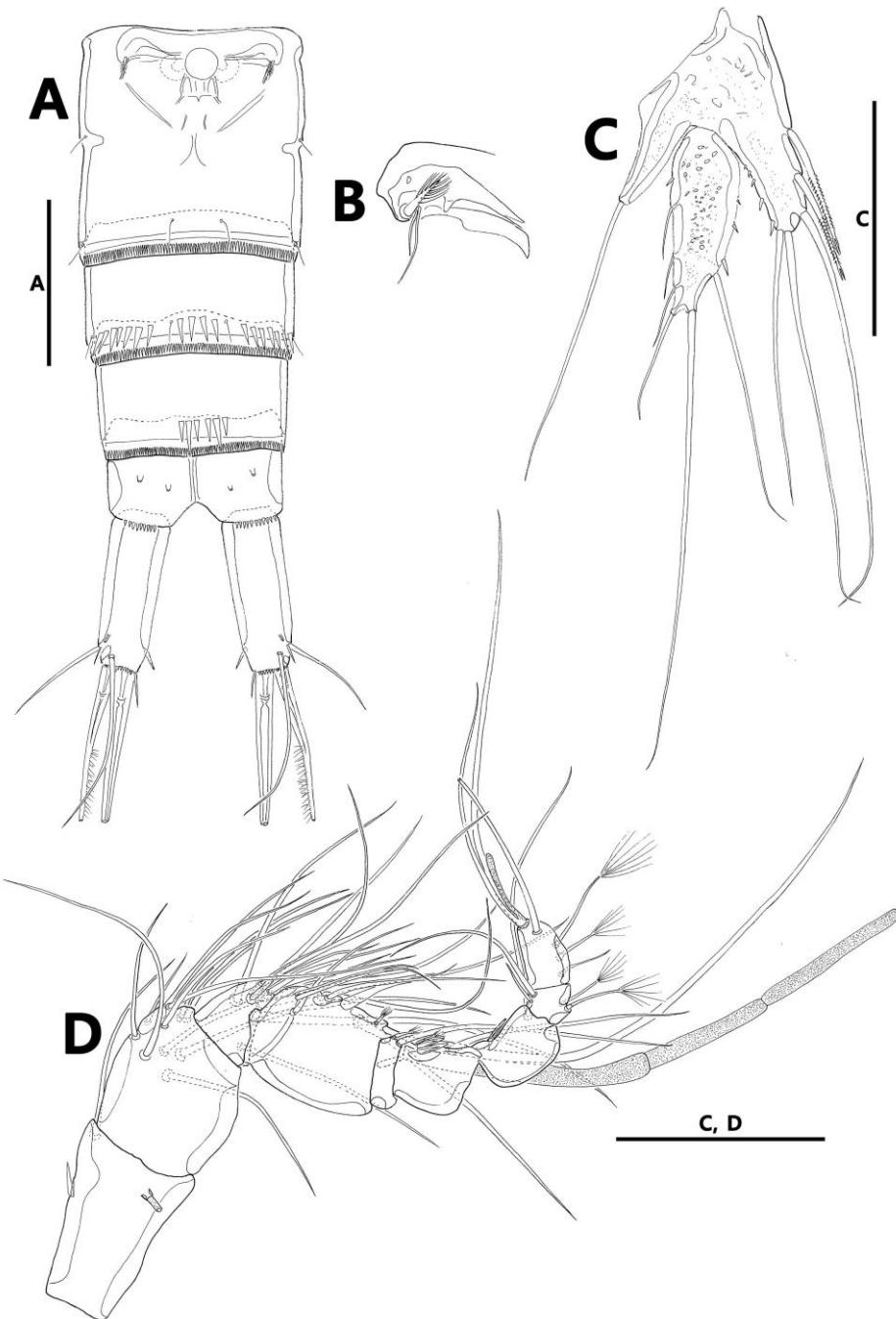
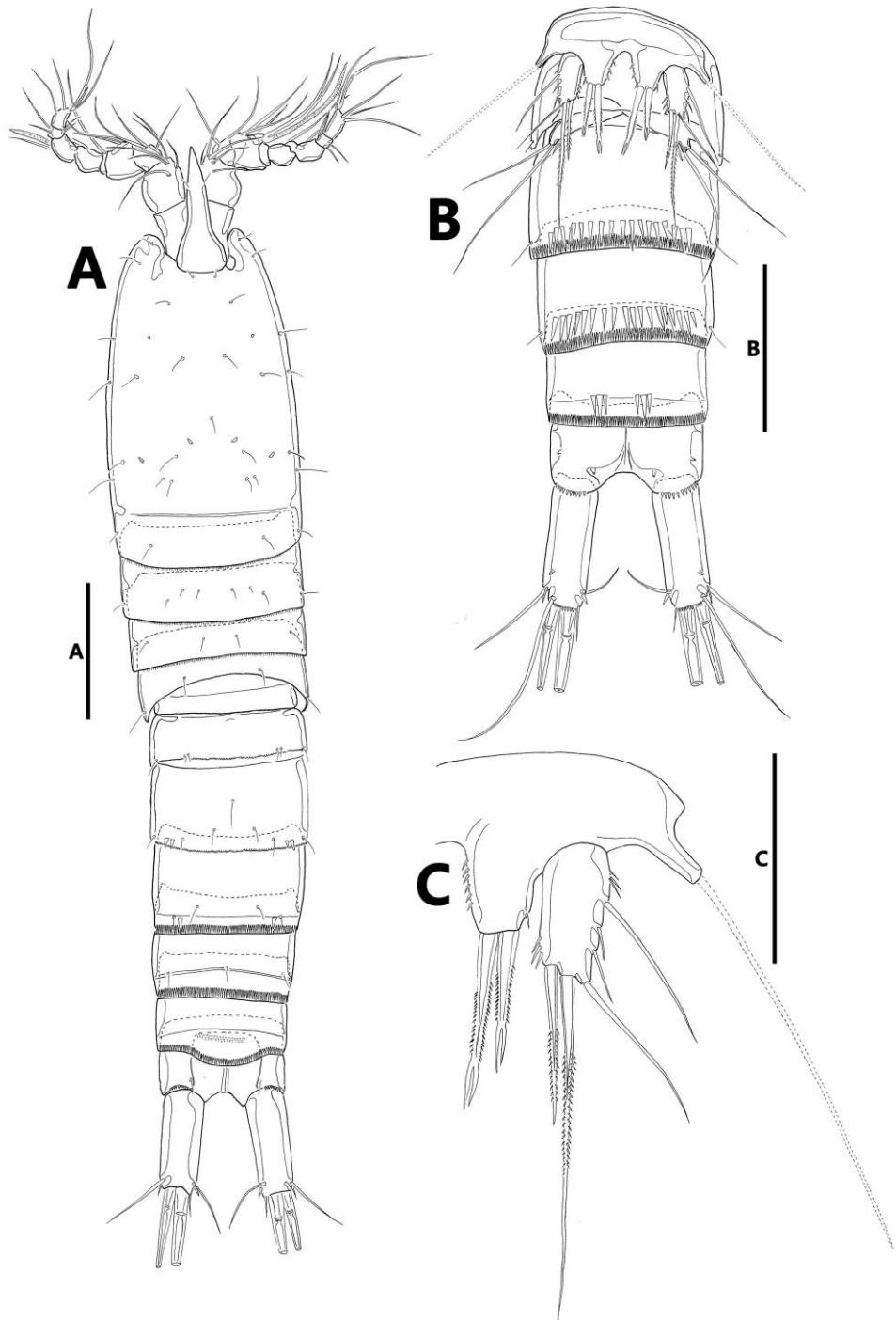


Fig. 44. *Typhlampionscus* sp. nov. 1, female. A, P3; B, P4. Scale bar: 50  $\mu$ m.



**Fig. 45.** *Typhlamphiascus* sp. nov. 1, female (A–C). A, urosome; B, genital field; C, P5. Male (D); D, antennule. Scale bars: 50 µm (B–D); 100 µm (A).



**Fig. 46.** *Typhlamphiascus* sp. nov. 1, male. A, habitus, dorsal; B, urosome, ventral; C, P5.  
Scale bars: 50  $\mu\text{m}$  (C); 100  $\mu\text{m}$  (A, B).

**30. *Typhlamphiascus* sp. nov. 2 (Figs. 47–52)**

**Type locality.** Off Jangsado Island ( $34^{\circ}42'48.2''N$ ,  $128^{\circ}33'39.18''E$ ), Hansan-myeon, Tongyeong-si, Gyeongsangnam-do, South Korea

**Materials examined.** Holotype: ♀, dissected and mounted in lactophenol solution on slides.

**Description. Female.** Body (Fig. 47A, B) fusiform, without conspicuous distinction between prosome and urosome; total length about 750  $\mu m$  measured from anterior margin of rostrum to posterior margin of caudal ramus; surface ornamented with paired sensilla except pre-anal somite and caudal rami. Rostrum (Fig. 47A, B) elongate, triangular, defined at base, reaching to 1/3 of second antennular segment; lateral margin with paired sensilla subdistally. Cephalothorax (Fig. 47A, B) longer than 3 prosomites combined. Genital double-somite (Fig. 48A, B) 1.2 times as long as width, as long as 2 succeeding urosomites combined, separate by only lateral suture. Genital apertures (Fig. 48D) separate, each covered by vestigial P6 composed of 1 pinnate and 2 slender (one long, one short) setae; copulatory pore located medially, with 1 circular copulatory bulb. Posterior margins of urosomites with hyaline frills except for anal somite; pre-anal somite with weak pseudoperculum. Anal somite with deep cleft medially bearing 2 rows of oblique setules, 2 sensilla on dorsal surface, and 2 rows of spinules ventrally. Caudal rami (Fig. 48A–C) elongate, about 2.4 times as long as greatest width in dorsal view, swollen medially, and with 7 setae: seta I small, naked; seta II bare, about three times as long as seta I; seta III elongate, bare, situated posteroventrally, longer than seta II; setae IV dramatically tapering at proximal part with patch of spinules proximally; seta V broken; seta VI naked, elongate as long as seta III; dorsal seta VII tri-articulated, shorter than seta III.

Antennule (Fig. 49A) 8-segmented; segment 1 with 1 row of spinules on anterior margin and 1 tube pore; segment 2 longest; segments 4 and 8 with aesthetasc fused to seta basally, respectively; segment 5 shortest; setal formula as follows: 1-[1], 2-[11], 3-[7], 4-[4 + ae], 5-[2], 6-[3], 7-[4], 8-[7 + ae].

Antenna (Fig. 51A). Coxa small. Allobasis elongate, partially separate by suture, with 1 minute abexopodal seta; proximal one with several rows of spinules; distal one longer than preceding one. Exopod 3-segmented; proximal elongate, with 1 pinnate seta at distal corner; middle one smallest; distal one with 1 row of spinules on surface, and 1 lateral and 3 apical

pinnate setae. Endopod 1-segmented, broadening distally; abexopodal margin armed with several stout spinules, 2 pinnate spines, and 1 slender seta; distal margin with 1 pinnate spine and 4 geniculate setae (innermost one of which spinulose and fused to pinnate seta basally), 1 plumose seta, and 1 hyaline frill; inner margin with 2 frills distally.

Mandible (Fig. 50A). Coxal gnathobase armed with 5 multicuspid, 2 bicuspisid and 2 unicuspisid teeth, and 1 pinnate seta fused small setae at basally, 1 row of small spinules and 8 long spinules; inner surface with 1 protrusion and 1 set of spinules. Basis broad with 6 sets of spinules or setules, and 3 pinnate setae. Endopod bilobate, with 1 row of lateral spinules; inner lobe with 1 small pinnate and 1 elongate bare setae, outer lobe with 6 naked setae apically. Exopod 2-segmented, narrower than endopod; proximal and distal segments with 1 and 2 setae, respectively.

Maxillule (Fig. 50B). Praecoxa with 1 row of spinules; arthrite armed with 8 spinulose spines, 1 pinnate and 1 bare setae, and 1 group of setules on inner margin, and 2 parallel setae on anterior surface. Coxal endite with 1 stout pinnate, 1 pinnate, and 1 naked setae apically. Basal endite with 2 of spinules on surface, 2 pinnate, and 1 plumose apical setae, 1 subdistal naked seta, and 1 small endite bearing 2 naked setae. Exopod 1-segmented, with 2 plumose setae apically. Endopod with 1 row of lateral setules, 2 lateral and 2 apical plumose setae.

Maxilla (Fig. 50C). Syncoxa large, with 1 row of spinules along outer margin, 1 row of small spinules on surface, and 3 endites; proximal endite small, with 1 spinulose setae; middle endite with 2 spinulose setae; distal endite with 2 spinulose setae. Allobasis drawn out into claw-like process, armed with 1 row of spinules, with 1 row of spinules, 2 naked, 1 spinulose stout setae, and 1 small peduncle bearing 1 spinulose seta. Endopod 2-segmented; proximal one small with 1 spinulose seta; distal one with 1 spinulose and 4 naked setae.

Maxilliped (Fig. 49B). Syncoxa with 4 rows of spinules on surface, 1 row of setules along outer margin, and 2 spinulose and 1 naked setae at distal corner. Basis elongate with 1 row of long setules along outer margin and 1 row of spinules on surface; palmar margin with 1 naked and 1 pinnate setae, and 1 row of spinules. Endopod with 1 stout pinnate claw-like spine, and 1 spinulose and 1 naked setae.

P1 (Fig. 51B). Coxa large, ornamented with 5 rows of spinules on anterior surface. Basis smaller than preceding one, with 1 pinnate outer spine and 1 pinnate inner spine, 3 rows of spinules on anterior and posterior surfaces. Exopod 3-segmented; outer margin of each

segment ornamented with few spinules; exp-1 with 1 outer pinnate spine; exp-2 with 1 pinnate outer spine, 1 plumose inner seta, and several inner setules; exp-3 with 3 pinnate outer spines and 2 apical setae. Endopod 3-segmented; enp-1 elongate, reaching to end of exopod, armed with inner and outer setules, respectively, and 1 pinnate inner seta subdistally; enp-2 with few outer spinules and 1 plumose inner seta at distal corner; enp-3 elongate, about 2.1 times as long as preceding one, with few outer spinules distally, 2 pinnate apical spines, and 1 naked inner seta.

P2–P4 (Figs. 51C, 52A, B). Coxa large, with 3 rows of spinules on anterior surface; posterior surface of P4 with few spinules. Basis with 1 pinnate spine (P2) or 1 plumose seta (P3–P4) on outer margin, and 1 group of spinules near outer spine or setae basally; inner anterior surface with 1 set of long spinules; distal margin with 1 row of spinules. Both rami 3-segmented each; endopod longer than exopod in P2 and P3, exopod longer than endopod in P4; all segments armed with outer spinules; proximal and middle segments of both rami with frills on distal margin; enp-1, enp-3 of P3 and P4 with 1 tube pore on anterior surface, respectively.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.023	1.1.120
P2	1.1.123	1.2.121
P3	1.1.123	1.1.221
P4	1.1.223	1.1.221

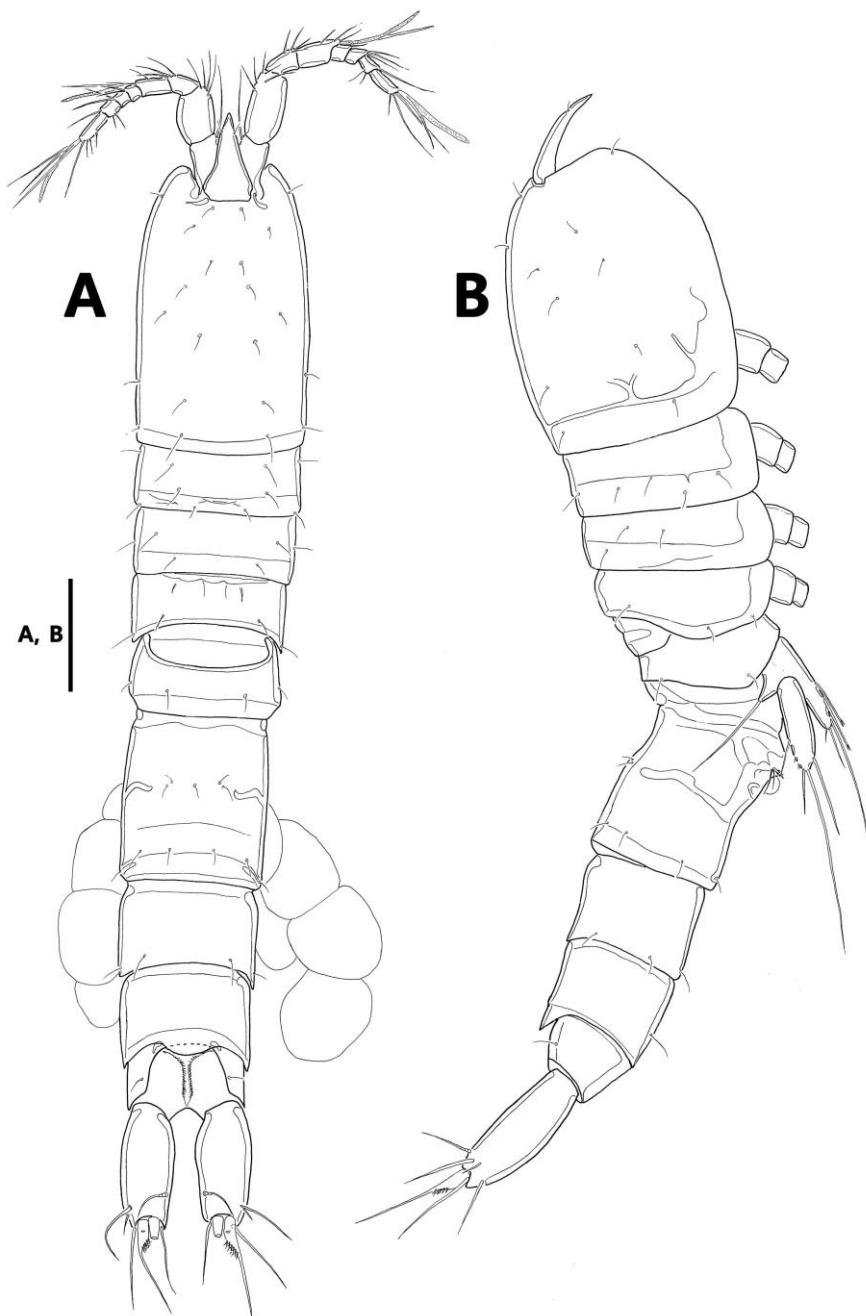
P5 (Fig. 48E). Each baseoendopod separate, with 1 bare seta on outer peduncle; endopodal lobe reaching to tree fifth of exopod, with 3 bare and 2 pinnate bearing bifid tip setae, of which outermost one very small, median one elongate. Exopod separated from baseoendopod, length 2.6 times as long as greatest width, with 6 naked setae, of which two distal ones on outer margin very small, delicate.

**Remarks.** The present species collected from Jangsado Island evidently belongs to the first group of the genus *Typhlamphiascus* Lang, 1944, proposed by Por (1963). This group is mainly characterized by the presence of five elements on the P4 enp-3 and composed of *T. accraensis* T. Scott, 1894, *T. blanchardi* (T. Scott, 1895), *T. dentipes* (Thompson & A. Scott, 1903), *T. gracilicaudatus* (Thompson & A. Scott, 1903), *T. longifurcatus* Rouch, 1962, *T.*

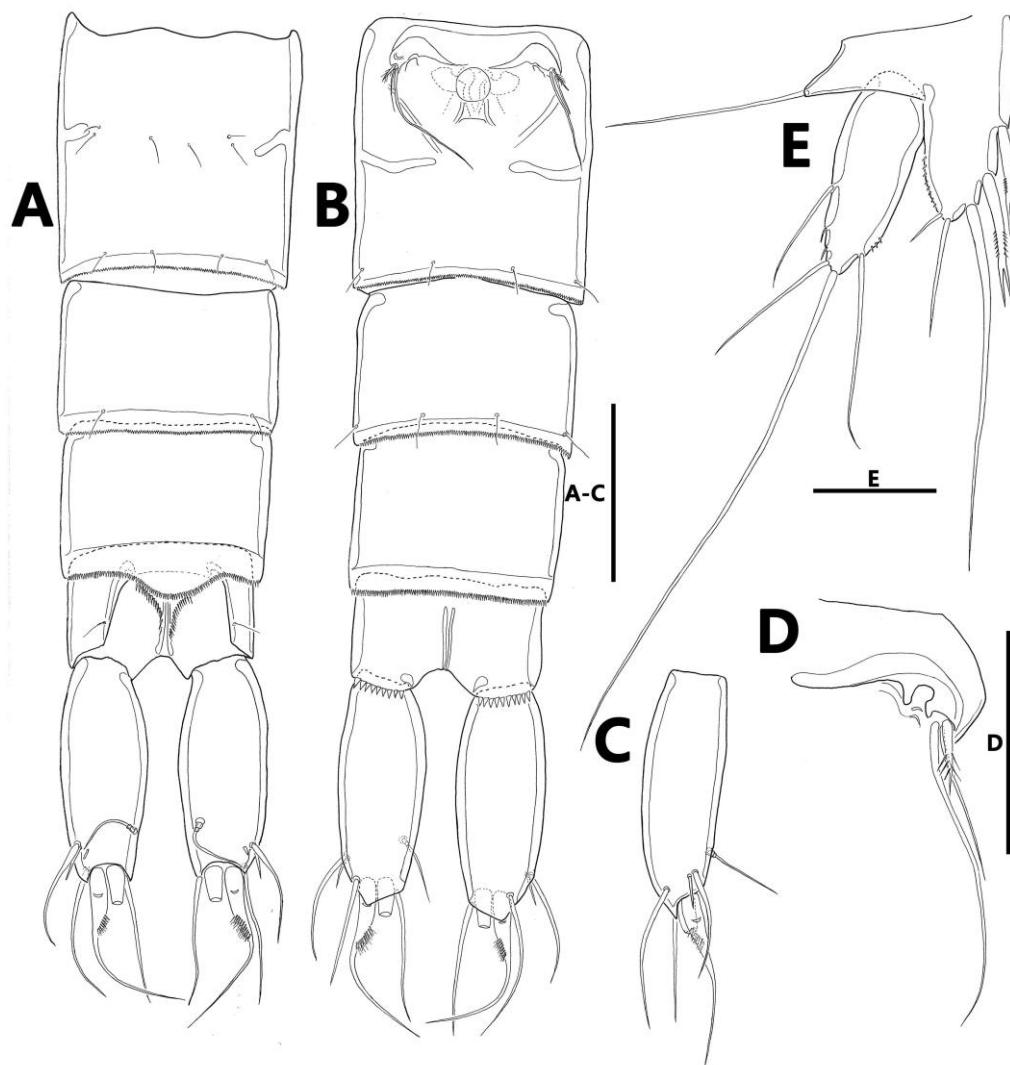
*gracilis* Por, 1963, *T. lutincola* Soyer, 1963, *T. drachi* Soyer, 1964, *T. bouligandi* Soyer, 1971 (Chullasorn 2009; Por 1963).

Within this group, the new species, *Typhlamphiascus* sp. nov. 2, shares the elongate caudal rami about twice as long as the anal somite with *T. longifurcatus* (2.1 times) and *T. bouligandi* (2.3 times). Caudal rami of the rest species belonging to this group are less than twice as long as anal somite, being about 1.5 times in *T. gracilicaudatus*, about 1.0 times in *T. accraensis*, *T. blanchardi*, *T. gracilis*, *T. lutincola* and *T. drachi*, and 0.6 times in *T. dentipes*. The lateral margins of caudal rami in both species, *T. bouligandi* and *T. pusillus* sp. nov. are convex, while these are straight in *T. longifurcatus*. *Typhlamphiascus* sp. nov. 2 clearly differs from *T. bouligandi* by the following morphological characteristics: (1) the length to greatest width ratio of caudal rami is smaller (2.5 times) than the latter (3.3 times); (2) the P1 exp-1 is reaching to the end of exopod, while it is distinctly exceeding to the end of exopod in *T. bouligandi*; (3) the length to greatest width ratio of female P5 exopod is smaller (2.6 times) than that of *T. bouligandi* (3.8 times) (Soyer 1971); (4) the seta on second exopodal segment of antenna is absent, while it is present in *T. bouligandi*.

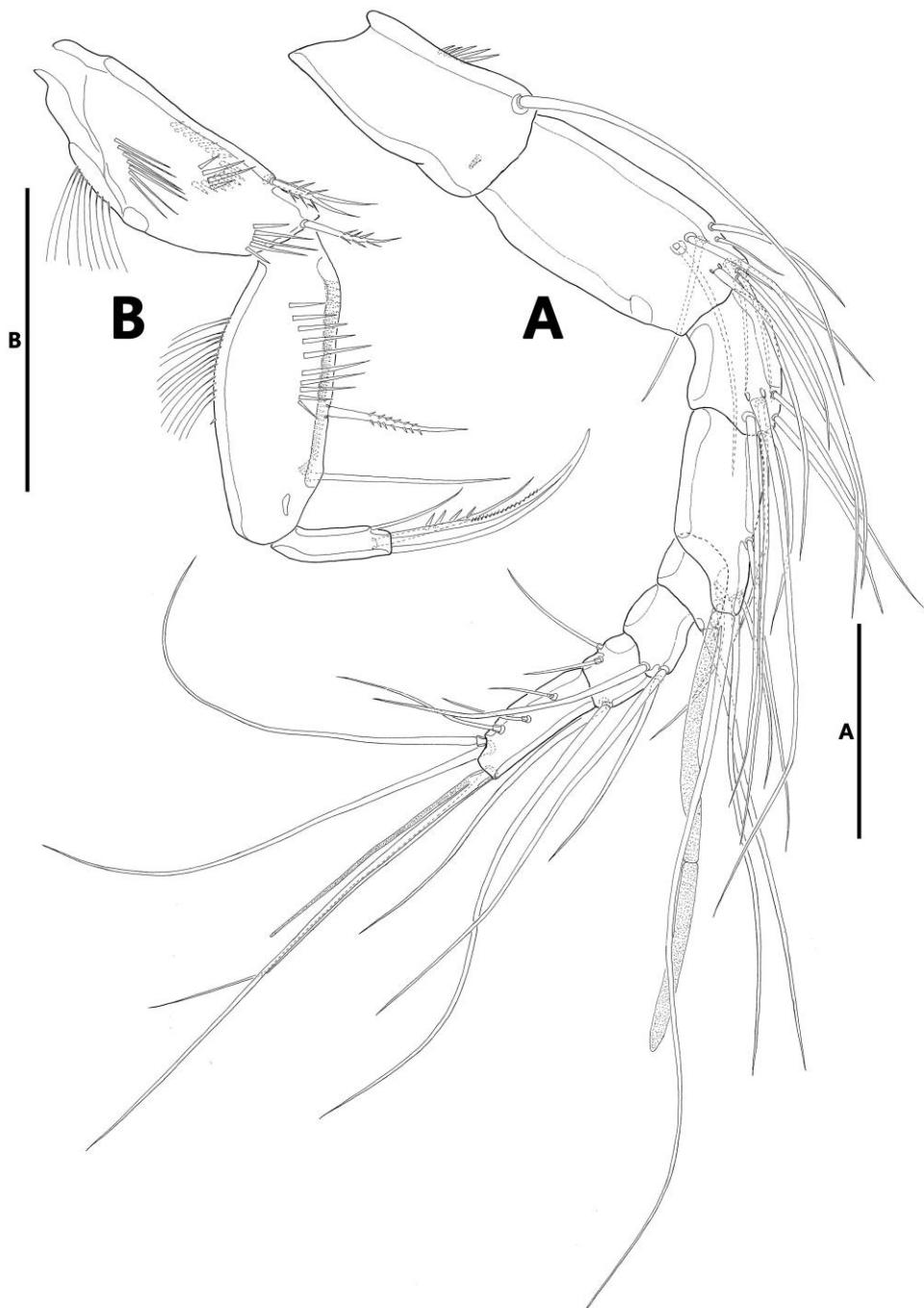
The taxonomic position of some *Typhlamphiascus* species seems to be doubtful. *Typhlamphiascus accraensis* represents unusual characteristic features: the female antennule is 9-segmented, while it is typically 8-segmented; the second exopodal segment of antenna has a seta which is absent in *Typhlamphiascus* species except for *T. bouligandi*; the P4 exp-3 has only 5 elements without inner setae, it has typically 7 elements in *Typhlamphiascus* species. The position of *T. dentipes* is also doubtful as the following morphological features: the P1 exp-3 has four elements compared to five in other species; the P4 exp-3 has three inner setae compared to two in other species. The latter feature might alludes that *T. dentipes* is more closed to *Bulbamphiascus* species than *Typhlamphiascus* species. The female P5 exopod of *T. dentipes* is also more similar to that of *B. chappuisi* Rouch, 1962 species in sharing the presence of bulbous projection.



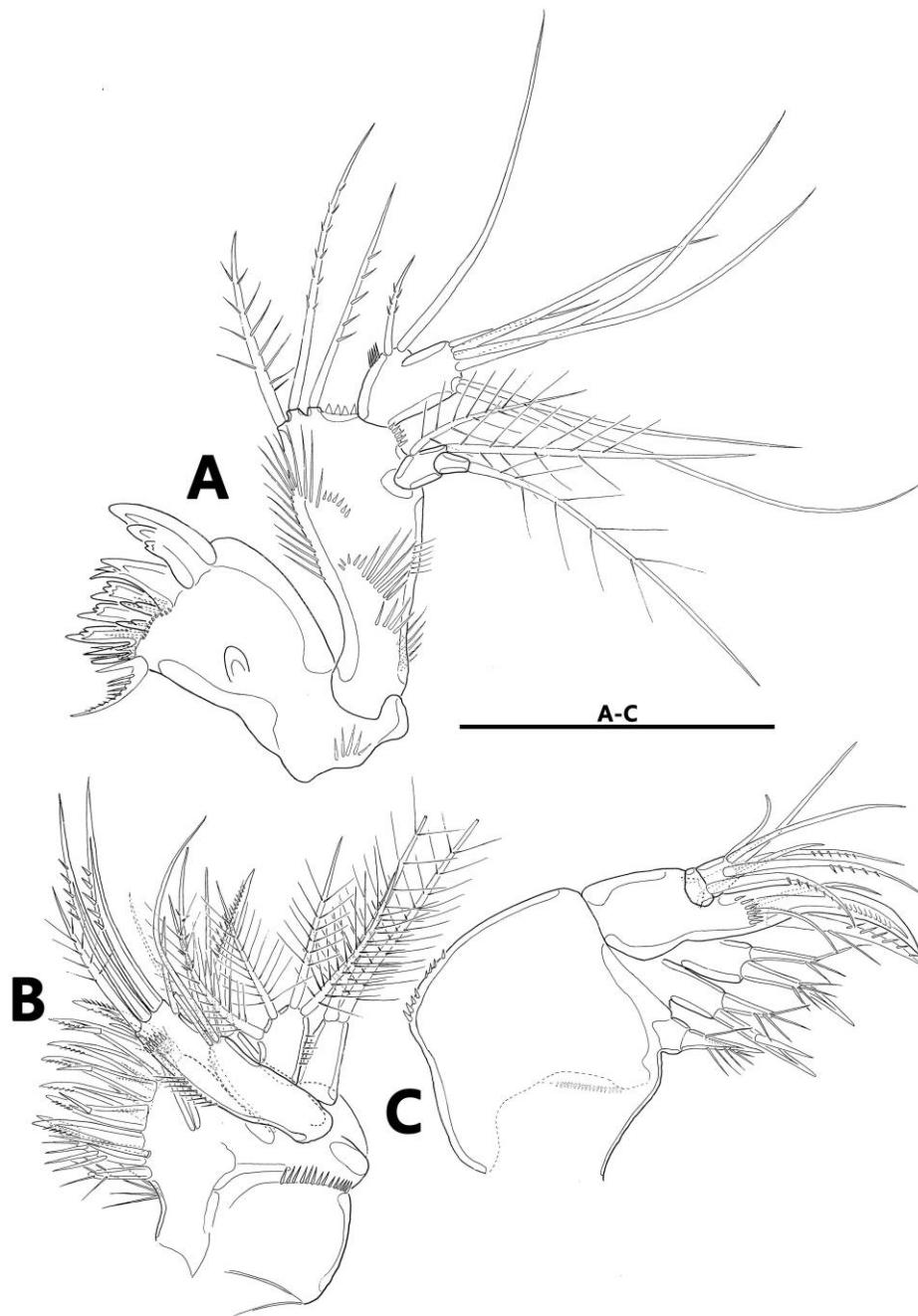
**Fig. 47.** *Typhlamphiascus* sp. nov. 2, female. A, habitus, dorsal; B, habitus, lateral. Scale bar: 100  $\mu\text{m}$ .



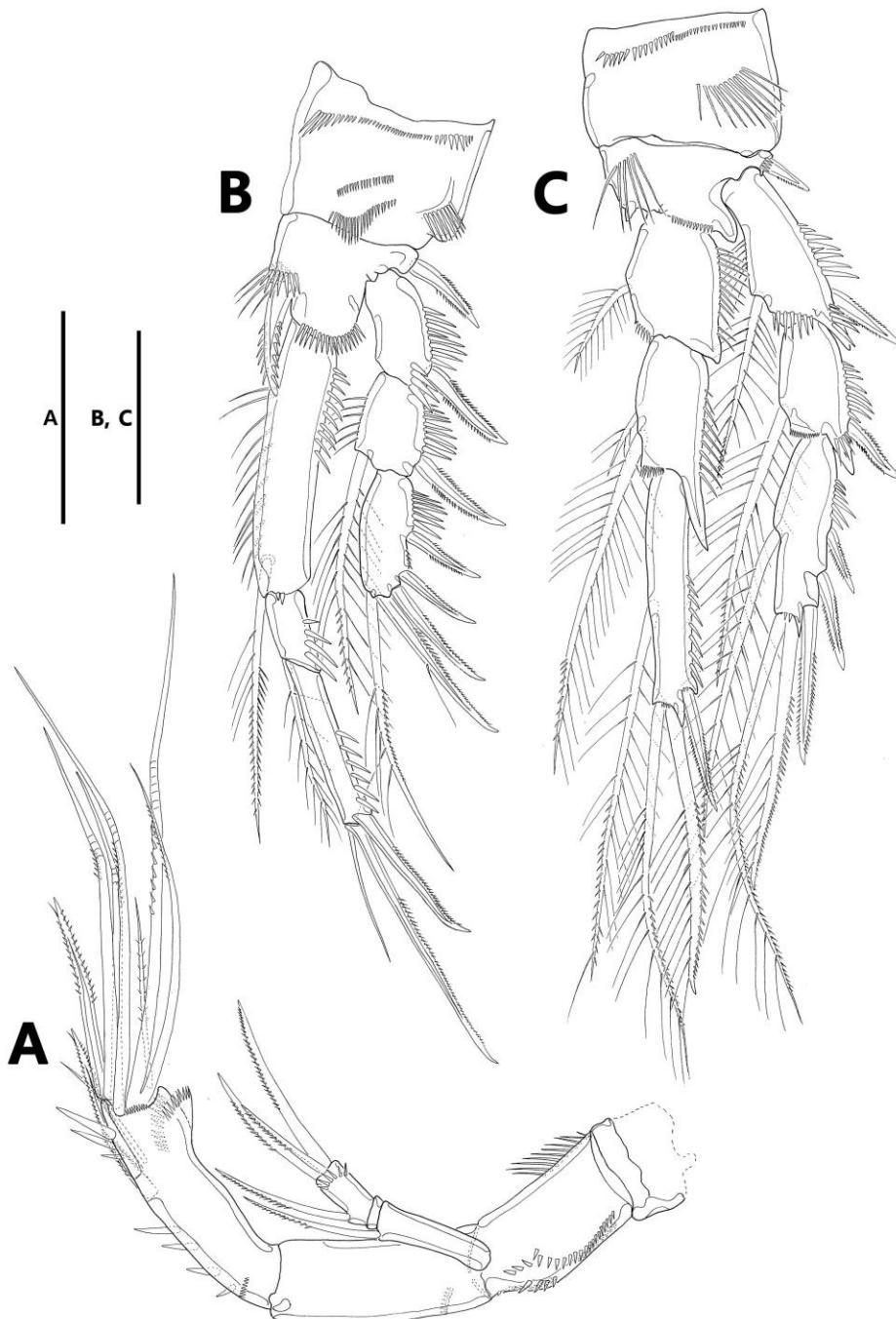
**Fig. 48.** *Typhlamphiascus* sp. nov. 2, female. A, urosome, dorsal; B, urosome, ventral; C, caudal ramus, lateral; D, genital field; E, P5. Scale bars: 50 µm (D, E); 100 µm (A–C).



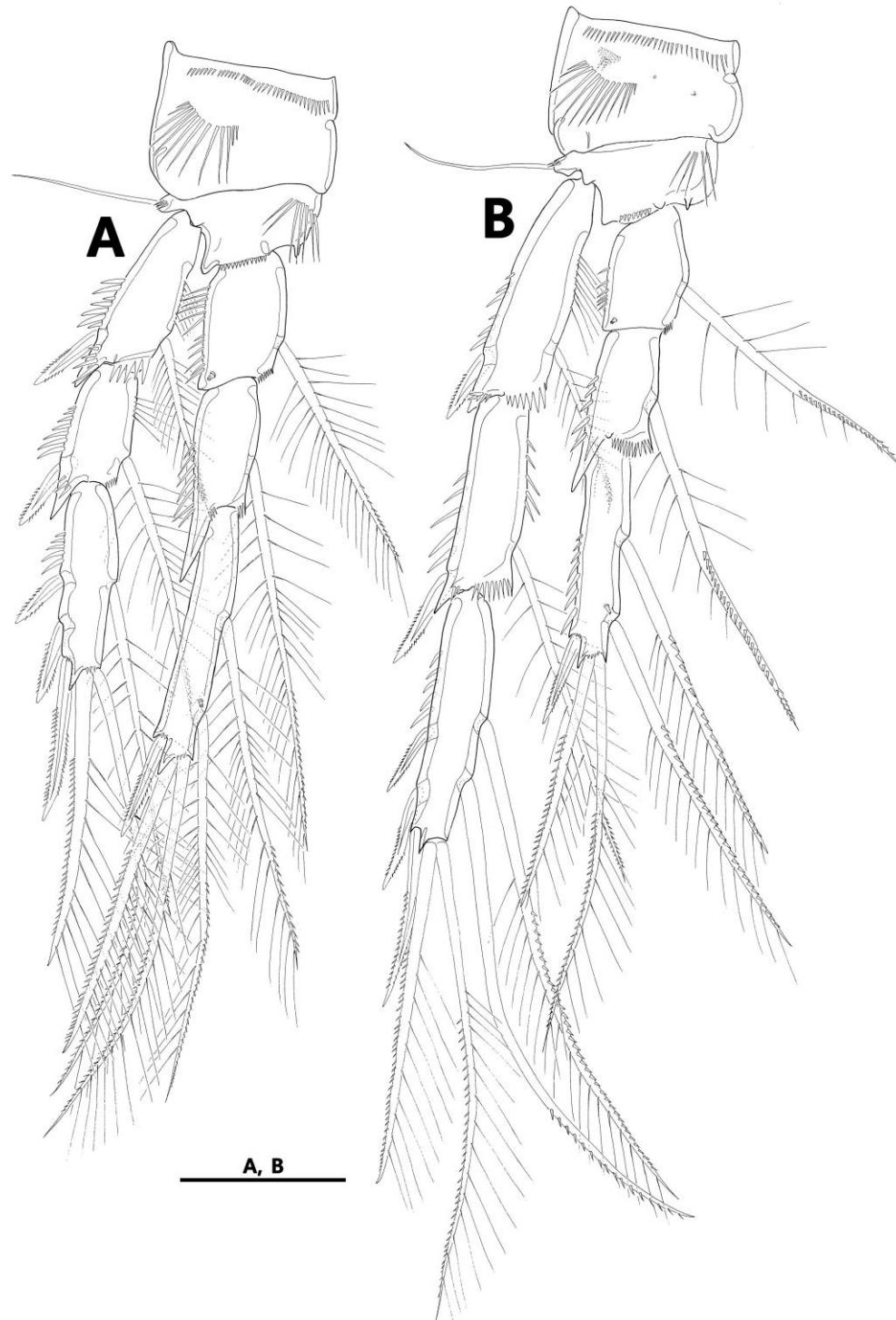
**Fig. 49.** *Typhlamlaphiascus* sp. nov. 2, female. A, antennule; B, maxilliped. Scale bar: 50  $\mu\text{m}$ .



**Fig. 50.** *Typhlamphiascus* sp. nov. 2, female. A, mandible; B, maxillule; C, maxilla. Scale bar: 50  $\mu\text{m}$ .



**Fig. 51.** *Typhlamlaphiascus* sp. nov. 2, female. A, antenna; B, P1; C, P2. Scale bar: 50  $\mu\text{m}$ .



**Fig. 52.** *Typhlamlphiascus* sp. nov. 2, female. A, P3; B, P4. Scale bar: 50  $\mu$ m.

**Genus *Paramphiascella* Lang, 1948 나도쌍낭장수노벌레 속**

모식종: *Paramphiascella hispida* (Brady, 1880)

**31. *Paramphiacella fulvofasciata* Rosenfield & Coull, 1974 노랑나도쌍낭장수노벌레  
(Figs. 53–59)**

*Paramphiacella fulvofasciata* Rosenfield & Coull, 1974, p. 295, figs. 1–25; Dahms, 1987, p. 218; Kim et al., 2015, p. 264, figs. 1–7.

**Materials examined:** 3♀♀, 5♂♂, Dapo-ri, Nambu-myeon, Geoje-si, Gyeongsangnam-do, Korea ( $34^{\circ}43'41.26''N$ ,  $128^{\circ}36'2.94''E$ ), 23 Mar. 2014.

**Description:** Female. Body (Fig. 53A, B) semicylindrical, fusiform, with inconspicuous boundary between prosome and urosome; total length 834.0  $\mu m$  (range from 666.5 to 834.0  $\mu m$ , mean = 742.4  $\mu m$ , n = 3), measured from anterior margin of rostrum to posterior margin of caudal ramus; surface ornamented with sensilla and pores. Rostrum (Fig. 55A) elongate, triangular, defined at its base, reaching to the end of second antennular segment, and with sensillum on each side subdistally. Cephalothorax tapering anteriorly, longer than 3 prosomites combined. Genital double-somite (fused genital and first abdominal somites; Fig. 54A) 0.8 times as long as wide, and with paired set of spinules on ventrolateral margin of first abdominal somite; lateral surface separated by subcuticular suture. Genital field (Fig. 54B) with separate genital apertures, each covered by vestigial P6 composed of 2 short plumose and 1 long bare setae; copulatory pore obscured by large and elongate, oval-shaped copulatory bulb. Urosomites 4 and 5 (Figs. 53A, B, 54A) with paired set of spinules on ventrolateral margin and row of ventral setules on posterior margin, respectively; posterior somite with pseudoperculum. Anal somite (Fig. 54C) with rows of spinules on lateral surface, and 3 paired rows of delicate spinules and pair of sensilla on dorsolateral surface; median deep cleft with pair of rows of oblique spinules; operculum ornamented with row of delicate spinules along posterior margin; ventral surface with 1 medial and 1 laterally paired rows of delicate spinules, and pair of tube pores; posterior border with pair of spinule rows ventrally. Caudal ramus (Fig. 54C) broader than long, length to width ratio about 1:2 in dorsal view, with tube pore on dorsal surface, 2 rows of spinules on median margin, 2 spinules on posterior border ventrally,

and 7 setae: seta I small and delicate; seta II bare and slightly longer than 2 times of caudal ramus; seta III slender, bare, situated at ventrolateral margin, and slightly longer than seta II; setae IV and V well-developed (Fig. 53C), seta V about 2 times as long as seta IV; seta VI elongate, bare, and 2 times as long as seta II; seta VII articulated basally and slightly shorter than seta II.

Antennule (Fig. 55A) 8-segmented; segment 1 longest and with row of spinules on anterior margin; segment 5 shortest; segments 4 and 8 with aesthetasc fused to seta basally, respectively; setal formula as follows: 1-[1], 2-[11], 3-[8], 4-[4+ae], 5-[2], 6-[4], 7-[4], 8-[7+ae].

Antenna (Fig. 55B). Coxa small, with row of setules along lateral margin. Allobasis elongate with 3 rows of spinules and 2 spinules on proximal segment, and 1 abexopodal seta. Exopod 3-segmented; proximal segment longest, with 1 pinnate seta; middle segment smallest, without seta; distal segment with row of spinules distally, and with 1 lateral pinnate, 1 slender plumose and 1 apical pinnate setae. Endopod 1-segmented, elongate, as long as allobasis, and with 2 frills on surface; abexopodal margin armed with 2 rows of stout spinules, 2 stout spines, and 1 slender seta; distal margin armed with frills and with 3 geniculate, 1 spinulose, 1 unipinnate and 1 plumose setae, and 1 pinnate spine; spinulose seta on distal margin fused to unipinnate seta basally.

Mandible (Fig. 55C). Coxal gnathobase well-developed; cutting edge armed with 2 tricuspid and 8 unicuspisid teeth, and 1 pinnate seta; inner margin with protrusion. Palp composed of basis, exopod and endopod; basis broad, with set of setules and 3 pinnate setae; endopod 1-segmented, bilobate, inner lobe with 1 apical seta and outer lobe with 2 lateral and 3 apical setae; exopod 2-segmented, proximal and distal segments with 1 and 3 setae, respectively.

Maxillule (Fig. 55D). Praecoxa with 2 rows of spinules on anterior surface; arthrite well-developed, armed with 8 spines, and 1 pinnate and 1 bare setae along distal margin, and 2 parallel setae on anterior surface. Coxal endite with 1 long bare and 1 stout pinnate setae. Basal endite with 2 rows of spinules on anterior surface, 3 setae on lateral margin, and 2 stout pinnate and 2 slender bare setae on distal margin. Both rami 1-segmented; exopod with row of lateral setules and 2 apical plumose setae; endopod with 1 lateral and 2 apical bare setae.

Maxilla (Fig. 55E). Syncoxa large, with 3 rows of spinules along outer margin, 1 row of

spinules on surface proximally and 3 endites; proximal endite with 2 plumose setae, middle one with 1 pinnate and 1 spinulose setae, and distal one with 2 slender pinnate and 1 stout spinulose setae. Allobasis drawn out into strong claw armed with 2 rows of spinules, and having 2 slender naked and 1 stout spinulose setae. Exopod absent. Endopod 2-segmented; proximal segment with bare seta; distal segment smaller than preceding one, with 6 setae.

Maxilliped (Fig. 55F). Coxa with row of spinules along inner margin, and bearing 3 spinulose and 1 bare setae at distal corner. Basis elongate, with row of long spinules on surface, row of spinules and 2 setae along palmar margin. Endopod with stout claw armed with row of spinules, and 3 accessory setae.

P1 (Fig. 56A). Intercoxal sclerite small, trapezoidal, and without ornamentation. Praecoxa small, with row of delicate spinules on distal margin. Coxa ornamented with 6 rows of spinules on anterior and posterior surfaces. Basis smaller than preceding one, with outer and inner pinnate spines, each furnished with few spinules at base, and 2 rows of spinules on distal margin. Exopod 3-segmented; outer margin of each segment ornamented with spinules; exp-1 with pinnate outer spine; exp-2 with pinnate outer spine and row of inner setules; exp-3 with 2 pinnate spines, 2 geniculate setae and 1 setule. Endopod 3-segmented; enp-1 elongate, slightly exceeding end of exopod, and armed with rows of spinules along outer margin, and armed with row of setules along margin, and with pinnate seta on inner margin distally; enp-2 smallest, with few outer spinules and small inner seta; enp-3 slightly longer than preceding one, with few outer spinules, 1 pinnate apical spine, and 1 geniculate apical and 1 small inner setae.

P2–P4 (Figs. 56B, 57A, B). Intercoxal sclerite larger than that of P1, distal margin with 2 pointed process; P2 with 2 rows of spinules on anterior surface distally. Praecoxa (omitted in figure of P2) small and with row of small spinules on distal margin. Coxa large, with 3 rows of spinules and 1 tube pore on anterior margin, and 1 row of spinules on posterior margins. Basis with outer pinnate spine (P2) or seta (P3 and P4), and with 3-4 spinules on anterior surface and distal margin. Both rami 3-segmented; exopod longer than endopod; each segment armed with spinules along outer margin; proximal two segments armed with hyaline frills on distal margin; exp-1 without inner seta; exp-3 of P2 without inner seta; exp-1 and exp-2 with pinnate outer spine and row of inner setules; exp-2 of P2 and P3 with several spinules on surface, respectively; each ramus with tube pore on second or third segment.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.0.022	1.1.120
P2	0.1.023	1.1.121
P3	0.1.123	1.1.221
P4	0.1.223	1.1.121

P5 (Fig. 54D). Baseoendopod with peduncle bearing bare outer seta; endopodal lobe reaching to 3/5 of exopod, with 5 pinnate setae, and few spinules on outer margin; second innermost seta serrate. Exopod separated from baseoendopod, length to width ratio 1.4:1, with few spinules on inner and outer margins, 2 tube pores on anterior surface, and 5 setae, innermost one pinnate, medial one slender (Kim et al., 2015).

**Male.** Sexual dimorphism represented in body size, urosome, antennule, P1, P2, P5, and P6. Body (Fig. 58A) similar to female, but smaller and slender than female, total length 710  $\mu\text{m}$  (range from 601.4 to 710.0  $\mu\text{m}$ , mean = 644.7  $\mu\text{m}$ , n = 5). Urosome (Fig. 58B) composed of 6 somites; urosomites 2 and 3 completely separated; urosomites 3 and 4 with row of spinules on ventral surface, respectively (Kim et al., 2015).

Antennule (Fig. 58C) 9-segmented, haplocer; segment 4 longest and stout; inner margin of segment 6 concave; segment 7 with 2 spines on inner margin; segment 8 shortest; segments 5 and 9 with aesthetasc fused with setae basally, respectively. Setal formula as follows: 1-[1], 2-[11], 3-[8], 4-[6], 5-[5+ae], 6-[2], 7-[1], 8-[4], 9-[7+ae] (cited from Kim et al., 2015).

P1 (Fig. 59A). Basis with curved inner spine and stout process. Enp-1 shorter and stouter than that of female.

P2 (Fig. 59B). Endopod modified, 2-segmented; second segment stout spine-like structure, with 2 pinnate setae and 1 stout spine; spine on second segment slightly exceeding end of endopod and bearing bifid tip.

P5 (Fig. 58D). Baseoendopodal lobe with row of delicate spinules on surface, and with 2 rows of stout spinules and 2 modified stout setae on distal margin. Exopod with tube pore on surface and 2 stout naked, 1 long naked, 1 stout pinnate and 1 stout modified setae on distal margin.

P6 (Fig. 58B). Each leg represented by small plate bearing 1 long and 1 short naked setae,

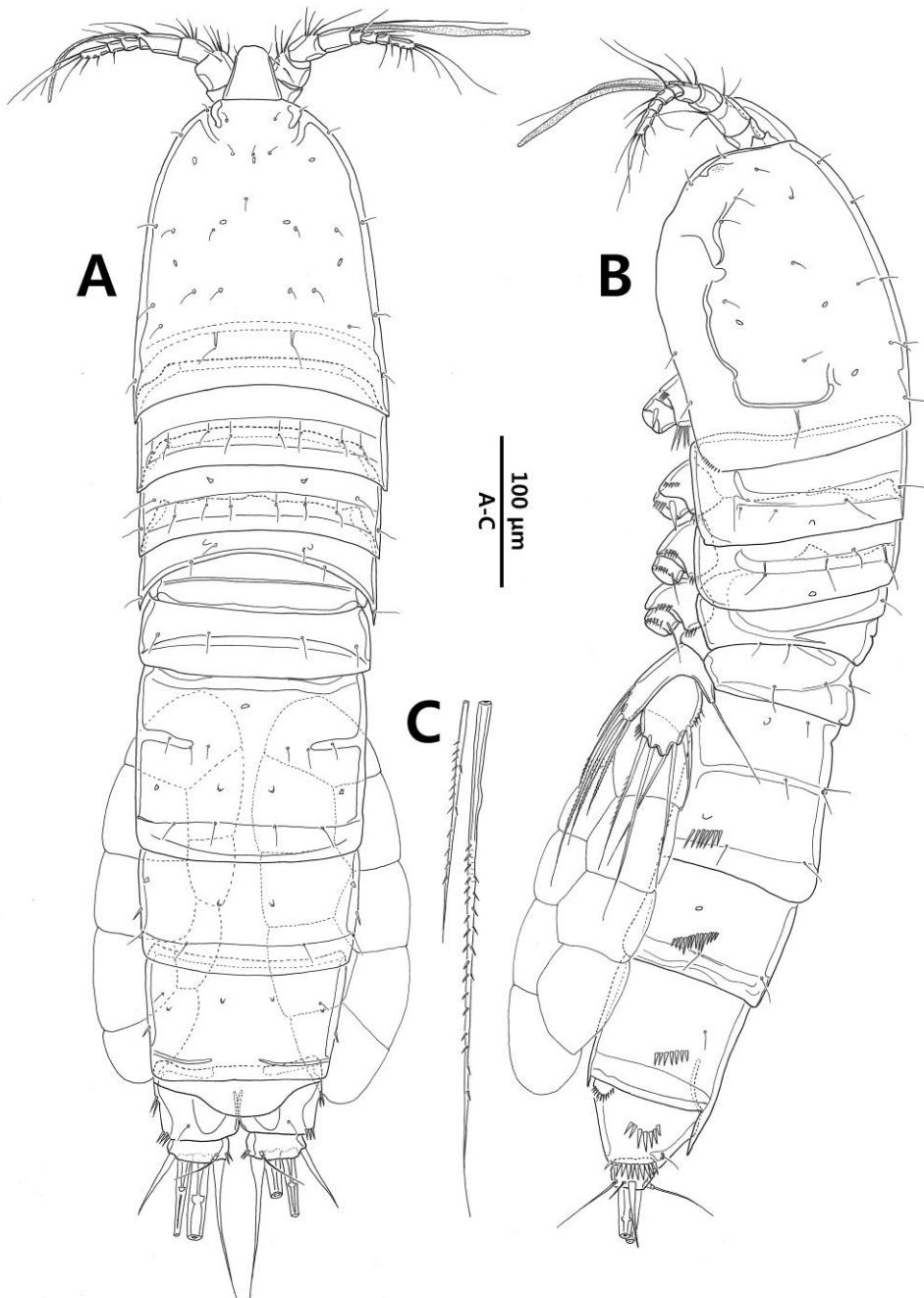
and 1 unipinnate seta (cited from Kim et al., 2015).

**Distribution:** Korea, England, German Bight, Beaufort Sea, and USA.

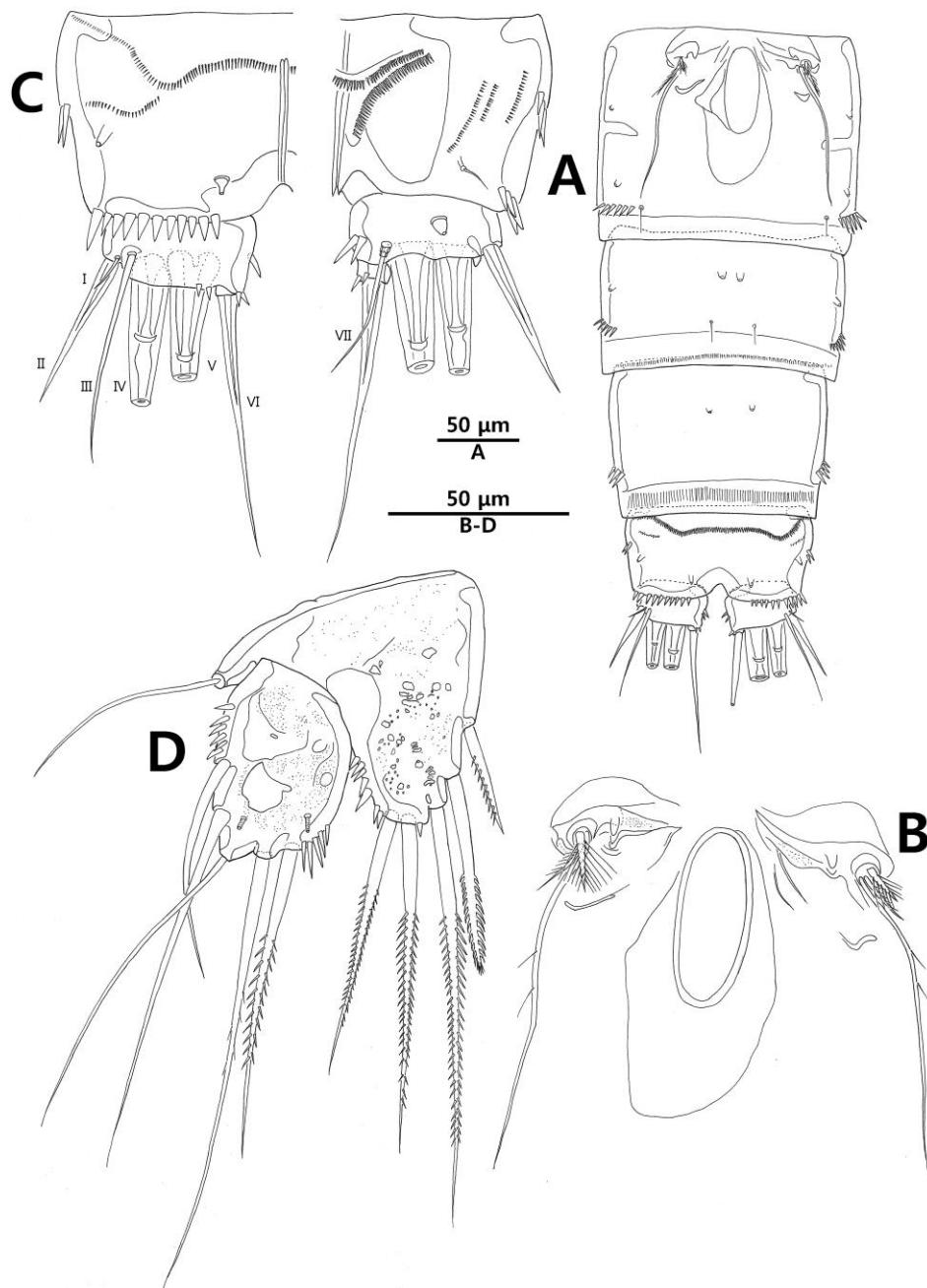
**Remarks.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974 has been reported from worldwide region including U.S.A. (Massachusetts), Beaufort Sea, England (Norfolk), and German Bight, showing an association with macro algae (*Laminaria* sp.) (Coull 1977; Dahms 1987; Rosenfield & Coull 1974). In the preset study, however, the materials of this species were collected from a sublittoral seagrass (*Zostera* sp.) bed composed of sand, without clear relationship of an association with the plant life.

The female of *P. fulvofasciata* is similar to *P. vararensis* (Scott, 1903), *P. mediterranea* Lang, 1948, *P. pacifica* Vervoort, 1962, and *P. bodini* Marcotte, 1974, but they can be easily distinguished by the structure of male P2 endopod (Marcotte 1974). Among them, *P. fulvofasciata* is mostly closed with *P. pacifica* in that the first endopodal segment of male P2 without distal spine, but they represent a certain difference each other in the second endopodal segment of male P2; the former has one spine and two pinnate setae, whereas the latter has tuberculate surface, a spine and a bare seta (Chullasorn 2010; Marcotte 1974; Vervoort 1962). This structure of male P2 in *P. fulvofasciata* is also very similar to that in *P. ferrarii* Chullasorn, 2010, but they are easily separated by the segmentation of antennary exopod (2-segmented in *P. ferrarii*).

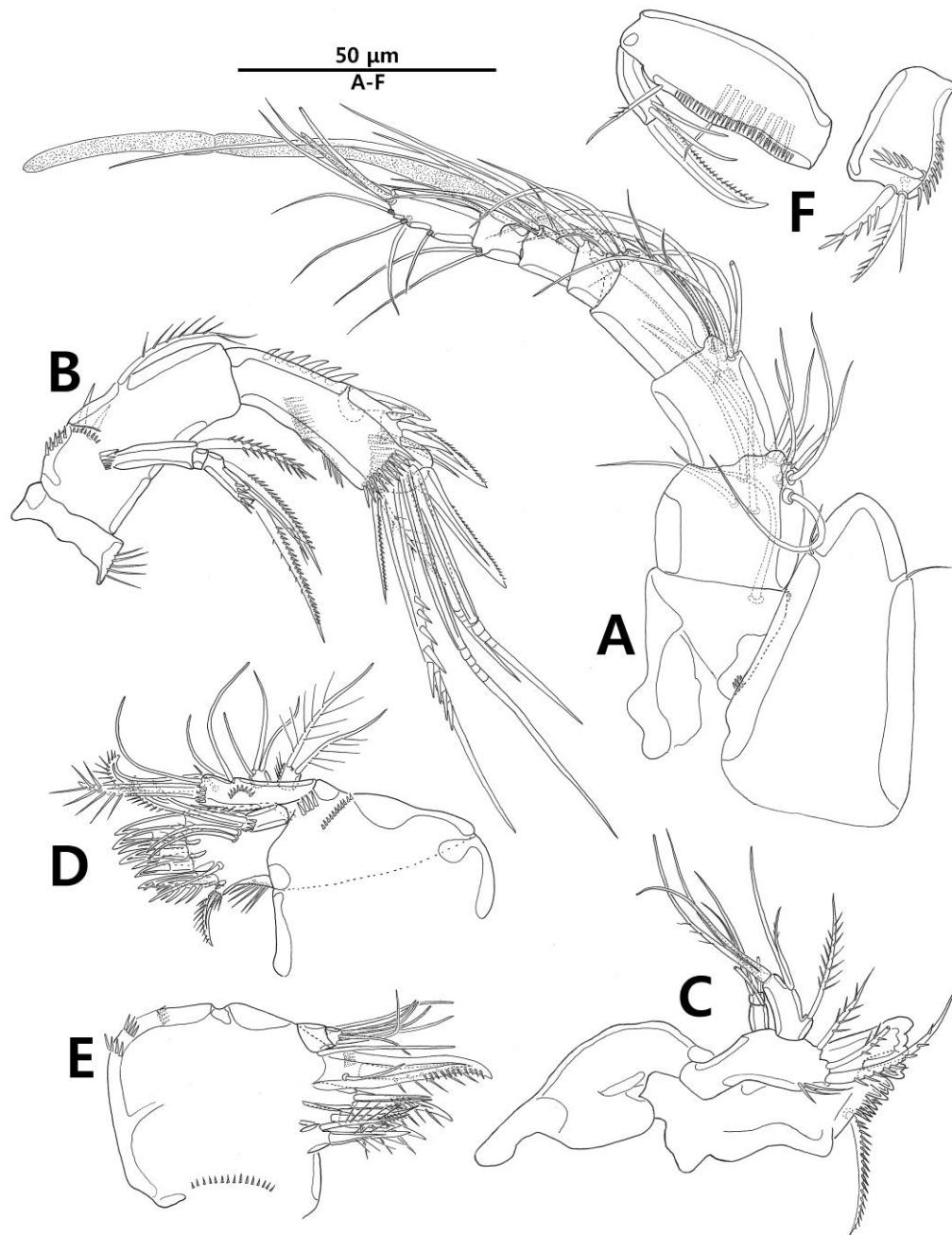
*Paramphiascella fulvofasciata* from Korean waters coincides well with the original description of Rosenfield & Coull (1974) from Massachusetts, U.S.A. As Dahms (1987) reported that the morphological differences in antennule and mouth parts are existed between the regional populations in this species, however, Korean specimens showed some minor differences from the original description in the structures of mouth parts as follows: the mandibular cutting edge is ornamented with eight unicuspids teeth instead of six; the praecoxal arthrite of maxillule has eight spines and one slender seta, whereas U.S.A specimens has only four spines (seta is absent in the original description); the basal endite of maxillule has seven elements instead of five; the proximal endite on the maxillary syncoxa has two setae instead of one; and the basis of maxilla has an accessory seta, whereas it is absent in the original description. These differences are more or less differentiated from those of the previous report with the materials collected from German Bight by Dahms (1987) (Kim et al., 2015).



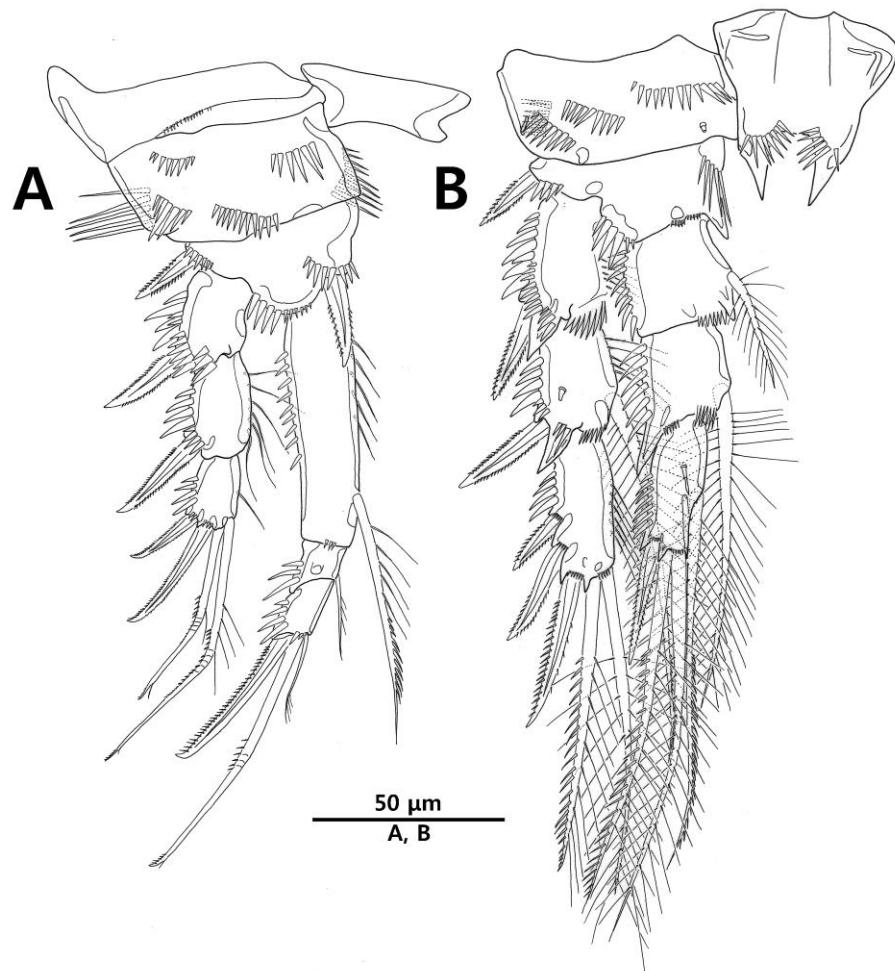
**Fig. 53.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, female. A, habitus, dorsal; B, habitus, lateral; C, caudal setae IV and V (cited from Kim et al., 2015).



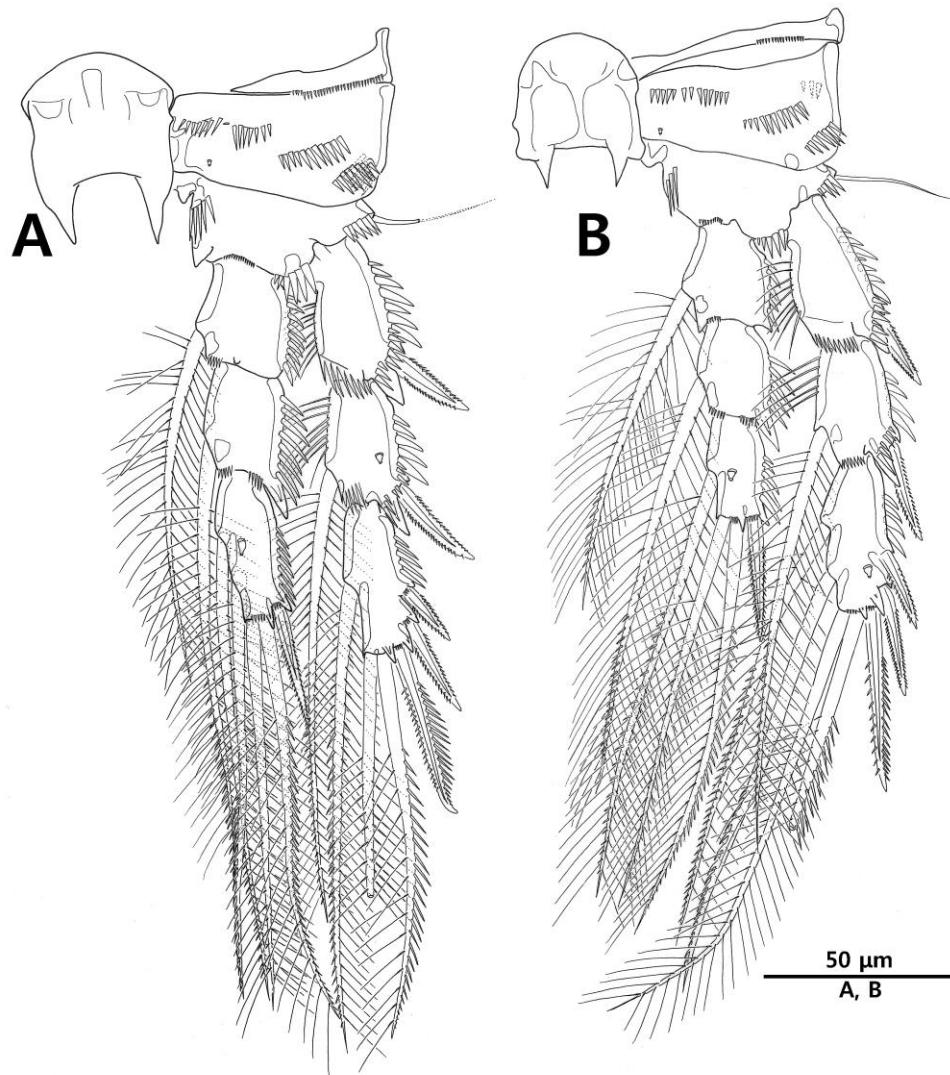
**Fig. 54.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, female. A, urosome, ventral; B, genital field; C, anal somite and caudal rami, dorsal (light), ventral (left); D, P5 (cited from Kim et al., 2015).



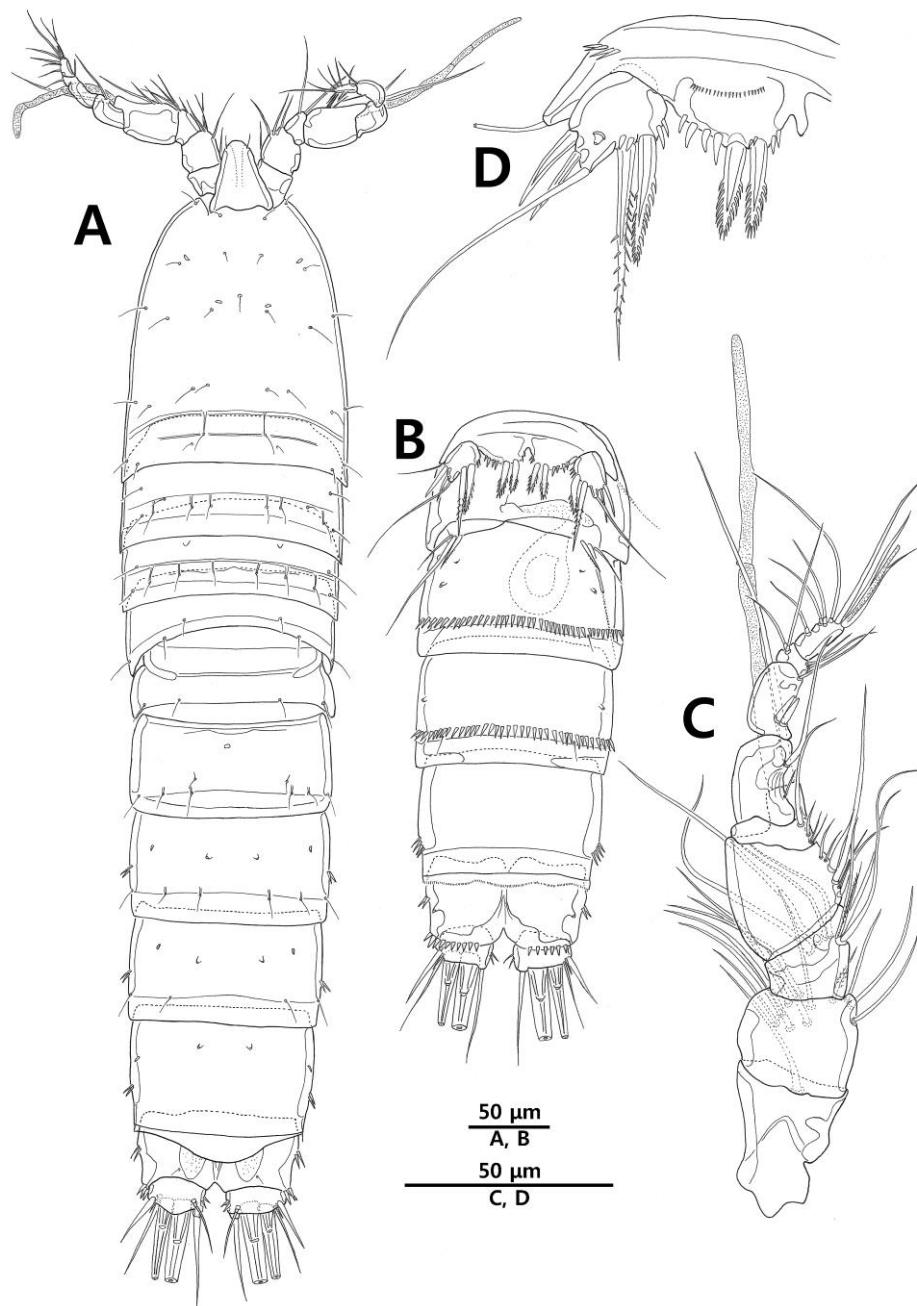
**Fig. 55.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, female. A, rostrum and antennule; B, antenna; C, mandible; D, maxillule; E, maxilla; F, maxilliped (cited from Kim et al., 2015).



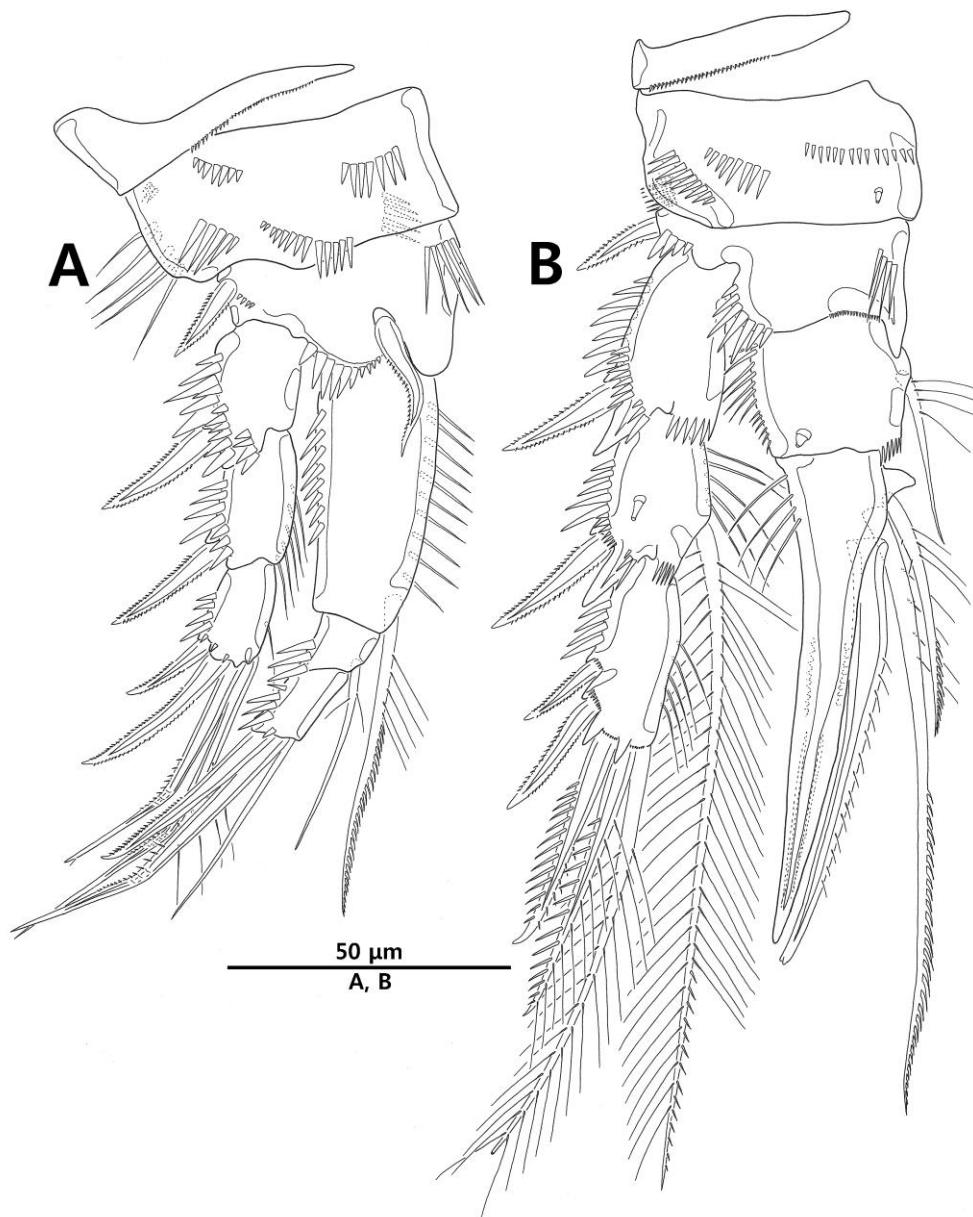
**Fig. 56.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, female. A, P1; B, P2 (cited from Kim et al., 2015).



**Fig. 57.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, female. A, P3; B, P4 (cited from Kim et al., 2015).



**Fig. 58.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, male. A, habitus, dorsal; urosome, ventral; C, antennule; D, P5 (cited from Kim et al., 2015).



**Fig. 59.** *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, male. A, P1; B, P2 (cited from Kim et al., 2015).

**Genus *Sinamphiascus* Mu & Gee, 2000 신쌍낭장수노벌레 속**

모식종: *Sinamphiascus dominatus* Mu & Gee, 2000

**32. *Sinamphiascus dominatus* Mu & Gee, 2000 우점신쌍낭장수노벌레**

*Sinamphiascus dominatus* Mu & Gee, 2000, p. 119, figs. 15–21; Nam & Lee, 2012, p. 46, figs. 1–8; Lee et al., 2012, p. 126, figs. 84–91.

관찰재료: 1♀, 경남 통영시 한산면, 장사도(수심 7m, 사질), 2014.3.23.

분포: 한국, 중국.

고찰: Mu & Gee (2005)는 우점신쌍낭장수노벌레(*Sinamphiascus dominatus*)을 보고하면서 신쌍낭장수노벌레 속(*Sinamphiascus*)을 새로이 만들었다. 흉지의 강모식에서 이 속의 범주는 둥근쌍낭장수노벌레 속(*Bulbamphiascus*)과 정확히 일치하지만, 제1족각, 제2족각, 제1흉지, 그리고 제1–2 흉지들의 성적이형 등을 고려할 때 신쌍낭장수노벌레 속은 *Haloschizopera* 와 가장 가깝다(Mu & Gee 2005).

**Subfamily Steneliinae Brady, 1880****Genus *Wellstenelia* Karanovic & Kim, 2014**

모식종: *Wellsetenelia calliope* Karanovic & Kim, 2014

**한국산 *Wellstenelia* 속의 종에 대한 검색표**

1. 암컷의 제5흉지 내지엽에 3개의 강모를 가진다..... *W. euterpe*
- 암컷의 제5흉지 내지엽에 4개의 강모를 가진다..... 2
  2. 미차의 길이는 최대 너비의 3.5배 이상이다..... 3
    - 미차의 길이는 최대 너비의 2.0배 정도이다..... 4

3. 미차의 길이는 최대 너비의 3.5 배 정도이다; 암컷의 제 5 흉지 내지엽에 존재하는 안쪽 두 번째 강모는 길다 ..... *W. calliope*
- 미차의 길이는 최대 너비의 4.3 배 정도이다; 암컷의 제 5 흉지 내지엽에 존재하는 안쪽 두 번째 강모는 짧다 ..... *W. qingdaoensis*
4. 제 2 촉각의 외지 첫 번째 마디는 말단에서 부풀었다; 암컷의 제 5 흉지 내지엽에 존재하는 안쪽 첫 번째 강모는 짧다 ..... *W. erato*
- 제 2 촉각의 외지 첫 번째 마디는 말단에서 부풀지 않았다; 암컷의 제 5 흉지 내지엽에 존재하는 안쪽 첫 번째 강모는 길다 ..... *W. clio*

### 33. *Wellstenhelia clio* Karanovic & Kim, 2014

*Wellstenhelia clio* Karanovic & Kim, 2014, p. 24, figs. 12–17.

**관찰재료:** 3♀♀, 전남 순천 여자만, 수심 10m(니질; 34°42'2.02"N, 127° 32'4.78"E), 2015.5.11.

**분포:** 한국.

**고찰:** *Wellstenhelia* 속의 5 종이(*W. calliope* Karanovic & Kim, 2014, *W. clio* Karanovic & Kim, 2014, *W. erato* Karanovic & Kim, 2014, *W. qingdaoensis* (Ma & Li, 2011), *W. euterpe* Karanovic & Kim, 2014) 우리나라에 보고되어 있다. *Wellstenhelia clio* 는 위의 종들과 미차의 길이, 암컷 제 5 흉지의 기내지에 존재하는 강모의 길이에서 서로 차이를 나타낸다(Karanovic & Kim 2014).

### 34. *Wellstenhelia erato* Karanovic & Kim, 2014

*Wellstenhelia erato* Karanovic & Kim, 2014, p. 31, figs. 18–23.

**관찰재료:** 5♀♀, 인천 강화군 삼산면 매음리, 석모도, 내건너방조제(갯벌), 2012.7.4.; 2♀♀, 인천 앞바다 조하대(37°24'N, 126°31'E; 수심 약 15m), 2012.6.22; 1♀, 1♂, 전남 진도군 고군면 내산리, 2013.4.9.

**분포:** 한국.

**고찰:** 이 종은 암컷 제 5 흉지의 기내지에 존재하는 강모 중 가장 안쪽 강모가 매우 짧아 근연종들과 쉽게 구분될 수 있다(Karanovic & Kim 2014). 한편, 이 종은 조하대의 니질 저질에서 출현하는 것으로 보고되어 있지만(Karanovic & Kim 2014), 본 연구에서는 조간대의 갯벌에서도 서식하고 있는 것을 확인하였다.

### 35. *Wellstenhelia qingdaoensis* (Ma & Li, 2011)

*Delavalia qingdaoensis* Ma & Li, 2011, p. 1087, figs. 1–8.

*Wellstenhelia qingdaoensis*: Karanovic & Kim, 2014, p. 38, figs. 24–29.

**관찰재료:** 11♀♀, 전남 순천 여자만( $34^{\circ}42'2.02''N$ ,  $127^{\circ}32'4.78''E$ ; 수심 10m, 니질), 2015.5.11.

**분포:** 한국, 중국.

**고찰:** 본 연구에서 확인된 개체들은 Karanovic & Kim (2014)의 재기재문의 문헌과 잘 일치하였으나, Ma & Li (2011)의 원기재문과는 제 5 흉지 외지의 형태에서 조금 차이를 나타냈다.

### Genus *Itostenhelia* Karanovic & Kim, 2014

**모식종:** *Itostenhelia polyhymnia* Karanovic & Kim, 2014

### 36. *Itostenhelia polyhymnia* Karanovic & Kim, 2014

*Itostenhelia polyhymnia* Karanovic & Kim, 2014, p. 54, figs. 34–42.

**관찰재료:** 2♀♀, 경기 옹진군 영흥면 외리, 용담리해수욕장(사질, 니질), 2012.7.17; 1♀, 전남 진도군 고군면 내산리, 2013.4.9; 1♀, 전남 무안군 해제면 송석리, 함평만(니질), 2013.6.10; 10♀♀, 2♂♂, 전남 강진군 도암면 신기리, 2016.5.6.

**분포:** 한국.

**고찰:** 이 종에는 몸의 크기에 따라 두 가지 형이 알려져 있다: *Itostenhelia polyhymnia* Karanovic & Kim, 2014 와 *I. polyhymnia* Karanovic & Kim, 2014 L-form. 후자의 몸길이는 511  $\mu\text{m}$  로 전자(450–428  $\mu\text{m}$ )보다 체형이 더 크다. 이러한 차이에도 불구하고, Karanovic & Kim (2014)은 두 형의 mtCOI 유전자를 분석한 결과, 염기서열이 서로 일치하여 같은 종으로 판단하였다. 본 연구에서는 이 종의 L-form 은 확인하지 못하였다.

#### Genus *Willenstenhelia* Karanovic & Kim, 2014

모식종: *Willenstenhelia thalia* Karanovic & Kim, 2014

##### 37. *Willenstenhelia thalia* Karanovic & Kim, 2014

*Willenstenhelia thalia* Karanovic & Kim, 2014, p. 74, figs. 48–54.

**관찰재료:** 10♀♀, 전남 해남군 화산면 평호리, 다박포선착장(니질), 2015.5.1; 3♀♀, 전남 순천 여자만( $34^{\circ}42'2.02''\text{N}$ ,  $127^{\circ}32'4.78''\text{E}$ ; 수심 10m; 니질), 2015.5.11; 3♀♀, 전남 강진군 도암면 신기리(갯벌), 2016.5.16.

**분포:** 한국.

**고찰:** 이 종은 Karanovic & Kim (2014)에 의하여 우리나라의 조하대에서만 기록되었지만, 본 연구에서는 조간대의 니질 갯벌에서도 서식하고 있는 것을 확인하였다.

**Family Thalestridae Sars, 1905 장군여왕노벌레 과****한국산 장군여왕노벌레 과(Thalestridae)의 속에 대한 검색표**

1. 체형은 등배로 납작하다..... 아메노여왕노벌레 속 *Amenophia*  
- 체형은 등배로 납작하지 않다 ..... 2
2. 제 1 흉지 내지는 2 마디로 이루어져 있다 ..... 3  
- 제 1 흉지 내지는 3 마디로 이루어져 있다 ..... 5
3. 제 5 흉지는 잎사귀 모양이다..... 진손가락여왕노벌레 속 *Eudactylopus*  
- 제 5 흉지는 잎사귀 모양이 아니다 ..... 4
4. 제 4 흉지 내지가 완전히 퇴화되어 있다 .....  
..... 가나무속살이노벌레 속 *Pseudonsiella*  
- 제 4 흉지 내지는 2 마디로 이루어져 있다 .....썩은나무살이 속 *Xylora*
5. 생식이중절은 등면에서 완전히 융합되어 있다.....  
..... 편장군여왕노벌레 속 *Phyllothalestris*  
- 생식이중절은 등면에서 분리되어 있다. 부장군여왕노벌레 속 *Parathalestris*

**Subfamily Thalestrinae Sars, 1905****Genus *Amenophia* Boeck, 1865 아메노여왕노벌레 속**

모식종: *Amenophia peltata* Boeck, 1865

**38. *Amenophia orientalis* Ho & Hong, 1988**

*Amenophia orientalis* Ho & Hong, 1988, p. 1624, figs. 2–5; Lee et al., 2012, p. 214, figs. 149–151.

**관찰재료:** 1♀, 전남 완도군 금일면 월송리, 금일도, 소량대교(해조류), 2015.3.19;  
5♀♀, 울산시 동구 방어동, 방어진항, (light trap), 2015.5.17; 3♀♀, 경북 포항시 남구

구룡포읍 삼정리(해조류), 2015.5.19; 2♀♀, 경북 울릉군 울릉읍 독도리, 독도(해조류, 수심 5m), 2016.6.23.

**분포:** 한국.

**고찰:** 이 종은 전남 완도군 소안도에서 최초로 기록되었는데, 미역 양식장에 피해를 주는 것으로 알려져 있다(Ho & Hong 1988). 본 연구 결과, 우리나라의 남해안과 동해안 일대의 해조류에서 서식하는 종으로 판단된다.

#### Genus *Parathalestris* Brady & Robertson, 1873 부장군여왕노벌레 속

**모식종:** *Parathalestris clausii* (Norman, 1869)

한국산 부장군여왕노벌레 속(*Parathalestris*)의 종에 대한 검색표(Chang & Song 1997)

1. 미차의 길이는 너비의 1.0 배 이하이다..... 2  
- 미차의 길이는 너비의 1.5 배 이상이다..... 6
2. 제 2 촉각 외지는 6 개의 강모를 가진다; 제 2 소악 전저합절의 몸쪽 첫 번째 내돌기는 2 개의 강모를 가진다..... 3  
- 제 2 촉각 외지는 5 개의 강모를 가진다; 제 2 소악 전저합절의 몸쪽 첫 번째 내돌기는 1 개의 강모를 가진다..... 5
3. 수컷 제 5 흉지의 내지엽은 잘 발달된 3 개의 가시를 가진다 .....  
..... *P. pacificus*  
- 수컷 제 5 흉지의 내지엽은 2 개의 작은 가지와 1 개의 잘 발달된 가시를 가진다 ..... 4
4. 미차의 길이는 너비 정도이다; 암컷 제 5 흉지의 외지에 존재하는 가장 안쪽 강모는 인접한 강모와 가깝게 배치되어 있다.....

- ..... 털부장군여왕노벌레 *P. parviseta*
- 미차의 길이는 너비보다 짧다; 암컷 제 5 흉지의 외지에 존재하는 가장 안쪽 강모는 인접한 강모와 멀리 떨어져 배치되어 있다 ..... *P. jejuensis*
  - 5. 두흉절의 등쪽 뒷 가장자리에 둥근 엽을 가지고 있다; 암컷 꼬리강모 III 는 부풀었다; 수컷 제 5 흉지 내지엽은 외지의 중간 부분까지 미친다 ..... 감염부장군여왕노벌레 *P. infestus*
  - 두흉절의 등쪽 뒷 가장자리에 둥근 엽을 가지지 않는다; 암컷 꼬리강모 III 는 둥글 납작하다; 수컷 제 5 흉지 내지엽은 외지의 중간 부분까지 미치지 못한다 ..... *P. bulbiseta*
  - 6. 몸의 표면에 망상구조를 가지지 않으며, 복절들의 등쪽 뒤쪽 가장자리는 매끈하다; 암컷의 미차는 부풀어 있는 강모를 가지지 않는다 ..... 흙부장군여왕노벌레 *P. verrucosa*
  - 몸의 표면에 망상구조를 가지며, 복절들의 등쪽 뒤쪽 가장자리는 톱니모양이다; 암컷의 미차는 부풀어 있는 강모를 가진다 ..... 고리부장군여왕노벌레 *P. areolata*

### 39. *Parathalestris bulbiseta* Lang, 1965

*Parathalestris bulbiseta* Lang, 1965, p. 171, figs. 92–95; Chang & Song, 1997a, p. 226, fig. 3A–E.

**관찰재료:** 3♀♀, 나사해수욕장, 울산 을주군 서생면 나사리(해조류), 2012.5.17; 5♀♀, 울산시 동구 방어동(light trap), 2015.5.17; 2♀♀, 3♂♂, 솔개해수욕장, 울산시 을주군 서생면 진하리(해조류), 2012.5.18; 10♀♀, 전남 완도군 금일면, 연지리, 금일도(잘피밭), 2012.5.21; 1♂, 전남 진도군 의신면 금갑리, 금갑해수욕장(해조류), 2015.5.2; 7♀♀, 경북 포항시 호미곶면 강사리(해조류), 2015.5.19; 1♀, 충남 보령시 오천면 장고리, 장고도(light trap), 2015.5.23; 2♀♀, 용두해수욕장, 충남 보령시 남포면 월전리, 2015.5.23.

**분포:** 한국, 미국(California).

**고찰:** 이 종의 꼬리강모 III 은 기저부에서 부풀어 있어 해부현미경 하에서도 쉽게 동정할 수 있다.

#### 40. *Parathalestris verrucosa* Itô, 1970 촉부장군여왕노벌레

*Parathalestris verrucosa* Itô, 1970, p. 211, figs. 1–4; Chang & Song, 1997a, p. 226, fig. 3F–J; Lee et al., 2012, p. 246, figs. 173–174.

**관찰재료:** 15♀♀, 3♂, 전남 완도군 보길면 예송리(light trap), 2015.4.15; 1♀, 전남 여수시 남면 금오도, 2015.5.13; 4♀♀, 1♂, 일산해수욕장, 울산시 동구 일산동(light trap), 2015.5.17.

**분포:** 한국, 일본.

**고찰:** 이 종은 Itô (1970)에 의하여 일본에서 기록된 후, 우리나라에서 두 번째로 보고되었다. 그러나 일본산 시료와 우리나라의 시료들은 제 2 촉각 외지의 마디수에서 차이를 보인다. 일본산 시료는 이 속의 다른 종들과 같이 2 마디로 이루어져 있지만, 한국산 시료는 융합되어 1 마디로 구성되어 있다(Itô 1970; Chang & Song 1997a; Lee et al. 2012). 이러한 차이점은 칼고리노벌레의 분류에서 속을 구분할 수 형질로 여겨지는 경우도 있으므로, 한국산 촉부장군여왕노벌레(*Parathalestris verrucosa*)에 대한 분류학적 재검토가 필요하다.

#### 41. *Parathalestris areolata* Itô, 1972 고리부장군여왕노벌레

*Parathalestris areolata* Itô, 1972, p.305, figs. 1–4; Chang & Song, 1997a, p.228, fig. 4C–H; Back & Lee, 2011, p. 86, figs. 1–7; Lee et al., 2012, p. 227, figs. 158–164.

**관찰재료:** 1♀, 명사십리해수욕장, 전남 완도군 신지면 대곡리, 2013.2.25; 2♀♀, 2♂♂, 전남 신안군 비금면 수대리, 서남문대교(light trap), 2015.4.6; 10♀♀, 2♂♂,

전남 완도군 보길면 부황리, 보길도(light trap), 2015.4.14; 3♀♀, 2♂♂, 전남 진도군 진도읍 산월리, 쉬미항(light trap), 2015.5.1.

**분포:** 한국, 일본.

**고찰:** 본 연구에서 관찰한 시료는 일본의 원기재(Itô 1972)와 우리나라의 재기재문들(Chang & Song 1997a; Back & Lee 2011; Lee et al. 2012)과도 잘 일치하였다. 이 종의 몸의 표면은 망상무늬으로 장식되어 있어 근연종들과 쉽게 구분할 수 있다.

#### **42. *Parathalestris parviseta* Chang & Song, 1997 틀부장군여왕노벌레**

*Parathalestris parviseta* Chang & Song, 1997a, p. 222, figs. 1–2; Lee et al., 2012, p. 242, figs. 171–172.

**관찰재료:** 4♀♀, 소매물도, 경상남도 통영시 한산면 매죽리(해조류), 2014.5.19.

**분포:** 한국.

**고찰:** 이 종은 미차의 길이와 암컷 제 5 흉지의 강모 형질상태에 의해 근연종들과 구분될 수 있다. 본 연구에서 관찰한 시료는 원기재문(Chang & Song, 1997a)과 잘 일치하였다.

#### **43. *Parathalestris jejuensis* Song & Hwang, 2010**

*Parathalestris jejuensis* Song & Hwang, 2010, p. 1338, figs. 1–6.

**관찰재료:** 1♀, 울산시 을주군 서생면 진하리, 솔개해수욕장(해조류), 2012.5.18; 2♀♀, 제주 서귀포시 대포동, 대포항(light trap), 2015.5.22; 2♀♀, 1♂, 제주 제주시 구좌읍 김녕리, 김녕해수욕장, 2014.06.23.

분포: 한국.

**고찰:** 우리나라에 보고된 부장군여왕노벌레 속(*Parathalestris*)의 종들 중 이 종은 털부장군여왕노벌레(*P. parviseta*)와 가장 유사하지만, 미차의 길이, 제2흉지 내지 첫번째 마디에 존재하는 강모의 길이, 수컷 제2흉지 내지 두번째 마디에 존재하는 강모의 길이, 암컷 제5흉지의 외지에 존재하는 강모의 배치, 수컷 제1족각의 형태, 수컷 제5흉지 기내지에 존재하는 강모의 길이, 수컷 제5흉지 외지의 길이에서 서로 차이를 보인다(Song & Hwang 2010).

#### Genus *Phyllothalestris* Sars, 1905 편장군여왕노벌레 속

모식종: *Phyllothalestris myysis* (Claus, 1863)

##### 44. *Phyllothalestris sarsi* Sewell, 1940 사스편장군여왕노벌레

*Phyllothalestris sarsi* Sewell, 1940, p. 180, figs. 21–23; Nicholls, 1941, p. 411; Wells & Rao, 1987, p. 40; Song et al., 2001, p. 230, figs. 1–4; Lee et al., 2012, p. 249, figs. 175–176.

**관찰재료:** 1♀, 제주 제주시 구좌읍 김녕리, 김녕해수욕장, 2014.06.23; 1♀, 방어진항, 울산시 동구 방어동(light trap), 2015.5.17; 1♀, 경북 포항시 남구 구룡포읍 삼정리(해조류), 2015.5.19; 1♀, 강원 고성군 현내면, 2016.7.20; 1♀, 강원 삼척시 원덕읍 노곡리, 2016.7.21.

**고찰:** 이 종은 진손가락여왕노벌레 속(*Eudactylops*)의 종들과 부장군여왕노벌레 속(*Parathalestris*)의 종들과 함께 해조류와 관련된 서식지에서 출현한다. 그러나 사스편장군여왕노벌레(*Phyllothalestris sarsi*)의 서식밀도는 다른 속의 종들에 비하여 매우 낮았다.

**Subfamily Eudactylopusinae Willen, 2000****Genus *Eudactylops* A. Scott, 1909 진손가락여왕노벌레 속**

모식종: *Eudactylops andrewi* Sewell, 1940

**한국산 진손가락여왕노벌레 속(*Eudactylops*)의 종에 대한 검색표**

1. 암컷의 제 1 촉각은 7 마디이다; 암컷의 제 5 흉지 외지는 넓고 사각형에  
    가깝다 ..... 앤드류진손가락여왕노벌레 *E. andrewi*
- 암컷의 제 1 촉각은 9 마디이다; 암컷의 제 5 흉지 외지는 난형이다.....  
        ..... 수진손가락여왕노벌레 *E. spectabilis*

**45. *Eudactylops spectabilis* (Brian, 1923) 수진손가락여왕노벌레**

*Parathalestris clausi* var. *spectabilis* Brian, 1923, p. 129, 133, pl. 4. (cited from Lang 1948).

*Eudactylops latipes* f. *typica*: Noodt, 1955, p. 58, figs. 6–12.

*Eudactylops spectabilis*: Monard, 1928, p. 356, fig. 21: 2; Lang, 1948, p. 561, fig. 228;  
Vervoort, 1964, p. 163; Apostolov & Marinov, 1988, p. 132; Chang & Song, 1995, p.  
380, figs. 1, 2; Lee et al., 2012, p. 224, figs. 156–157.

**관찰재료:** 5♀♀, 부산시 기장군 일광면 학리, 일광해수욕장(해조류), 2012.5.18;  
8♀♀, 5♂♂, 울산시 을주군 서생면 진하리, 솔개해수욕장(해조류), 2012.5.18; 1♀,  
삼척시 근덕면 궁촌리, 궁촌항, 2014.9.16; 2♀♀, 경북 포항시 북구 청하면 방어리,  
2014.9.17; 1♀, 경남 통영시 산양읍 연곡리 연대도, 2014.10.18; 1♂, 전남 여수시  
남면 우학리, 금오도(해조류), 2015.5.13; 5♀♀, 울산시 동구 일산동,  
일산해수욕장(light trap), 2015.5.17; 2♀♀, 대포항, 제주 서귀포시 대포동(light trap),  
2015.5.22.

**분포:** 한국, 마르마라해, 지중해.

**고찰:** 이 종은 같은 속의 앤드류진손가락여왕노벌레(*Eudactylopus andrewi*)와 함께 출현하지만, 제 5 흉지의 형태에 의해서 쉽게 구분할 수 있다.

#### 46. *Eudactylopus andrewi* Sewell, 1940 앤드류진손가락여왕노벌레

*Eudactylopus latipes* f. *andrewi* Sewell, 1940, p. 201, figs. 31–33.

*Eudactylopus andrewi*: Vervoort, 1964, p. 154, figs. 56–59.

*Eudactylopus andrewi*: Itô, 1974, p. 580, figs. 16–27; Chang & Song, 1995, p. 385, fig. 3; Lee et al., 2012, p. 219, figs. 152–155.

**관찰재료:** 3♀♀, 전남 신안군 흑산면 가거도리, 가거도(해조류), 수심 5m, 2013.7.30; 3♀♀, 제주 제주시 애월읍 곽지리, 곽지해수욕장(해조류), 2014.6.26; 2♀♀, 부산시 기장군 일광면 학리, 일광해수욕장(해조류), 2015.7.28; 2♀♀, 제주 서귀포시 대포동, 대포항(light trap), 2015.5.22.

**분포:** 한국, 일본, 스리랑카, 말레이 군도, 말디브 군도, 캐롤라인 군도.

**고찰:** 이 종은 우리나라의 해조류와 연관된 서식지에서 흔히 출현하는 대형 종이다.

#### Superfamily Ameiroidea Boeck, 1865

##### Family Ameiridae Boeck, 1873 맵시장수노벌레 과

한국산 맵시장수노벌레 과(Ameiridae)의 속에 대한 검색표(Lang 1965)

1. 제 1 흉지의 외지 두 번째 마디는 내측강모를 가지지 않는다 ..... 2
  - 제 1 흉지의 외지 두 번째 마디는 내측강모를 가진다.....  
..... 수려장수노벌레 속 *Nitokra*
2. 제 1 흉지의 내지 첫 번째 마디는 외지보다 훨씬 짧다; 제 3 흉지 내지 세 번째 마디는 6 개의 강모/가시를 갖는다 ..... *Proameira*

- 위의 형질들이 결합되어 나타나지 않는다..... 3
- 3. 제 1 촉각은 우상강모를 가지지 않는다; 제 2 촉각의 기절과 내지의 첫 번째 마디는 융합되어 기절내지합부를 형성하지 않는다.....  
..... 맵시장수노벌레 속 *Ameira*
- 제 1 촉각은 우상강모를 가진다; 제 2 촉각은 기절내지합부를 가진다..... *Pseudameira*

### Genus *Ameira* Boeck, 1865 맵시장수노벌레 속

모식종: *Ameira longipes* Boeck, 1865

한국산 맵시장수노벌레 속(*Ameira*)의 종에 대한 검색표(Karanovic & Cho 2012)

- 1. 항절의 안쪽 중앙 모서리는 뒤쪽을 향하여 돌출되어 있으며, 매우 경화되어 있다 ..... *A. kimchi*
- 항절의 안쪽 중앙 모서리는 뒤쪽을 향하여 돌출되어 있지 않으며, 조금 경화되어 있다 ..... 2
- 2. 미차의 안쪽 가장자리는 매끈하다; 수컷 제 5 흉지의 외지에 존재하는 안쪽 첫 번째 강모는 작다 ..... *A. zahaae*
- 미차의 안쪽 가장자리에 잔가시열을 가진다; 수컷의 제 5 흉지의 외지에 존재하는 안쪽 첫 번째 강모는 잘 발달되어 있다 .....  
..... 맵시장수노벌레 *A. parvula*

#### 47. *Ameira parvula* (Claus, 1866) *sensu* Chang, 2007 맵시장수노벌레

*Ameira parvula*: Chang, 2007, p. 250, fig. 4; Chang, 2009b, p.202, pls. 8B, 24A, fig. 83;  
Chang, 2010, p. 71, fig. 30.

관찰재료: 1♀, 전라남도 신안군 압해읍 신용리, 압해도, 2012.4.6; 1♀, 전남 완도군 신지면 대평리(갯벌), 2012.7.19; 1♀, 전북 부안군 진서면 곰소리, 곰소항, 2014.8.14;

1♀, 강원 속초시 대포동, 외옹치항, 2014.9.14; 2♀♀, 경상남도 거제시 남부면  
갈곶리, 2014.10.21; 1♀, 충남 서천군 서면 도둔리, 춘장대해수욕장, 2016.08.17.

**분포:** 한국.

**고찰:** *Ameira parvula* (Claus, 1866)는 범세계적으로 기록이 되어 있으며, 우리나라에서는 Chang (2007)에 의하여 기수역에서 보고되었다. 그러나 맵시장수노벌레가 각 지역의 개체군마다 미세한 형태적 차이를 보이고 있으며, 최근 갈고리노벌레의 분류에서는 종의 형태적 및 분자적 형질을 모두 반영한다는 점을 고려하여, Karanovic & Cho (2012)은 이 종을 species-complex로 여기고 한국산 맵시장수노벌레를 새로운 종으로 보았다. 그러나 Chang (2007)의 도판 및 기재문에 구기부와 후복부의 형질이 기록되어 있지 않았기 때문에 그들은 이 종을 신종으로 기록하지는 않았다. 한편, 그들은 서해와 남해에서 각각 *A. zahaae* Karanovic & Cho, 2012 와 *A. kimchi* Karanovic & Cho, 2012 를 신종으로 보고하였으나, 본 연구에서는 확인되지 않았다.

### Genus *Nitokra* Boeck, 1865 수려장수노벌레 속

**모식종:** *Nitokra typica* Boeck, 1865

한국산 수려장수노벌레 속(*Nitokra*)의 종에 대한 검색표(Karanovic & Cho 2012)

1. 제 4 흉지 외지 세 번째 마디는 8 개의 강모/가시를 가진다 .....  
..... 유사수려장수노벌레 *N. affinis californica*
- 제 4 흉지 외지 세 번째 마디는 7 개의 강모/가시를 가진다 ..... 2
2. 제 2 흉지 내지 세 번째 마디는 3 개의 강모/가시를 가진다 .....  
..... 예쁜이장수노벌레 *N. lacustris*
- 제 2 흉지 내지 세 번째 마디는 4 개의 강모/가시를 가진다 ..... 3

3. 제 1 흉지 내지 첫 번째 마디의 길이는 외지 첫 번째와 두 번째 마디를 합한 정도이다..... 가시수려장수노벌레 *N. spinipes*
- 제 1 흉지 내지 첫 번째 마디의 길이는 외지 첫 번째와 두 번째 마디를 합한 것보다 짧다 ..... 4
4. 암컷 제 5 흉지 외지의 길이는 너비의 2 배 이하이다; 후체부 체절의 뒤쪽 가장자리는 옆면에만 잔가시열을 갖는다 .....
- ..... 등근수려장수노벌레 *N. pietschmanni*
- 암컷 제 5 흉지 외지의 길이는 너비의 2 배 이상이다; 후체부 체절의 뒤쪽 가장자리는 등면과 옆면에 잔가시열을 갖는다 .....
- ..... 수려장수노벌레 *N. koreanus*

#### 48. *Nitokra spinipes* Boeck, 1865 가시수려장수노벌레

*Nitocra spinipes* Boeck, 1865, p. 274 (cited from Lang 1948); Lang, 1948, p. 810, fig. 325; Borutzky, 1952, p. 126, fig. 47:1–14; Tanaka & Hue, 1966, p. 71, fig. 7; Wells & Rao, 1987, p. 127.

*Nitocra spinipes armata* Lang, 1965, p. 352, figs. 192–195.

*Nitokra spinipes*: Chang & Yoon, 2008, p. 115, figs. 2–3; Chang, 2009b, p. 206, pl. 8C, figs. 85–86; Chang, 2010, p. 75, figs. 31–32.

**관찰재료:** 2♀♀, 인천 강화군 내가면 황청리(갯벌), 2012.7.5; 2♀♀, 강원 양양군 강현면 주청리, 낙산해수욕장(해조류), 2014.9.14; 2♀♀, 1♂, 강원 동해시 북호동, 대진항, 2014.9.16; 4♀♀, 전남 진도군 지산면 가학리, 세방낙조(암반, 사질), 2015.5.2; 1♀, 전남 고흥군 금산면 신평리, 거금도, 2015.7.14.

**분포:** 범세계적.

**고찰:** 이 종은 우리나라의 기수역에서 출현하는 종으로 보고되어 있지만, 본 연구에서는 해수역의 서식지에서도 채집되었다. 이 점으로 보아 이 종은 광염성 종으로 추측된다.

#### 49. *Nitokra affinis californica* Lang, 1965 유사수려장수노벌레

*Nitocra affinis f. californica* Lang, 1965, p. 357, figs. 196–198; Kunz, 1975, p. 188, figs. 74, 75; Apostolov & Marinov, 1988, p. 234, figs. 92–93.

*Nitokra affinis californica*: Chang & Yoon, 2008, p. 121, figs. 5; Chang, 2009b, p. 213, fig. 89; Chang, 2010, p. 81, fig. 35.

**관찰재료:** 1♀, 경남 거제시 사등면 사곡리, 사곡해수욕장(해조류), 2013.7.2; 1♀, 제주시 애월읍 꽈지리, 꽈지해수욕장, 2014.6.26; 1♀, 제주시 우도면 서광리, 서빈백사, 2014.6.24.

**분포:** 한국, 남아프리카, 불가리아, 미국.

**고찰:** 이종의 제 1 흉지와 제 5 흉지는 가시수려장수노벌레(*Nitokra spinipes*)와 유사하지만, 제 4 흉지 외지 세 번째 마디의 강시/강모의 수에 따라 쉽게 구별할 수 있다. 유사수려장수노벌레(*Nitokra affinis californica*)는 이 마디에 8 개의 가시/강모를 가지고 있으나, 우리나라에 기록된 이 속의 다른 종들은 모두 7 개의 가시/강모만을 가진다.

#### 50. *Nitokra koreanus* Chang, 2007 수려장수노벌레

*Nitokra koreanus* Chang, 2007, p. 247, figs. 2–3; Chang & Yoon, 2008, p. 125; Chang, 2009b, p. 218, figs. 92–93; Chang, 2010, p. 86, figs. 38–40.

**관찰재료:** 1♀, 전라남도 해남군 송지면 산정리(갯벌), 2015.5.1.

**분포:** 한국.

**고찰:** 이 종은 담수의 영향이 크게 미치는 기수역의 서식지에서 흔하게 출현하며, 겨울철 서식밀도가 증가하는 것으로 알려져 있다(Chang 2009b, 2010).

**Family Canthocamptidae Brady, 1880 딱정장수노벌레 과**

**Subfamily Canthocamptinae Brady, 1880 딱정장수노벌레 아과**

**Genus *Mesochra* Boeck, 1865 큰뿔장수노벌레 속**

**모식종:** *Mesochra lilljeborgii* Boeck, 1865

한국산 큰뿔장수노벌레 속(*Mesochra*)의 종에 대한 검색표(Chang 2010)

1. 제 1 흉지 내지의 첫 번째 마디는 외지의 길이보다 길다; 암컷 제 5 흉지의 외지는 기내지와 분리되어 있어있다..... 2
  - 제 1 흉지 내지의 첫 번째 마디는 외지의 길이보다 현저히 짧다; 암컷 제 5 흉지의 외지는 기내지와 융합되어 있다 ..... 3
2. 제 2–4 흉지의 외지 세 번째 마디는 바깥 가장자리에 2 개의 가시를 가진다; 제 1 흉지 내지는 2 개의 마디로 이루어져있다 ..... 큰뿔장수노벌레 *M. suifunensis*
  - 제 2–4 흉지의 외지 세 번째 마디는 바깥 가장자리에 3 개의 가시를 가진다; 제 1 흉지 내지는 3 개의 마디로 이루어져있다 ..... 알라스카큰뿔장수노벌레 *M. alaskana*
3. 제 2–3 흉지 내지의 세 번째 마디에 4 개의 강모/가시를 가진다 ..... 앞치마큰뿔장수노벌레 *M. hinumaensis*
  - 제 2–3 흉지 내지의 세 번째 마디에 3 개의 강모/가시를 가진다 ..... 두강모큰뿔장수노벌레 *M. bisetosa*

**51. *Mesochra suifunensis* Borutzky, 1952 sensu Lee & Chang, 2003** 큰뿔장수노벌레

*Mesochra suifunensis*: Lee & Chang, 2003, p. 206, fig. 2; Chang, 2009b, p. 234, fig. 100; Chang, 2010, p. 100, Fig. 44.

[non] *Mesochra suifunensis* Borutzky, 1952, p. 148, figs. 52, 53; Tai & Song, 1979, p. 207, fig. 109.

**관찰재료:** 1♀, 인천시 강화군 내가면 황정리(갯벌), 2012.7.5; 2♀♀, 전남 광양시 진월면 신아리, 섬진강교(기수역), 2015.6.3.

**분포:** 중국, 한국.

**고찰.** *Mesochra suifunensis* 는 러시아, 중국, 그리고 한국에서 보고되었다(Borutzky 1952; Tai & Song 1979; Lee & Chang 2003). 그러나, 중국과 한국의 개체들은 Borutzky (1952)의 원기재문과 제 1 내지 두 번째 마디와 제 2-3 흉지 내지 첫 번째 마디의 강모/가시의 수에서 각각 차이를 보이고 있다(Lee & Chang 2003). 이와 같은 차이는 최근 칼고리노벌레류의 분류에서 속, 또는 종을 구분하는 중요한 형질로 여겨지고 있으므로 중국과 한국의 개체들은 러시아개체와 다른 종으로 판단된다. 또한 한국산 시료는 Tai & Song (1979)의 기재문과 제 3 흉지 외지 세 번째 마디의 내측강모의 길이에서 뚜렷한 차이를 보였다.

우리나라에서는 순수 담수역인 대청호의 수심 45 m 의 저질에서 보고되었는데(Lee & Chang 2003), 본 연구에서는 갯벌과 기수역에서 이 종이 출현하는 것을 확인하였다.

**52. *Mesochra hinumaensis* Kikuchi, 1972 앞치마큰뿔장수노벌레**

*Mesochra hinumaensis* Kikuchi, 1972, p. 173, figs. 3-4 (cited from Chang, 2010); Chang, 2009b, p. 236, figs. 101-102; Chang, 2010, p. 102, figs. 45-46.

**관찰재료:** 1♀, 경남 사천시 사천읍 구호리, 중선포천 하구역(기수역), 2016.04.26.

**분포:** 일본, 한국.

**고찰:** 이 종은 제 1 흉지의 형질에서 두강모큰뿔장수노벌레(*M. bisetosa*)와 가장 유사하지만, 제 2–3 흉지 내지의 마지막 마디에 존재하는 강모의 수에서 서로 차이를 보인다(Chang 2009b, 2010).

#### Family Lourinidae Monard, 1927 매끈장수노벌레 과

#### Genus *Lourinia* Wilson, 1924 매끈장수노벌레 속

##### 53. *Lourinia armata* (Claus, 1866) 병정매끈장수노벌레

*Jurinia armata* Claus, 1866, p. 25, pl. 2, figs. 15–24.

*Ceyloniella armata*: Sewell, 1940, p. 124.

*Ceyloniella armata* f. *major* Sewell, 1940, p. 329, figs. 77–78.

*Ceyloniella armata* f. *minor* Sewell, 1940, p. 331, fig. 79.

*Lourinia armata*: Lang, 1948, p. 1215, fig. 490; Vervoort, 1964, p. 304, figs. 120, 121b, c, 122–124; Yoo & Lee, 1993, p. 116, figs. 1–2; Lee et al., 2012, p. 82, figs. 53–54.

**관찰재료:** 3♀♀, 강원도 양양군 현북면 하광정리, 하조대해수욕장(사질), 2014.9.15; 3♀♀, 경북 영덕군 축산면 경정리, 2014.9.17; 1♀, 전남 진도군 의신면 금갑리, 금갑해수욕장(해조류), 2015.5.2; 1♂, 전북 군산시 비응도동(암반, 해조류), 2016.8.17; 1♀, 1♂, 충남 보령시 응천읍 관당리, 무창포해수욕장, 2016.08.17

**분포:** 한국, 말디브 군도, 인도양, 대서양, 태평양, 호주.

**고찰:** 이 종은 전세계의 여러 지역에서 보고 되었으나, 각 지역의 개체들은 몸길이, 제 5 흉지의 강모와 꼬리강모의 형태, 흉지의 강모식에서 서로 차이를 보이고 있다(Vervoort 1964). Yoo & Lee (1993)는 우리나라에 이 종을 보고하면서,

우리나라 시료들의 꼬리강모 III 가 이전의 기록들(예, Vervoort 1964)과 달리 둥글 납작한 형태를 가진다고 보고하였다.

### Superfamily Cletodoidea T. Scott, 1905

#### Family Cletodidae T. Scott, 1905 뿔장수노벌레 과

한국산 뿔장수노벌레 과(Cletodidae)의 속에 대한 검색표(Boxshall & Halsey 2004)

1. 제 5 흉지의 내지엽은 손가락모양이며 경화되어있다 · *Paracrenhydrosoma*
  - 제 5 흉지의 내지엽은 손가락모양이 아니며, 일반적은 모양이다..... 2
2. 제 1 흉지의 내지 첫 번째 마디에 내측강모를 가진다; 암컷의 제 1 촉각은 4 마디로 이루어져 있다..... 기수뿔장수노벌레 속 *Limnocletodes*
  - 제 1 흉지의 내지 첫 번째 마디에 내측강모를 가지지 않는다; 암컷의 제 1 촉각은 4 혹은 5 마디로 이루어져 있다 ..... 3
3. 제 4 흉지 내지는 1 마디로 이루어져 있다.....
  - .....꼬마뿔장수노벌레 속 *Kollerua*
  - 제 4 흉지 내지는 2 마디로 이루어져 있다..... 3
3. 제 2 촉각 외지는 매우 작고 1 개의 강모를 가진다; 수컷의 제 3 흉지의 내지는 3 마디로 이루어져 있다 ..... *Strongylacron*
  - 제 2 촉각 외지는 잘 발달되어 있으며 2 개의 강모를 가진다; 수컷의 제 3 흉지의 내지는 2 마디로 이루어져 있다..... 4
4. 암컷의 제 5 흉지 외지는 길며, 강모들은 가늘다.....
  - .....날씬뿔장수노벌레 속 *Enhydrosoma*
  - 암컷의 제 5 흉지 외지는 짧고, 강모들은 잘 발달되어 가시와 유사하다.
    - .....*Geehydrosoma*

**Genus *Enhydrosoma* Boeck, 1873 날씬뿔장수노벌레 속****모식종:** *Enhydrosoma curticauda* Boeck, 1873**한국산 날씬뿔장수노벌레 속(*Enhydrosoma*)의 종에 대한 검색표**

1. 제 1 흉지 외지의 세 번째 마디는 5 개의 강모/가시를 가진다 .....  
..... *E. kosmetron*
  - 제 1 흉지 외지의 세 번째 마디는 4 개의 강모/가시를 가진다 ..... 2
2. 제 1 흉지 내지의 두 번째 마디는 3 개의 강모/가시를 가진다 .....  
..... 잘린꼬리뿔노벌레 *E. curticauda*
  - 제 1 흉지 내지의 두 번째 마디는 2 개의 강모/가시를 가진다 ..... 3
3. 제 5 흉지의 내지엽은 암수모두 외지보다 짧다; 암컷 미차의 길이는 그 폭의 3 배 정도이다 ..... *E. apimeon*
  - 제 5 흉지의 내지엽은 암수모두 외지보다 길다; 암컷 미차의 길이는 그 폭의 2 배 이하이다 ..... 4
4. 암컷 제 5 흉지 내지엽의 안쪽 가장자리에 가시모양의 돌기를 가진다;  
미차의 길이는 항문절의 길이보다 길다 ..... *E. robustum*
  - 암컷 제 5 흉지 내지엽의 안쪽 가장자리에 가시모양의 돌기를 가지지  
않는다; 미차의 길이는 항문절의 길이보다 짧다 ..... *E. coreana*

**54. *Enhydrosoma curticauda* Boeck, 1873 잘린꼬리뿔노벌레**

*Enhydrosoma curticauda* Boeck, 1873, p. 54; Lang, 1948, p. 1264, fig. 504: 2; Chislenko, 1967, p. 172, fig. 67; Gee, 1994, p. 84, figs. 1–8, 9A, 11, 12.

*Enhydrosoma curticadudatum*: Sars, 1909a, p. 298, fig. CCV.

[non] *Enhydrosoma curticauda*: Kim, 2013, p. 96.

**관찰재료:** 6♀♀, 인천 앞바다, 조하대( $37^{\circ}24'N$ ,  $126^{\circ}31'E$ ; 수심 약 15m), 2012.6.22; 15♀♀, 전남 순천 여자만, 조하대( $34^{\circ}42'N$ ,  $127^{\circ}32'E$ ; 수심 약 10m), 2015.5.11.

**분포:** 한국, 알제리, 노르웨이, 영국, 스웨덴, 독일, 프랑스, 이탈리아.

**고찰:** 이 종은 본 연구에서 관찰한 한국산 시료는 Gee (1994)의 재기재문과 이마뿔, 제 5 흉지, 미차 등의 중요한 형질들에서 잘 일치하였다. 그러나, 우리나라의 우도의 산호사해수욕장에서 보고된 개체(Kim 2013)와는 현저한 차이를 보였다. Gee (1994)와 Kim (2013)의 재기재문은 다음과 같은 형질상태에서 서로 차이를 나타내고 있다. Gee 의 시료는 암컷의 몸 길이가  $0.52\text{--}0.58\text{ }\mu\text{m}$  의 범위를 나타내지만, Kim의 시료는  $850\text{ }\mu\text{m}$ 로 더 길다. Gee의 시료는 제2-4 흉지의 내지 첫번째 마디에 내측강모를 가지고 있지 않지만, Kim의 시료는 이를 가지고 있다. Gee 의 시료는 제 4 흉지의 외지 두번째 마디에 내측강모를 가지고 있지 않지만, Kim 의 시료는 이를 가지고 있다. 이러한 차이점으로 보아 Kim (2013)의 보고는 오동정으로 판단되며, 우도의 개체군에 대한 분류학적 재검토가 필요하다.

### 55. *Enhydrosoma coreana* Kim, Trebukhova, Lee & Karanovic, 2014

*Enhydrosoma coreana* Kim et al., 2014, p. 251, fig. 1-8.

**관찰재료:** 2♀♀, 전남 순천 여자만, 조하대( $34^{\circ}42'2.02''N$ ,  $127^{\circ}32'4.78''E$ ; 수심 10m, 니질), 2015.5.11.

**분포:** 한국.

**고찰.** Kim et al. (2014)은 날씬뿔장수노벌레 속(*Enhydrosoma*)에서 두 종, 즉 잘린꼬리뿔노벌레(*E. curticauda*) 와 *E. coreana* 가 다른 종들과 구별되는 공유파생형질들을 발견하였으나, 신속을 설정할 경우 *E. curticauda* 가 모식종이기 때문에 다른 모든 종들이 새로운 속으로 옮겨져야 된다는 점과 분자적 형질을

분석하지 않았다는 점을 고려하여 이 속의 모든 종들을 날씬뿔장수노벌레 속으로 유지 하였다.

### 56. *Enhydrosoma robustum* Karanovic, Kim & Lee, 2015

*Enhydrosoma robustum* Karanovic et al., 2015, p. 469, figs. 10–15.

**관찰재료:** 20♀♀, 5♂♂, 전남 순천 여자만, 조하대( $34^{\circ}42'2.02''N$ ,  $127^{\circ}32'4.78''E$ ; 수심 10m, 니질), 2015.5.11.

**분포:** 한국.

**고찰:** 이 종은 날씬뿔장수노벌레 속(*Enhydrosoma*)의 다른 두 종, 즉 *Enhydrosoma apimelon*, *E. kosmetron* 와 함께 최근 Karanovic et al. (2015)에 의하여 우리나라 조하대의 니질 저질에서 보고되었다. *Enhydrosoma robustum*의 모식산지는 서해의 가로림만이지만, 본 연구에서는 남해안에 위치한 여자만에서 이 종이 채집, 확인되었다.

### Genus *Limnocletodes* Borutzky, 1926 기수뿔장수노벌레 속

**모식종:** *Limnocletodes behningi* Borutzky, 1926

한국산 기수뿔장수노벌레 속(*Limnocletodes*)의 종에 대한 검색표(Chang 2010)

1. 암컷 제 5 흉지 기내지의 양쪽 가장자리에 1 개의 강모를 가진다 .....  
..... 작대기뿔장수노벌레 *L. angustodes*
- 암컷 제 5 흉지 기내지의 양쪽 가장자리에 2 개의 강모를 가진다 .....  
..... 기수뿔장수노벌레 *L. behningi*

### 57. *Limnocletodes behningi* Borutzky, 1926 기수뿔장수노벌레

*Limnocletodes behningi* Borutzky, 1926, p. 213, figs. 1–6 (cited from Lang 1948); Lang, 1948, p. 1321; Borutzky, 1952, p. 378, fig. 103: 16–32; Shen & Tai, 1962, p. 399, figs. 33–45; Shen & Sung, 1965, p. 176; Wells, 1971, p. 516, figs. 27–34; Tai & Song, 1979, p. 289, fig. 162; Apostolov & Marinov, 1988, p. 315, fig. 123: 2a–k; Lee & Chang, 2007, p. 256, figs. 2–4; Chang, 2009b, p. 334, figs. 170–172, pl. 11D; Chang, 2010, p. 201, fig. 104–106.

*Limnocletodes secundus* Sewell, 1934, p. 101, fig. 11(cited from Chang 2010); Lang, 1948, p. 1323.

**관찰재료:** 1♀, 충남 태안군 이원면 내리, 가로림만(니질), 2012.6.23; 8♀♀, 인천 강화군 삼산면 매음리, 민머루해수욕장, 2012.7.4; 1♀, 경기도 옹진군 영흥면 잠경리, 영흥도(갯벌), 2012.7.17; 1♀, 전남 진도군 임회면 남동리(갯벌), 2013.4.9; 1♀, 충남 서천군 장항읍 송림리, 송림산림해수욕장(사질, 니질), 2013.8.13; 3♀♀, 2♂♂, 전남 완도군 신지면 대평리, 신지도(갯벌), 2013.9.19; 1♀, 전남 광양시 진월면 신야리, 섬진강교(기수역), 2015.8.18; 11♀, 전남 신안군 지도읍, 지도, 2016.5.22.

**분포:** 한국 중국, 일본, 러시아(카스피해), 인도, 불가리아, 루마니아.

**고찰:** 이 종은 암컷 제 5 흉지의 기내지엽에 2 개의 강모를 가지고 있는 점에서 *Limnocletodes wellsi* Gee, 1998 와 가장 유사하지만, 제 4 흉지의 외지 두 번째 마디에 존재하는 강모의 수에서 서로 차이를 나타낸다(Lee & Chang 2007). 한편, Wells (1971)는 *L. secundus* Sewell, 1934 를 기수뿔장수노벌레의 junior synonym 으로 처리하였으며, 이는 Chang (2010)에 의하여 받아들여졌다. 그러나 Gee (1988)는 전자를 *species inquirenda* 로 제안하였다.

**58. *Limnocletodes angustodes* Shen & Tai, 1963** 작대기뿔장수노벌레

*Limnocletodes angustodes* Shen & Tai, 1963, p. 425, figs. 47–54, figs. 47–54; Tai & Song, 1979, p. 291, fig. 163; Lee & Chang, 2007, p. 260, fig. 5; Chang, 2009b, p. 339, fig. 173; Chang, 2010, p. 206, fig. 107.

**관찰재료:** 1♀, 전남 광양시 진월면 신아리, 섬진강교(기수역), 2015.4.18.

**분포:** 중국, 한국.

**고찰:** 이 종은 Shen & Tai (1963)에 의하여 중국에서 처음으로 기록되었으며, 일본과 한국에서 차례로 보고되었다. Lee & Chang (2007)은 한국산 시료가 원기재문과 제 5 흉지 외지의 장식에서만 차이를 보인다고 하였지만, 제 4 흉지 내지의 마지막 마디에 존재하는 강모의 길이에서도 뚜렷한 차이를 나타내고 있다.

**Genus *Kollerua* Gee, 1994** 꼬마뿔장수노벌레 속

**모식종:** *Kollerua radhakrishnai* (Reddy, 1979)

**59. *Kollerua longum* (Shen & Tai, 1979)** 꼬마뿔장수노벌레

*Enhydrosoma longum* Shen & Tai, 1979, p. 234, fig. 2; Tai & Song, 1979, p. 270, fig. 151.

*Kollerua longum*: Gee, 1994, p. 106; Lee & Chang, 2007, p. 262, figs. 6–8; Chang, 2009, p. 341, pls. 11E, F, 27D, figs. 175–176; Chang, 2010, p. 209, figs. 108–109.

**관찰재료:** 1♀, 경기도 옹진군 영흥면 잠정리, 영흥도(갯벌), 2012.7.17; 1♀, 경기도 옹진군 영흥면 선재리, 측도(니질, 사질), 2012.7.17; 2♀♀, 경기 옹진군 영흥면 외리, 영흥도, 용담리해수욕장(사질, 니질), 2012.7.17; 10♀♀, 전남 진도군 임회면 남동리(갯벌), 2013.4.9; 1♀, 전남 완도군 신지면 대평리(갯벌), 2013.9.16; 5♀♀, 1♂, 전남 해남군 송지면 산정리(갯벌), 2015.5.1; 2♀♀, 1♂, 전남 진도군 의신면

초사리(갯벌), 2015.5.3; 2♀♀, 전남 여수시 화양면 이목리, 2016.5.29; 2♀♀, 전남 신안군 증도면, 증도, 점안선착장, 2016.6.1.

**분포:** 중국, 한국.

**고찰:** 날씬뿔장수노벌레 속(*Enhydrosoma*)의 종들에 대한 재검토를 통하여 Gee (1994)는 제 4 흉지의 내지가 한 마디로 이루어진 5 종을 수용할 수 있는 꼬마뿔장수노벌레 속(*Kollerua*)을 새로이 만들었다. 꼬마뿔장수노벌레(*K. longum*)는 제 2 흉지의 외지, 암컷 제 5 흉지의 형질상태에 따라 근연종들과 서로 구분될 수 있다(Lee & Chang, 2007; Chang, 2010).

### Genus *Strongylacron* Gee & Huys, 1996

**모식종:** *Strongylacron buchholtzi* (Boeck, 1873)

#### 60. *Strongylacron glabrum* Kim, Jung & Yoon, 2016 (Figs. 60–68)

*Strongylacron glabrum* Kim et al., 2016a, p. 1, figs. 2–10.

**Type locality.** Namdong-ri (34°21.666'N, 126°09.449'E), Imhoe-myeon, Jindo-gun, Jeollanam-do, Korea.

**Materials examined.** Holotype ♀ (NIBRIV0000326503) and allotype ♂ (NIBRIV0000326504), both undissected and preserved in 99.9% ethyl alcohol. Paratypes: 2♀♀ (NIBRIV0000326505, NIBRIV0000326506) and 2 ♂♂ (NIBRIV0000326507, NIBRIV0000326508) dissected and mounted on each slide, respectively. All materials were collected from mud flats on type locality on 9 April 2013.

**Additional materials.** 15 ♀♀, Songseok-ri, Haeje-myeon, Muan-gun, Jeollanam-do, Korea on 9 April 2013; 2 ♀♀, Noil-ri, Gwajeok-myeon, Goheung-gun, Jeollanam-do, Korea on 30 Apr. 2013. For the photographs of SEM: 4 ♀♀ and 2 ♂♂, Sinyong-ri, Aphae-myeon, Sinan-gun, Jeollanam-do on 6 April 2012. All materials collected from sediments composed of mud or muddy sand on each locality.

**Description. Female.** Body (Figs. 60A, B, 66A) semi-cylindrical, tapering posteriorly, with inconspicuous boundary between prosome and urosome; total length including tip of rostrum and caudal rami from 889.1 to 923.1  $\mu\text{m}$  (mean 905.3  $\mu\text{m}$ ,  $n = 3$ ) in lateral view. All somites covered with fine setules on surface; posterior border with row of setules except for anal somite. Rostrum (Figs. 61A, 66E) well-developed, fused to cephalothorax basally, slightly recurved dorsally, with pair of subapical sensilla; anterior margin rounded, naked, slightly concave midway; posterior surface with tube pore.

Prosome (Figs. 60A, B, 66B–D) 4-segmented, comprising cephalothorax and 3 free pedigerous somites. Cephalothorax slightly shorter than succeeding somites combined, with 8 rod-like projections. Each posterior border of 3 free somites (Fig. 66C) with 8, 10, 8 rod-like projections bearing sensillum, respectively.

Urosome (Figs. 60A, B, 62A) 5-segmented, comprising P5-bearing somite, genital double-somite, and 3 postgenital somites. P5-bearing somite with 8 rod-like projections bearing sensillum on posterior border dorsally. Genital double-somite, dorsal and lateral surfaces completely divided by suture, but ventral surface (Fig. 62A) partially fused; each posterior border with 6 and 8 rod-like projections bearing sensillum, respectively. Genital field (Fig. 62D) with vestigial P6 represented by seta. Urosomite 4 with 6 rod-like projections bearing sensillum on posterior margin. Urosomite 5 with pair of lateral protrusions covered with setules. Anal somite (Fig. 64D) with semi-circular operculum bearing pair of 2 setae and 1 row of setules on posterior margin; lateral margin of each side with extra tube pore.

Caudal rami (Figs. 64D, 67E, F) cylindrical, tapering posteriorly, as long as anal somite in length, with 2 tube pores and 7 caudal setae: lateral seta I along with seta II inserted in proximal fifth of ramus; seta III half of caudal ramus in length; seta IV small, fused to well-developed seta V at its base; seta V 3.0 times as long as caudal ramus; seta VI shortest, located at inner distal corner; seta VII located in dorsal surface proximally, articulated basally.

Antennule (Figs. 61B, 66F) 5-segmented, short, blunt; surface (Fig. 67A) ornamented with small papillae. Segment 1 short, with 3 rows of setules on surface and row of stout spinules on anterior margin. Segment 2 longest. Segments 3 and 5 with aesthetasc fused to seta at its base, respectively. Segment 4 shortest. Setal formula as follows: 1-[1], 2-[8], 3-[7+ae], 4-[1], 5-[10+ae].

Antenna (Figs. 61C, 67B). Coxa small. Allobasis long, with 2 abexopodal setae; antennary

exopod small, peduncle-like, with long bipinnate seta. Endopod 1-segmented, slightly shorter than allobasis; anterior margin with row of setules, row of subdistal spinules, and 2 spines; distal margin with 5 non-geniculate spines, 1 slender seta, and 1 tube pore; surface with row of spinules distally.

Mandible (Fig. 61D). Coxal gnathobase well-developed, with 3 bicuspid teeth; outer distal corner broad, rounded; surface with group of setules. Palp 1-segmented; basis with 2 short and 1 long plumose setae; exopod and endopod fused to basis, each represented by plumose seta.

Maxillule (Fig. 61E). Praecoxa with patch of setules on surface; arthrite armed with 5 spines on distal margin, 1 pinnate seta on lateral margin and 2 tube setae on anterior surface. Coxal endite with 1 stout bipinnate and 1 slender setae; surface with row of spinules. Basal endite with 6 elements, 1 row of spinules and 1 row of setules. Both rami incorporated into basis, each represented by 1 plumose and 1 naked setae.

Maxilla (Fig. 61F). Syncoxa with 1 row of setules and 1 patch of setules along outer margin, bearing 2 endites: proximal endite with 2 stout pinnate (one fused to endite proximally) and 1 bare setae; distal endite with 1 pinnate and 2 bare setae. Allobasal endite forming claw like, with 3 elements and 1 tube pore. Endopod incorporated into allobasis and represented by 2 setae. Exopod absent.

Maxilliped (Fig. 61G). Syncoxa with 3 rows of setules and 1 long bipinnate seta. Basis elongate, with 2 rows of setules along palmar margin; outer distal margin with row of setules distally. Endopod represented by claw, longer than length of basis, with accessory seta.

P1 (Fig. 62B). Coxa with row of spinules on anterior surface. Basis with 2 rows of spinules on anterior surface, 1 outer seta, and 1 pinnate inner spine. Exopod 3-segmented, slightly longer than endopod; each segment ornamented with rows of outer spinules and inner setules; exp-1 and -2 with outer spine, respectively; exp-3 with 2 outer spines, 2 apical setae, and 1 posterior tube pore. Endopod 2-segmented; each segment ornamented with rows of outer spinules and inner setules; enp-2 1.5 times as long as preceding one, and armed with 1 short inner seta, 1 long apical seta, and 1 outer spine.

P2–P4 (Figs. 62C, 63A, B). Praecoxa with row of spinules on distal margin. Coxa with row of spinules on anterior surface. Basis with 1 or 2 rows of spinules and 1 tube pore on anterior margin, and 1 outer seta. Exopod 3-segmented; each segment ornamented with rows of outer

spinules and inner setules; exp-1 and -2 without inner seta; exp-3 with tube pore on anterior margin. Endopod 2-segmented; endopod of P4 very short and slightly exceeding end of P4 exp-1.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	I-0, I-0, II,2,0	0-0, I,1,1
P2	I-0, I-0, II,2,0	0-0, 0,2,0
P3	I-0, I-0, II,2,1	0-0, I,2,0
P4	I-0, I-0, II,2,1	0-0, I,1,1

P5 (Figs. 63C, 67C, D) distinctly U-shaped, covered with fine setules. Baseoendopod with anterior tube pore and peduncle bearing outer seta; endopodal lobe reaching to 2/3 of exopod, with 3 pinnate setae, 2 tube pores, and 1 row of spinules. Exopod indistinctly separated from baseoendopod, 3.5 times as long as width, with 1 anterior tube pore and 3 pinnate setae; innermost seta shorter than exopod.

**Male.** Body (Figs. 64A, 68A, B) 700.0–934.1 µm (mean 799.8, n = 3) in length, measured from anterior margin of rostrum to end of caudal rami.

Urosomites 2 and 3 (Figs. 64B, 68A) not fused. P6 (Fig. 64B) asymmetrical, and with 2 rows of setules on posterior margin and plate on one side of body. Urosomite 3, ventral surface asymmetrical ventrally, with 1 row of setules and 1 row of delicate setules.

Caudal rami (Figs. 64A, B, 68C–E) longer than female, 1.9 times longer than anal somite in length.

Antennule (Figs. 65A, 68F) 6-segmented, subchirocer. Segment 1 with 3 rows of spinules on surface. Segment 4 swollen; proximal corner with 1 row of spinules and 2 spines; small peduncle on inner surface with aesthetasc and seta. Segment 5 shortest with protrusions at distal corner. Each aesthetasc on segments 4 and 6 fused to seta at its base. Setal formula as follows: 1-[1], 2-[8], 3-[10], 4-[12+ae], 5-[0], 6-[9+ae].

P3 (Fig. 65B). Endopod 3-segmented, modified; enp-2 with recurved apophysis at inner distal edge; enp-3 small, with 2 plumose apical setae. Exp-3 with tube pore on anterior surface.

P5 (Fig. 64C). Baseoendopod and exopod confluent. Endopodal lobe very small, with 2 setae, 2 tube pores, and 1 row of spinules; inner seta half of outer one in length. Exopod with 1 tube pore and 3 setae, innermost seta approximately 1/3 of outermost seta in length (Kim et

al. 2016a).

**Distribution.** The south-western coasts of South Korea.

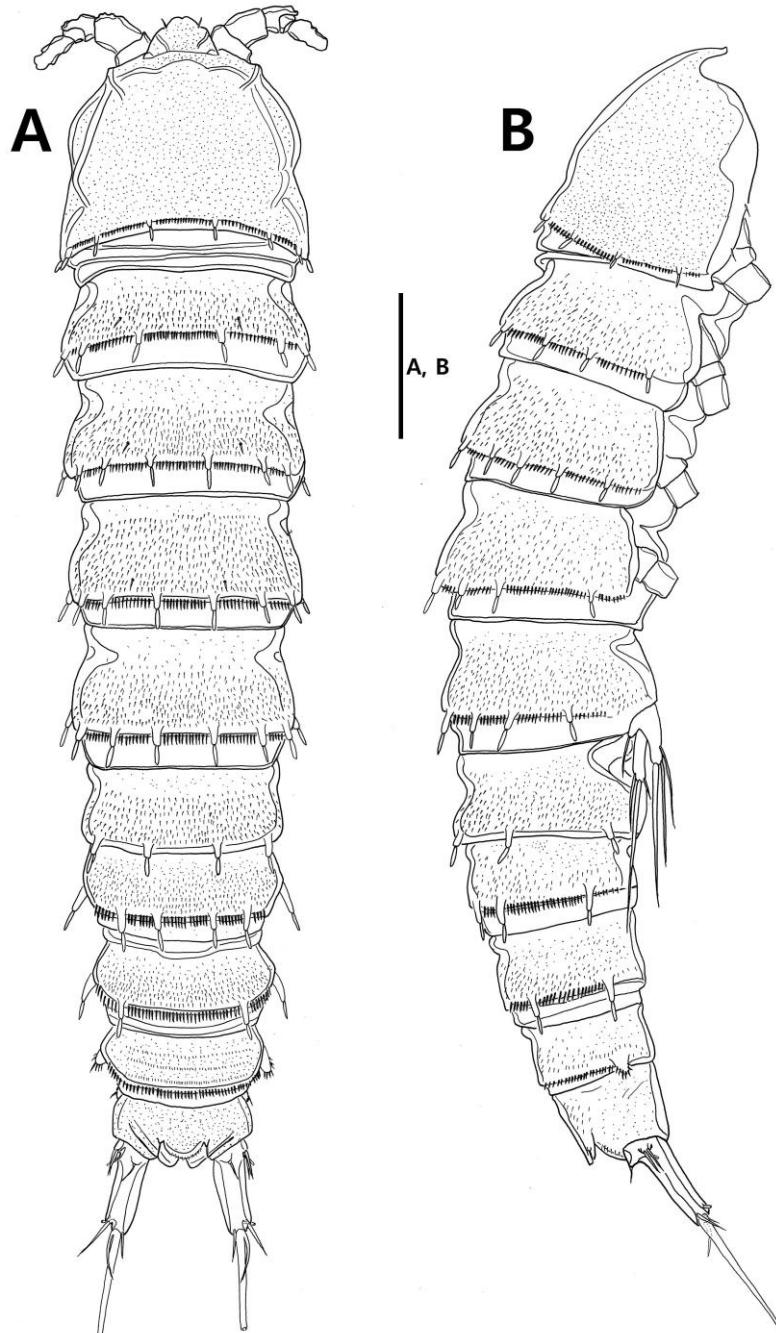
**Remarks.** Gee & Huys (1996) redefined the taxonomic status of four *Enhydrosoma* species, *E. buchholzii* (Boeck, 1873), *E. barnishi* Wells, 1967, *E. bifurcarostratus* Shen & Tai, 1965, and *E. vervoorti* Fiers, 1987, belonging to the *buchholzii*-species group (see Gee 1994), and they established two genera, *Schizacron* Gee & Huys, 1996 and *Strongylacron* Gee & Huys, 1996. These genera share a distinctive U-shaped female P5, which is known as a unique structure of the family Cletodidae T. Scott, 1904, but they are typically divided in terms of the structure of rostrum (Gee & Huys 1996). *Schizacron* is characterized by having a recurved dorsally and markedly bifid anterior rostral margin, while *Strongylacron*'s rostrum is non-recurved and has a broadly rounded anterior margin (Gee & Huys 1996). Additionally, they recognized the presence of a row of fine setules on the anterior rostral margin as a significant generic characteristic of *Strongylacron*. The genus *Strongylacron* was erected based on only one species, *St. buchholzii*, with a restricted distribution in the north Atlantic Ocean (northwestern Europe and Canada) (Boeck 1873; Sars 1909a; Willey 1929; Wells 1963; Gee & Huys 1996).

In the genus *Strongylacron*, the presence of fine setules on the anterior margin of rostrum seems to be not a generic characteristic but a specific feature to distinguish species. In related genera such as *Cletodes* Brady, 1972, *Enhydrosoma* Boeck, 1873, and *Schizacron* Gee & Huys, 1996, the rostrum of most species are usually naked except for *Cletodes macrura* Fiers, 1991 and *Schizacron barnishi* (Wells, 1967) (Wells 1967; Fiers 1991; Gee 1994; Gee & Huys 1996). There is additional differences on the position of the tube pore on the caudal rami between *St. glabrum* Kim, Jung & Yoon, 2016 and the generic diagnosis given by Gee & Huys (1996). The tube pore on outer margin is located proximally in *St. glabrum*, while it is inserted medially in the generic diagnosis (Gee & Huys 1996).

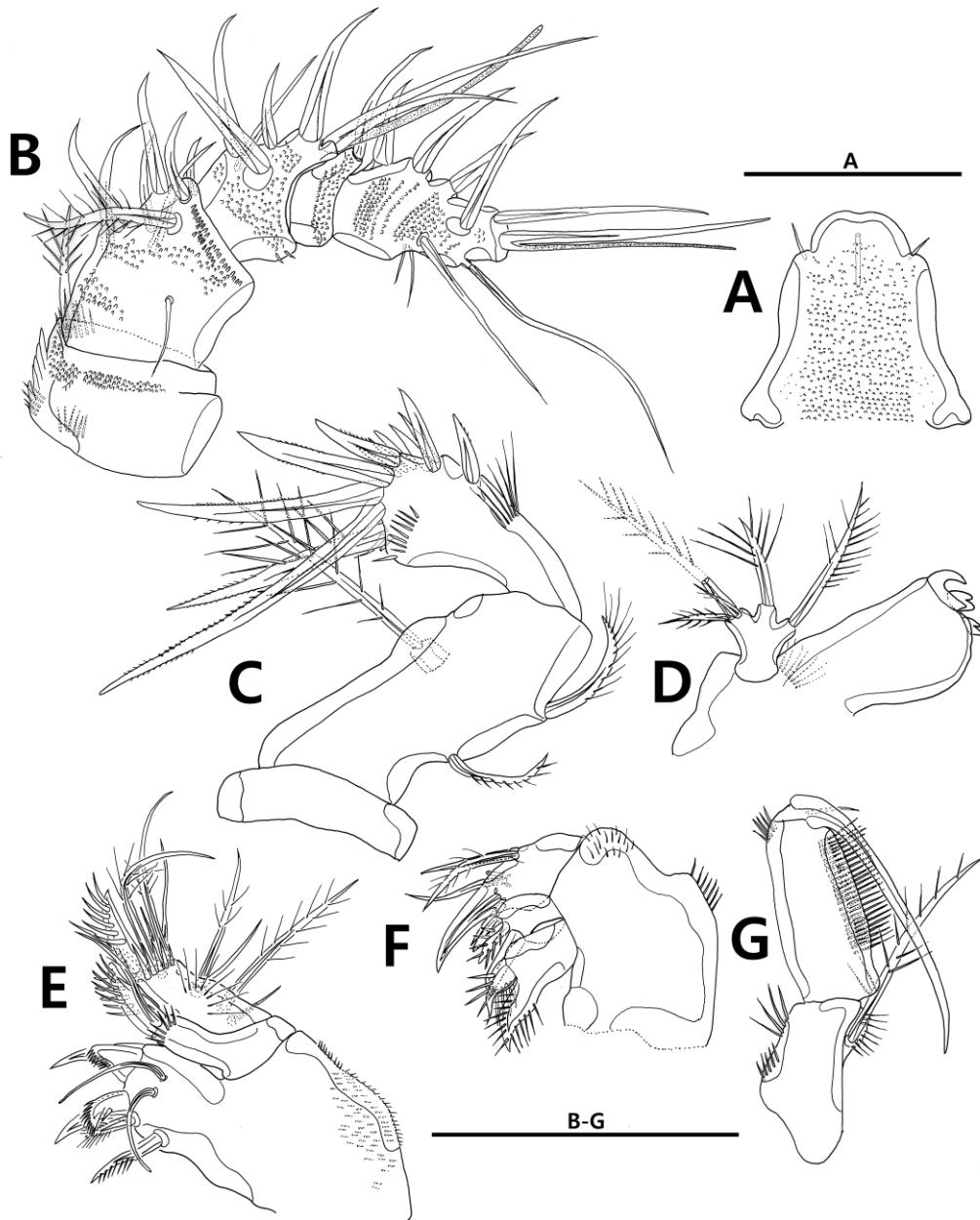
Nevertheless, *St. glabrum* can be placed in the genus *Strongylacron* without doubt based on its possession of the following morphological features: (1) each third exopodal segment of P1–P4 with four, four, five, five setae/spines, (2) rostrum with non-recurved anterior margin dorsally, (3) a minute antennary exopod with a pinnate seta, (4) female P5 distinctly U-shaped, (5) a recurved apophysis on the second endopodal segment of male P3, and (6) two apical setae on the third endopodal segments of male P3.

*Strongylacron glabrum* shows many differences from *St. buchholtzi*, including: (1) the anterior margin of the rostrum is slightly concave in the middle and naked between sensilla (vs. having row of fine setules (Sars 1909a, pl. CXCVIII, R + a1.; Gee and Huys 1996, Fig. 1B)); (2) the outermost seta on the distal margin of the antennary endopod is stout as neighboring one (vs. slender than the neighboring one (Sars 1909a, pl. CXCVIII, a2.; Gee & Huys 1996, Fig. 1C)); (3) the mandibular basis has one long and two short setae (vs. two long and one short setae (Gee & Huys 1996, Fig. 3B)); (4) the mandibular gnathobase does not have one plumose seta (vs. having a short and stout pinnate seta (Gee & Huys 1996, Fig. 3B)); (5) caudal seta VI is shorter than seta IV in length (vs. seta VI is longer than seta IV (Sars 1909a, pl. CXCVIII, F.; Gee & Huys 1996, Fig. 2A)); (6) the tube pore on outer margin of caudal rami is proximally inserted (vs. medially (Gee & Huys 1996, Fig. 2A)); (7) the length to greatest width ratio of caudal ramus in male is about 3.6:1 (vs. 2.6:1 (Gee & Huys 1996, Fig. 2B)); (8) the length to greatest width ratios of female P5 exopod and endopodal lobe are approximately 3.5:1 and 2.7:1, respectively (vs. at most 3.0:1 and 1.8:1, respectively (Sars 1909a, pl. CXCVIII, p5.; Gee & Huys 1996, Fig. 3D)); (9) the innermost seta on female P5 exopod is shorter than the length of exopod (vs. longer than exopod (Sars 1909a, pl. CXCVIII, p5.; Gee & Huys 1996, Fig. 3D)); (10) the outermost seta on the endopodal lobe of male P5 is reaching half of the middle one on exopod (vs. slightly shorter (Gee & Huys 1996, Fig. 4C)); (11) each posterior border of the prosomite has eight or ten rod-like projections (vs. 14–18 (Gee & Huys 1996, Fig. 1C)).

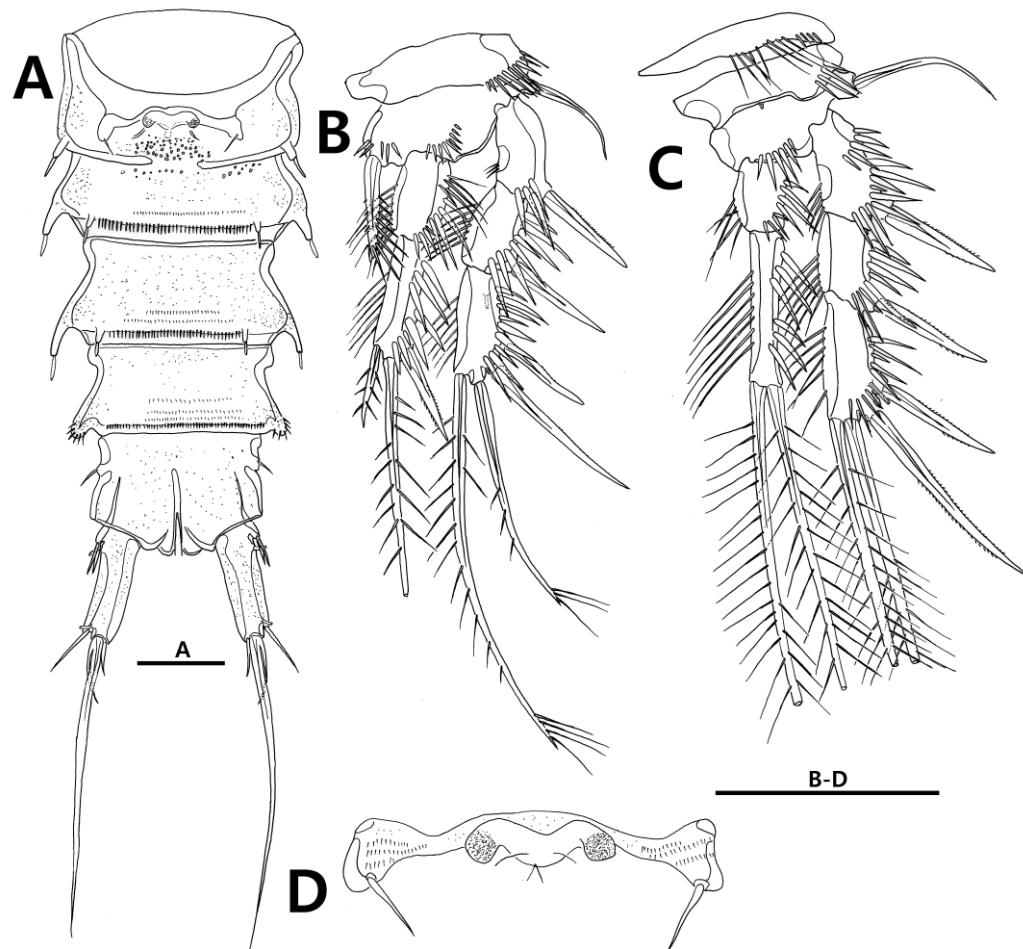
Members of the family Cletodidae are known as mud-burrowers from shallow and sublittoral marine habitats (Por 1986; Boxshall & Halsey 2004; Kim et al. 2014; Song et al. 2014). *Strongylacron* species were also reported from muddy bottoms. *Strongylacron buchholtzi* was known from intertidal and sublittoral (depth of 20 m) habitats on the Atlantic Ocean (northwestern Europe, Canada) (Boeck 1873; Sars 1909a; Willey 1929; Wells 1963; Gee & Huys 1996). *Strongylacron glabrum* was found from intertidal mudflats on the southwestern coasts of South Korea (Kim et al. 2016a).



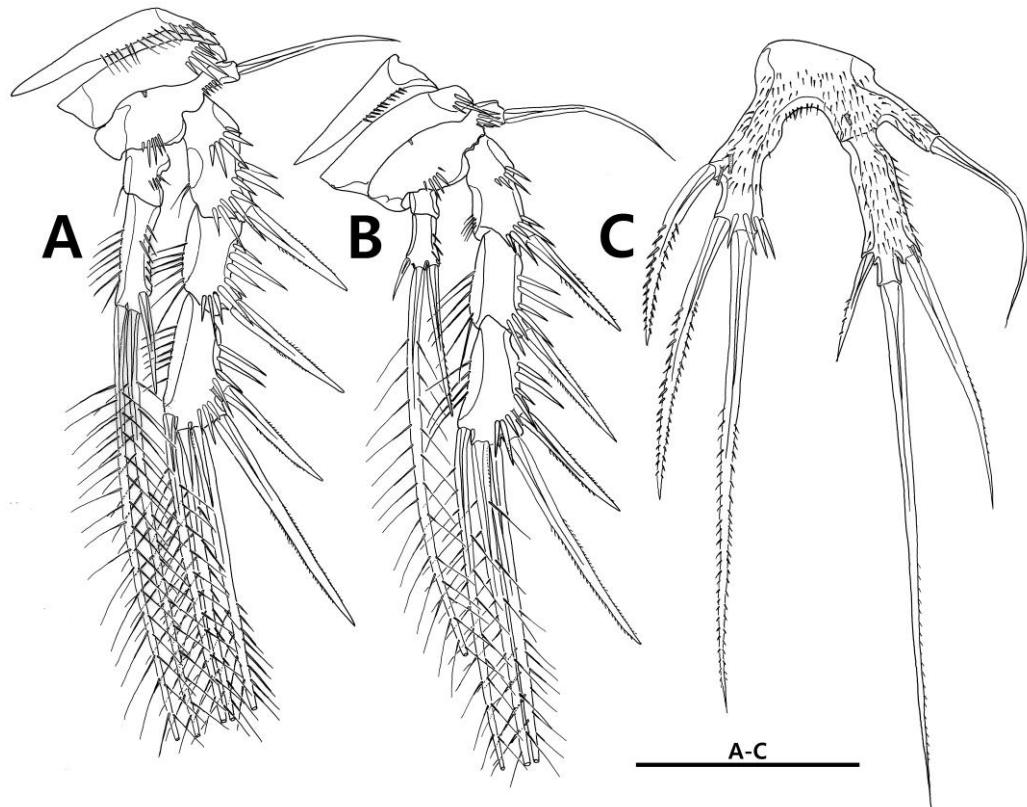
**Fig. 60.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, habitus, dorsal; B, habitus, lateral. Scale bar: 100  $\mu$ m (cited from Kim et al. 2016a).



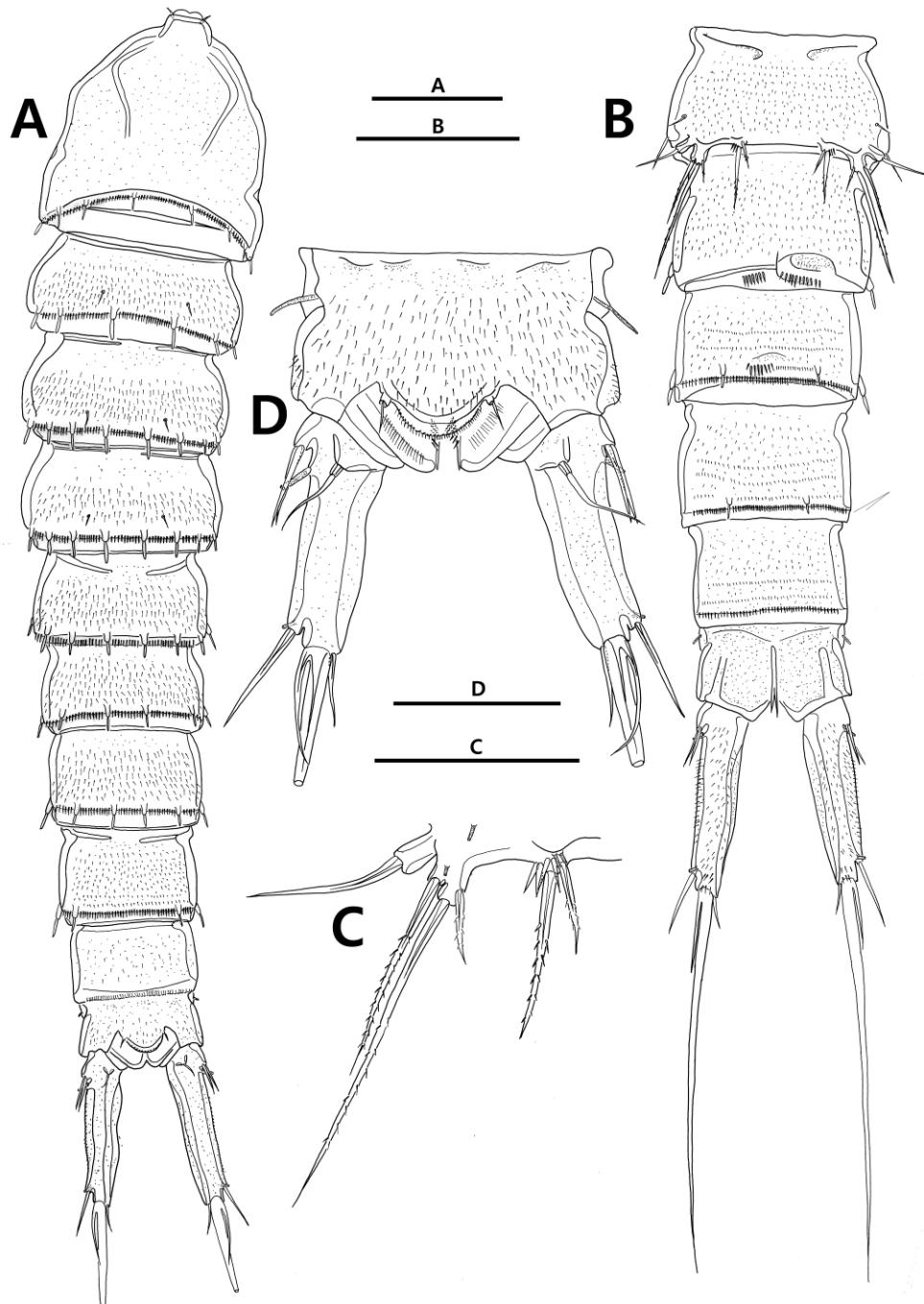
**Fig. 61.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, rostrum; B, antennule; C, antenna; D, mandible; E, maxillule; F. maxilla; G, maxilliped. Scale bars: 50  $\mu\text{m}$  (cited from Kim et al. 2016a).



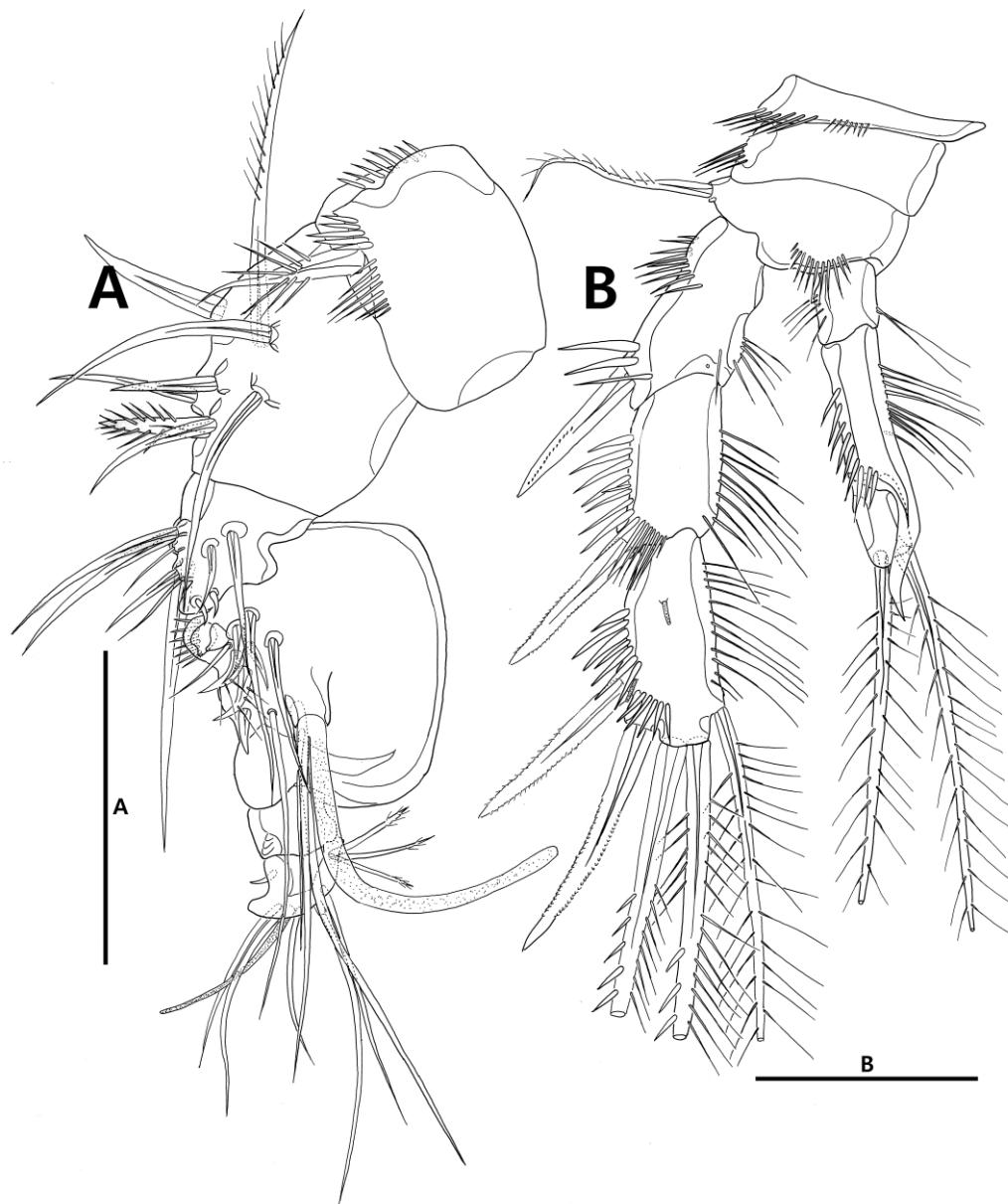
**Fig. 62.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, urosome except P5-bearing somite, ventral; B, genital field; C, P1; D, P2. Scale bars: 50  $\mu\text{m}$  (cited from Kim et al. 2016a).



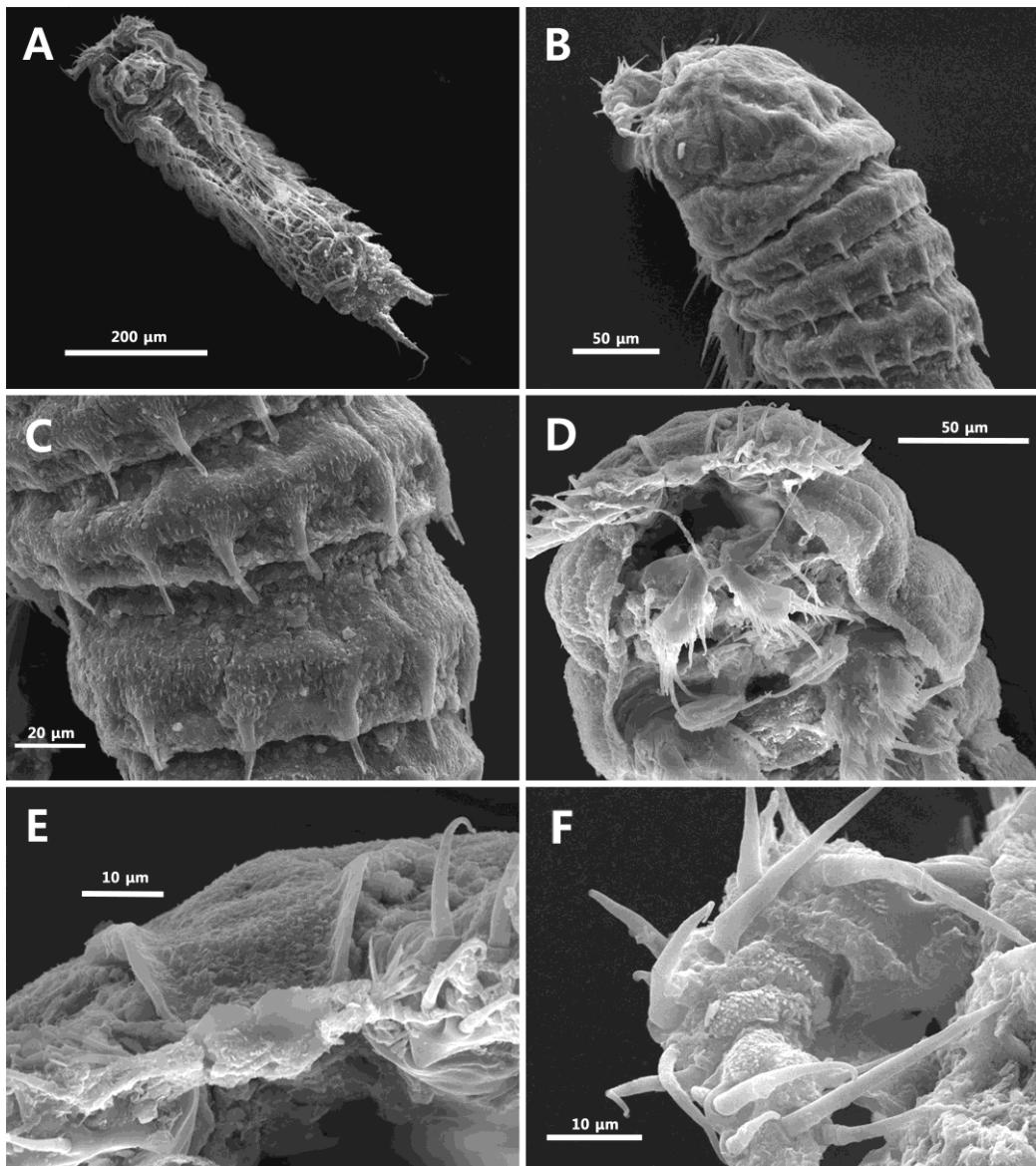
**Fig. 63.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, P3; B, P4; C, P5. Scale bar: 50  $\mu\text{m}$  (cited from Kim et al. 2016a).



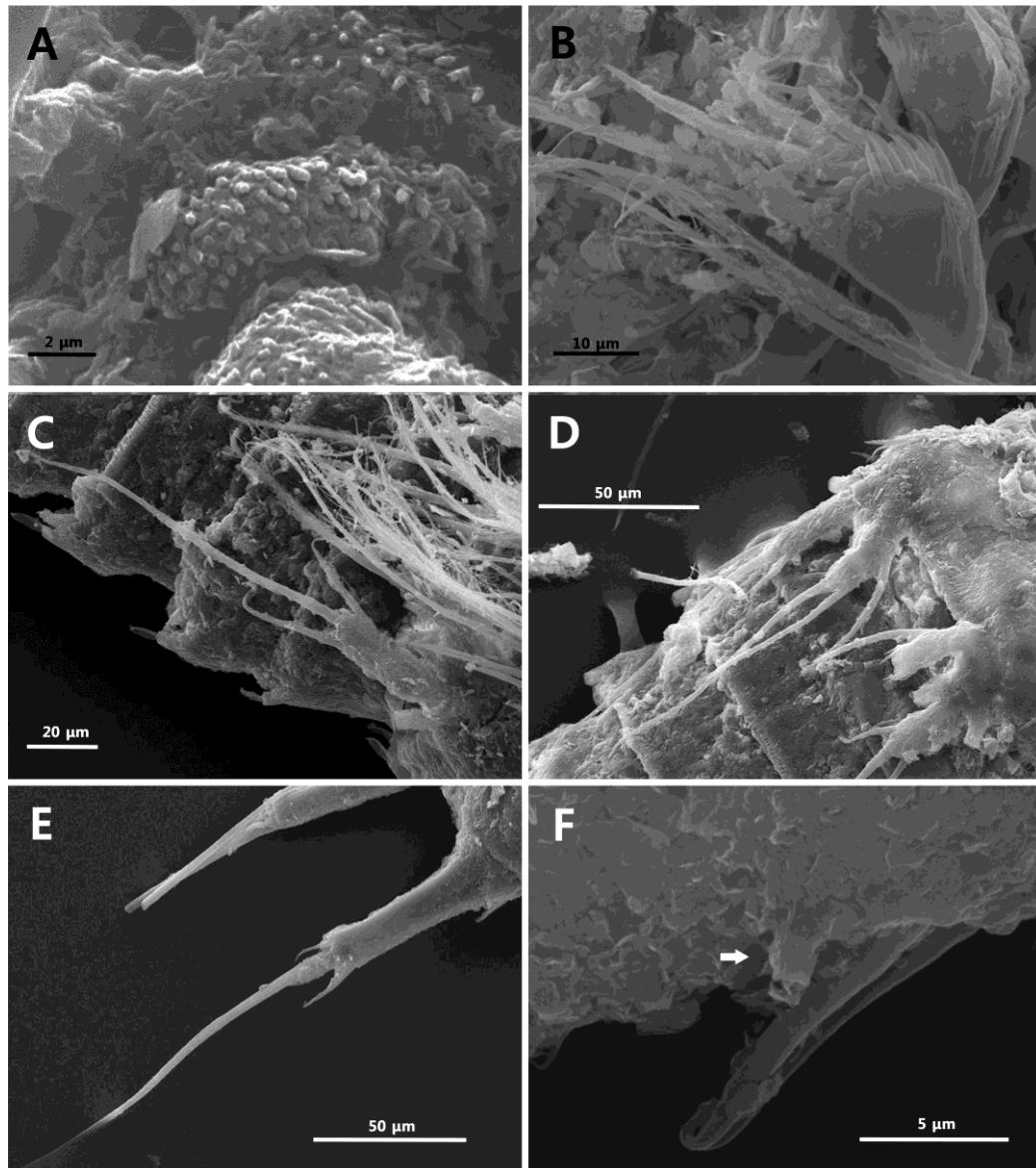
**Fig. 64.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, male: A, habitus, dorsal; B, urosome, ventral; C, P5. Female: D, anal somite and caudal rami, dorsal. Scale bars: 50 µm (C, D), 100 µm (A, B) (cited from Kim et al. 2016a).



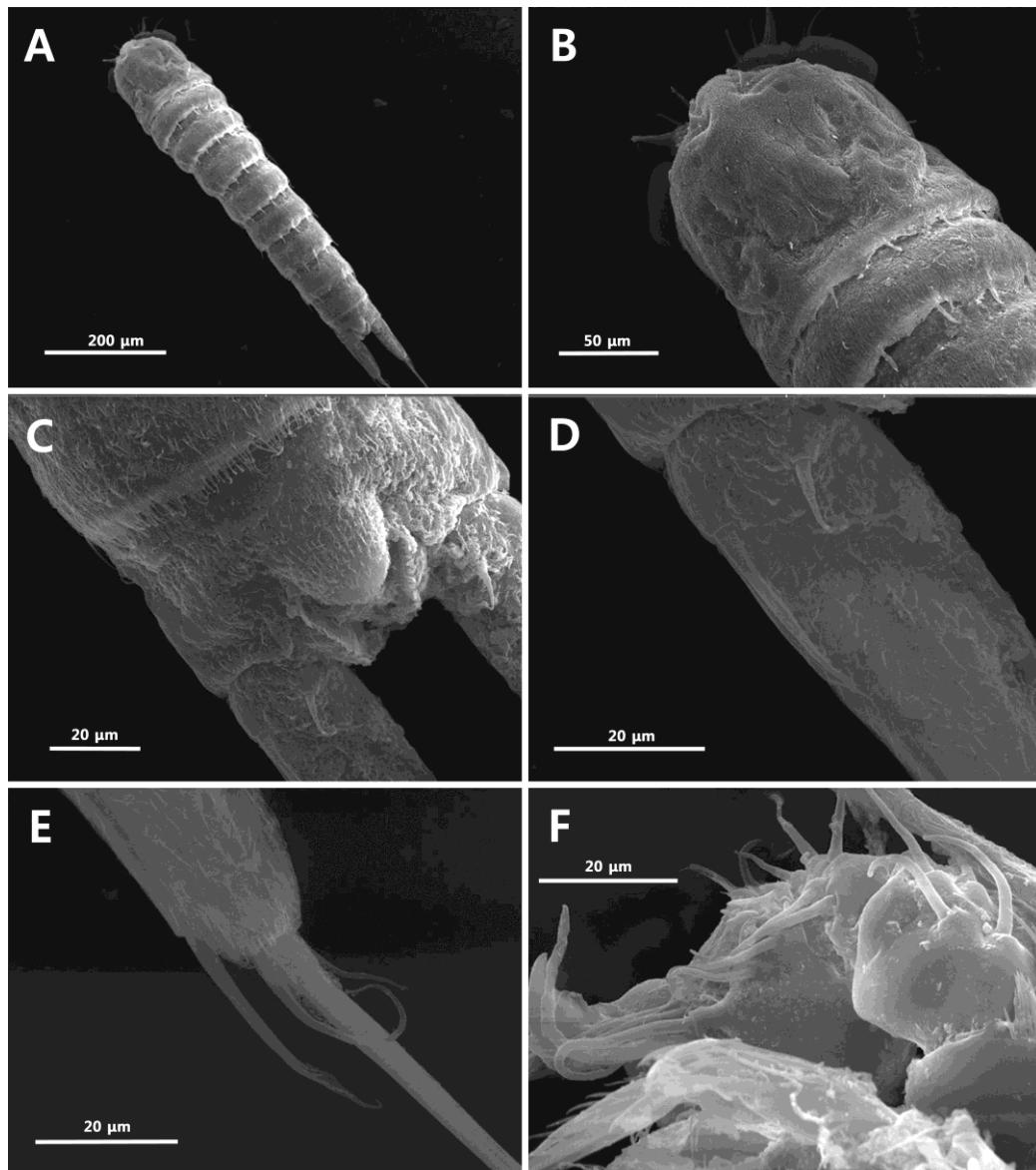
**Fig. 65.** *Strongylacron glabrum* Kim, Jung & Yoon, 2016, male. A, antennule; B, P3. Scale bars: 50  $\mu$ m (cited from Kim et al. 2016a).



**Fig. 66.** Scanning electron microscope photographs of *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, habitus, ventral; B, prosome, dorsolateral; C, thoracic somites 2–4, dorsolateral; D, cephalothorax, ventral; E, rostrum, anterior; F, antennules, dorsal (cited from Kim et al. 2016a).



**Fig. 67.** Scanning electron microscope photographs of *Strongylacron glabrum* Kim, Jung & Yoon, 2016, female. A, surface of antennules, dorsal; B, antennary endopod; C, D, P5; E, caudal rami; F, caudal setae I, II and tube pore (arrow) (cited from Kim et al. 2016a).



**Fig. 68.** Scanning electron microscope photographs of *Strongylacron glabrum* Kim, Jung & Yoon, 2016, male. A, habitus, dorsal; B, cephalothorax and thoracic somite 2, dorsal; C, anal somite, dorsal; D, proximal part of caudal ramus; E, distal part of caudal ramus, dorsal; E, antennule, ventral (cited from Kim et al. 2016a).

**Table 2.** Morphological differences between *Strongylacron buchholtzi* and *S. glabrum* (cited from Kim et al. 2016a)

Character	<i>S. buchholtzi</i>	<i>S. glabrum</i>
<b>Body</b>		
length (μm)♀	500–810	889–923
<b>Prosomite</b>		
number of rod-like projections on posterior border	14–18	8–10
<b>Rostrum</b>		
anterior margin	with row of fine setules	naked
<b>Antenna</b>		
outermost seta on distal margin of endopod	slender	stout
<b>Mandible</b>		
gnathobase	with seta	without seta
basis	with	with
	2 long, 1 short	1 long, 2 short
<b>P5</b>		
exopod, length ratio to greatest width♀	at most 3.0:1	approximately 3.5:1
endopodal lobe, length ratio to greatest width♀	at most 1.8:1	approximately 2.7:1
length of outer seta to baseoendopod to middle seta on exopod♂	slightly short	half
<b>Caudal ramus</b>		
position of tube pore on lateral margin♀	median	proximal
seta III, length ratio to caudal ramus♀	1.1:1	0.4:1
seta VI, length ratio to caudal ramus♀	0.84:1	0.3:1
length ratio to greatest width ♂	2.6:1	3.6:1

**Genus *Paracrenhydrosoma* Gee, 1999**

모식종: *Paracrenhydrosoma maccalli* (Schizas & Shirley, 1994)

**61. *Paracrenhydrosoma kiai* Song, Dahms, Lee, Ryu & Khim, 2014**

*Paracrenhydrosoma kiai* Song et al., 2014, p. 2, figs. 2–7.

관찰재료: 4♀♀, 경남 통영시 한산면, 한산도(수심 10m, 니질), 2014.3.24; 7♀♀, 전남 순천 여자만(수심 12m, 니질), 2015.5.11.

분포: 한국.

고찰: *Paracrenhydrosoma* 속은 Gee (1999)에 의하여 새로운 속으로 설정되었다. 이 속은 *Acrenhydrosoma* 속과 유사하지만, 헛황문판의 부재, 항문판이 항절의 뒤쪽에 배치된 점, 잘 발달된 이마뿔, 큰턱의 촉지에 4 개의 강모를 가지는 점, 제 1 흉지 내지의 두 번째 마디에 3 개의 강모를 가지는 점, 암컷 제 5 흉지 외지에 2 개의 강모를 가지는 점에서 서로 차이를 나타낸다. 이 속의 종들은 흉지의 강모식, 이마뿔의 형태, 큰턱의 촉지의 마디수와 강모수, 미차의 길이, 암컷 제 5 흉지의 강모의 종류에서 서로 차이를 나타낸다(Song et al. 2014). 본 연구에서 관찰한 시료는 모든 형질에서 Song et al. (20014)의 원기재문과 잘 일치하였다.

**Genus *Geehydrosoma* Kim, Trebukhova, Lee & Karanovic, 2014**

모식종: *Geehydrosoma intermedia* (Chislenko, 1978)

**62. *Geehydrosoma intermedia* (Chislenko, 1978)**

*Enhydrosoma intermedia* Chislenko, 1978, p. 185, figs. 17–18.

*Geehydrosoma intermedia*: Kim et al., 2014, p. 264, figs. 9–19.

**관찰재료:** 1♀, 전남 완도군 금일면 연지리, 금일도(잘피밭), 2012.5.21; 6♀♀, 1♂, 인천 앞바다, 조하대( $37^{\circ}24'N$ ,  $126^{\circ}31'E$ ; 수심 약 15m), 2012.6.22; 1♀, 1♂, 경남 통영시 한산면, 장사도(수심 7m, 사질), 2014.3.23; 2♀♀, 전북 군산시 옥도면 비안도리, 가력도(갯벌), 2014.8.13; 11♀♀, 2♂♂, 전남 순천, 여자만( $34^{\circ}42'N$ ,  $127^{\circ}32'E$ ; 수심 약 10m), 2015.5.11; 1♀전남 여수시 화양면 이목리, 2016.5.29.

**분포:** 한국, 러시아(포시예트만).

**고찰:** 이 좋은 처음 러시아에서 날씬뿔장수노벌레 속(*Enhydrosoma*)으로 기록이 되었다. Kim et al. (2014)은 한국과 러시아 개체군 사이에 형태적 차이가 없음을 확인하였고, 제 5 흉지의 자가파생형질과 분자적 데이터를 바탕으로 *Geehydrosoma*라는 신속을 만들었다. 멕시코에서 기록된 *G. brevipodium* (Gómez, 2004)도 이 속에 포함되었다. 본 연구에서는 조하대(인천 앞바다, 여자만)뿐만 아니라 조간대 지역에서도 *G. intermedia* 가 채집되었는데, 주로 니질 저질에서 서식하고 있는 것으로 추측된다.

### Family Nannopodidae Brady, 1880

#### 한국산 Nannopodidae 과의 속에 대한 검색표

1. 제 2–4 흉지의 외지는 3 마디로 이루어져 있다; 암컷 제 5 흉지의 내지엽이 발달하지 않았다 ..... 2
- 제 2–4 흉지의 외지는 2 마디로 이루어져 있다; 암컷 제 5 흉지의 내지엽이 잘 발달하였다 ..... 사냥장수노벌레 속 *Huntemannia*
2. 제 3 흉지 내지는 1 마디로 이루어져 있다. 꼬마발장수노벌레 속 *Nannopus*
  - 제 3 흉지 내지는 2 마디로 이루어져 있다 ..... *Ilyophilus* comb. nov.

## Genus *Huntemannia* Poppe, 1884

모식종: *Huntemannia jadensis* Poppe, 1884

### 63. *Huntemannia doheoni* Song, Rho & Kim, 2007

*Huntemannia doheoni* Song et al., 2007b, p. 38, figs.1–6.

**관찰재료:** 2♂♂, 충남 태안군 소원면 모항리, 만리포해수욕장(사질), 2012.6.23; 2♀♀, 충남 태안군 원북면 방갈리, 민어도(플랑크톤네트), 2012.6.23; 2♀♀, 경기 옹진군 영흥면 잠경리, 잠경리해수욕장(사질, 니질), 2012.7.17; 1♂, 전남 완도군 신지면 신리, 명사십리해수욕장(사질), 2013.6.25.

**분포:** 한국.

**고찰:** 현재 *Huntemannia* 속에는 *Huntemannia jadensis* Poppe, 1884, *H. micropus*, Monard, 1935, *H. lacustris* Wilson, 1958, *H. biarticulatus* Shen & Tai, 1973, *H. doheoni* Song, Rho & Kim, 2007의 5종 만이 기록되어 있다. 각 종들은 몸 길이, 제2–4 흉지 외지 마디들의 분리 유무, 제 2–4 흉지들의 강모식, 제 3–4 흉지 외지에 존재하는 가시의 성적이형 등의 형질에 따라 서로 구분될 수 있다. 특히, *H. doheoni* 는 마지막 형질인 수컷 제 3–4 흉지 외지에 독특한 형태의 가시를 가져 다른 종들과 구별될 수 있다(Song et al. 2007b).

## Genus *Nannopus* Brady, 1880 꼬마발장수노벌레 속

### 64. *Nannopus* sp. nov. (Figs. 69–72)

**Type locality.** Intertidal flats around Jindo Island ( $34^{\circ}21'49.48''N$ ,  $126^{\circ}9'43.68''E$ ); Namdong-ri, Imhoe-myeon, Jindo-gun, Jeollanam-do, Korea.

**Material examined.** Holotype ♀ (NIBRIV0000470371), dissected on seven slides. Allotype ♂ (NIBRIV0000470372), dissected on 12 slides. Paratypes: 1♀ (NIBRIV0000470373),

dissected on four slides; 1♀ (NIBRIV0000470374), dissected on two slides; 1♂ (NIBRIV0000470375), dissected on two slides. All materials examined were collected from the type locality on 9 April 2013.

**Description. Female.** Habitus (Fig. 69A) semi-cylindrical, depressed, tapering posteriorly, and usually rolling up when preserved in alcohol; total body length measured from tip of rostrum to end of caudal rami 662 µm long; prosome 1.8 times as long as urosome. Surface covered with dispersedly small cuticular ellipsoid and with ridges except anal somite; ridges (Fig. 69D) composed of cuticular ellipsoid. Posterior margin of each somite except anal somite dentate. Rostrum (Fig. 70A) triangular, fused to cephalothorax, and reaching midlength of second segment of antennule; apex rounded bluntly, furnished with setules on posterior margin; lateral margin with notch at one third anteriorly and paired sensilla. Cephalothorax tapering anteriorly, as long as three succeeding somites combined, about 224 µm in length; surface and posterior margin with paired sensilla; surface with 2 ridges; P1-bearing somite partially exposed in lateral view. Each pedigerous somite with posterior part protruded gradually. Prosomites bearing P2–P5 with 8, 6, 8, 6 ridges on dorsal surfaces, respectively. Urosome (Fig. 69B, C) tapering posteriorly. Genital-double somite (composed of genital somite and urosomite 3) slightly shorter than 2 succeeding somites combined; partially fused ventrally, but divided dorsally and laterally by transverse chitinous stripe; posterior margin of urosomite 3 dentate ventrally, with four sensilla; dorsal surface of urosomites 2 and 3 with 4 and 6 ridges, respectively; genital field (Fig. 69F) with separate genital organs on each side, each with 1 plumose seta representing P6. Urosomite 4 with 6 ridges on dorsal surface, 2 pairs of sensilla on ventral surface; posterior margin dentate. Urosomite 5 without sensilla on posterior margin. Anal somite about 2 times as long as preceding one, with 1 pair of sensilla on dorsal surface, 2 pairs of sensilla on ventral surface; operculum well-developed, covered with minute setules; dorsal posterior margin with row of setules.

Caudal rami (Fig. 69E) cylindrical, tapering posteriorly, about 1.5 times as long as wide, and with row of setules on inner margin, 7 accessory setae; setae I and II bare, small; seta III bare slightly longer than ramus in length; seta IV pinnate, as long as seta III; seta V well-developed, pinnate, about 3 times as long as caudal ramus in length; seta VI minute, naked; dorsal seta VII articulated, slightly longer than seta IV in length.

Antennule (Fig. 69G) short, robust, 5-segmented. First segment short, robust, covered with papilla, and with 1 row of setules, 1 row of spinules and 1 small seta. Second segment longest, with 2 rows of setules and 9 setae; surface covered with papilla. Third segment with several setules, 7 setae and 1 aesthetasc. Forth segment smallest, with several setules and 1 seta. Fifth segment about three times as long as preceding one, with 9 setae, 1 aesthetasc, and several setules. Each aesthetasc on both third and fifth segments fused basally to slender seta.

Antenna (Fig. 70B). Coxa small, with patch of papillae and 1 row of setules. Allobasis with 2 plumose setae on abexopodal margin; surface covered with minute spinules. Exopod 1-segmented, short, with 4 bare setae. Endopod shorter and narrower than allobasis; abexopodal margin with 1 row of long spinules midway, 1 row of small spinules and 2 stout elements; inner margin with hyaline frill subdistally; distal margin with 1 hyaline frill and 4 elements.

Mandible (Fig. 70C). Gnathobase well-developed with 2 rows of setules; broad cutting edge armed with 1 main bicuspid, 3 bicuspid, and 1 recurved teeth; inner distal corner with 2 pinnate setae, which fused basally and inner one armed with 2 pointed process. Palp 1-segmented, broad; surface covered with rows of long spinules; basal endite with 2 long plumose setae; exopod small, fused to basis, with 1 apical seta; endopod incorporated into basis, represented by 2 small setae.

Maxillule (Fig. 70D). Praecoxa with 1 row of spinules on surface and 1 row of setules on outer margin; arthrite well-developed, armed with 6 stout, 1 pinnate and 1 naked spines on distal margin, and having 1 long recurved, 1 slender pinnate setae along medial margin; surface with 2 parallel setae anteriorly and 1 tube pore posteriorly. Coxa with 1 row of spinules anteriorly; endite small, armed with 2 rows of spinules, and with 2 apical elements. Basal endite elongate; surface armed with 1 row of spinules anteriorly and with 2 uniplumose setae; distal margin 1 stout unipinnate and 2 naked setae. Exopod 1-segmented, fused to basis, with 2 apical setae. Endopod incorporated into basis, represented by seta.

Maxilla (Fig. 70E). Syncoxa with 2 rows of spinules along outer margin and 2 endites; proximal endite with 3 spinulose setae, two of which fused to endite; distal endite with 1 naked and 2 spinulose setae. Basal endite drawn out into claw, with 1 long seta; surface with 1 row of spinules. Endopod 1-segmented, confluent with basis, with 2 long apical setae.

Maxilliped (Fig. 70F) 3-segmented, subchelate. Syncoxa elongate, with 1 small seta on inner distal corner and 5 rows of spinules on surface. Basis elongate, ovate, slightly longer

than preceding one, with 1 row of setules at distal corner and 2 rows of spinules along palmer margin. Endopod 1-segmented, small, with 1 claw bearing row of spinules and 2 accessory setae.

P1 (Fig. 71A). Intercoxal sclerite wide; proximal margin convex midway. Praecoxa triangular, with row of setules on distal margin. Coxa small, wide, and with 2 rows of spinules along distal margin. Basis with 3 rows of spinules on anterior surface; distal margin concave; inner spine pinnate distally, with small seta; outer peduncle with 1 naked seta. Exopod 3-segmented; each segment armed with outer spinules and inner setules; exp-1 and exp-2 with 1 pinnate outer spine, respectively; exp-3 with 2 outer spines and 2 apical setae. Endopod 2-segmented vestigially; anterior surface fused, but posterior one with chitinous suture; proximal segment with 1 row of spinules at outer distal corner, 1 pinnate apical spine, 1 delicate inner seta; delicate inner seta inserted on posterior surface.

P2 (Fig. 71B). Intercoxal sclerite wide; proximal margin slightly convex midway. Coxa small, wide, and with 2 rows of spinules. Basis longer and narrower than coxa, with bare outer seta. Exopod 3-segmented; each segment armed with outer spinules and inner setules; exp-1 with long pinnate seta on outer margin; exp-2 with 1 plumose inner seta and 1 pinnate outer spine; exp-3 with 2 outer spines, 2 apical setae, and 1 inner seta. Endopod 2-segmented; enp-1 with 1 row of spinules at inner distal corner; enp-2 with 1 row of spinules along distal margin, 1 pinnate apical spine, and 1 bare inner seta.

P3 (Fig. 71C). Intercoxal sclerite wide and slightly concave. Coxa smaller than that of P2, with 2 rows of spinules. Basis with 2 rows of spinules on anterior surface; outer seta very long and plumose. Exopod 3-segmented; each segment armed with outer spinules and inner setules; exp-1 and exp-2 similar to that of P2; exp-3 with 2 outer spines, 2 apical setae, and 2 inner setae. Endopod 1-segmented, very small, with 1 small apical seta.

P4 (Fig. 71D). Intercoxal sclerite similar to that of P3. Coxa with 1 row of spinules on anterior surface. Basis with 2 rows of stout spinules and 1 row of minute spinules on anterior surface; outer seta similar to that of P3. Exopod similar to that of P3 except for exp-3; inner seta on exp-3 stout and pinnate distally. Endopod smaller than that of P3.

P5 (Fig. 71E). Baseoendopod wide, plate-like, and with 1 row of setules on posterior surface and 3 plumose setae on distal margin; innermost seta on distal margin pinnate distally; endopodal lobe not extended; outer peduncle with 1 row of setules and 1 long plumose seta.

Exopod 1-segmented, rectangular, and with 4 setae; innermost seta on exopod well-developed, fused to exopod; posterior surface with 2 rows of setules.

**Male.** Habitus (Fig. 72A) similar to that of female, but smaller than female; total length 500 µm in lateral view; genital somite and third urosomite separate.

Antennule (Fig. 72B, C) 5-segmented, haplocer; first segment small with 1 row of spinules and 1 minute seta; second segment with 9 setae; third segment triangular in shape, with 1 row of spinules proximally and 8 setae; fourth segment stout, semi-ovate, with 6 setae and 2 peduncles; large peduncle on forth segment with 1 seta and 1 aesthetasc, small one with 1 seta and 1 spine; fifth segment smallest, tapering distally, with 7 setae and 1 aesthetasc; each aesthetasc on fourth and fifth segments fused seta basally.

P5 (Fig. 72D). Baseoendopod small, with 3 peduncles each with apical seta; innermost seta on baseoendopod stout; outer peduncle with 1 long unipinnate seta. Exopod fused to baseoendopod, with 2 unipinnate and 2 naked setae.

P6 (Fig. 72D) symmetrical, small, with 1 unipinnate and 1 bare setae on apical margin.

**Remarks.** To date, there are several obvious discrepancies between the definition of the genus *Nannopus* by Brady (1880) and the concept of the genus accepted presently (Canu 1892; Scott 1902; Sars 1909a; Gurney 1932; Shen & Tai 1964; Wells 1971; Kikuchi & Yokota 1984; Kornev & Chertoprud 2008; Fiers & Kotwicki 2013; Vakati et al. 2016 etc.). Brady (1880) described that “inner branches of the third and fourth pairs rudimentary, and consisting only of a few setae” in the definition of the genus *Nannopus* and ‘In place of the inner branch of the third and fourth pairs is a small tubercle, which gives attachment to a long plumose seta and two or three very small cilia’ in the description of *N. palustris* Brady, 1880. While the present concept of *Nannopus* considers that P3 and P4 are two- and one-segmented, respectively. Such discrepancies were originated from Canu’s (1892) reinterpretation of Brady’s thoracic legs. Canu (1892) has first found out that the illustration of P1 expresses the absence of the median spine on the basis, which is essential in harpacticoid copepods. Canu (1892) has suggested that this figure represents P2 or P3. He also believed that Brady’s figure 20 captioned as P3 actually expressed the P4 of *N. palustris* without providing reasons (Canu, 1892). This reinterpretation has been accepted by subsequent authors when reporting *Nannopus* species (Scott 1902; Sars 1909a; Gurney 1932; Shen & Tai 1964; Wells 1971;

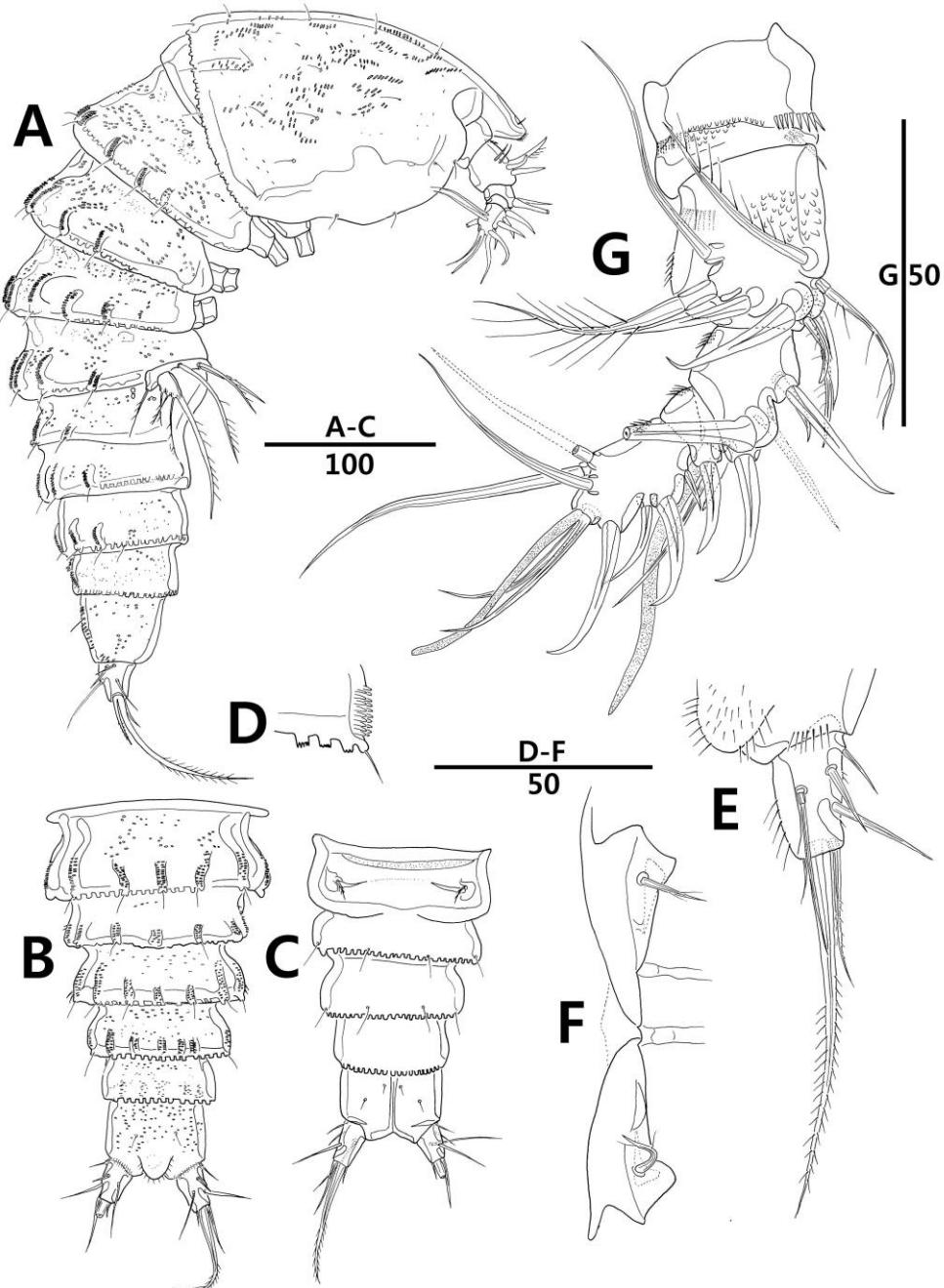
Kikuchi & Yokota 1984; Kornev & Chertoprud 2008; Fiers & Kotwicki 2013, Vakati et al. 2016 etc.).

However, this concept of *Nannopus* accepted presently might be incorrect by the discovery of *Nannopus* sp. nov. collected from Korea. The new species shows a one-segmented P3 endopod in accordance with the definition of the genus described by Brady (1880). Considering the segmentation of thoracic legs present in *Nannopus* sp. nov., the author suggest that Brady had not mistaken in the illustration of P3 at least and Canu's (1892) assumption for P3 is incorrect. The author also think that the segmentation of P3 endopod is sufficient to be a generic characteristics dividing *Nannopus* species. So, other eight *Nannopus* species having two-segmented P3 endopod should be transferred to other new genus. By the way, the diagnosis of the genus *Ilyophilus* Lilljeborg, 1902, which is a junior synonym of *Nannopus*, accord with the characteristics of P3 and P4 of these eight *Nannopus* species. Thus, the genus *Ilyophilus* have to be revived to accommodate *I. flexilibis* Lilljeborg, 1902 comb. nov., *I. perplexus* Sars, 1909b comb. nov., *I. unisegmentatus* (Shen & Tai, 1964) comb. nov., *I. didelphis* (Fiers & Kotwicki, 2013) comb. nov., *I. hirsutus* (Fiers & Kotwicki, 2013) comb. nov., *I. procerus* (Fiers & Kotwicki, 2013) comb. nov., *I. scaldicola* (Fiers & Kotwicki, 2013) comb. nov., and *I. ganghwaensis* (Vakati, Kihara & Lee, 2016) comb. nov. Although the detailed characteristics of *N. palustris* are still unknown, the revival of *Ilyophilus* can be supported by the differences between *Nannopus* sp. nov. and *Ilyophilus* species in the following characteristics: the rostrum in *Nannopus* sp. nov. is furnished with ventral setules compared to dorsal setules in *Ilyophilus* species; the mandibular palp in *Nannopus* sp. nov. has five setae compared to four setae in *Ilyophilus* species except for *I. unisegmentatus* having five setae; the sexual dimorphism on P3 endopod in *Nannopus* sp. nov. is absent compared to present in *Ilyophilus* species; the male P6 in *Nannopus* sp. nov. is represented by two setae compared to three setae in *Ilyophilus* species.

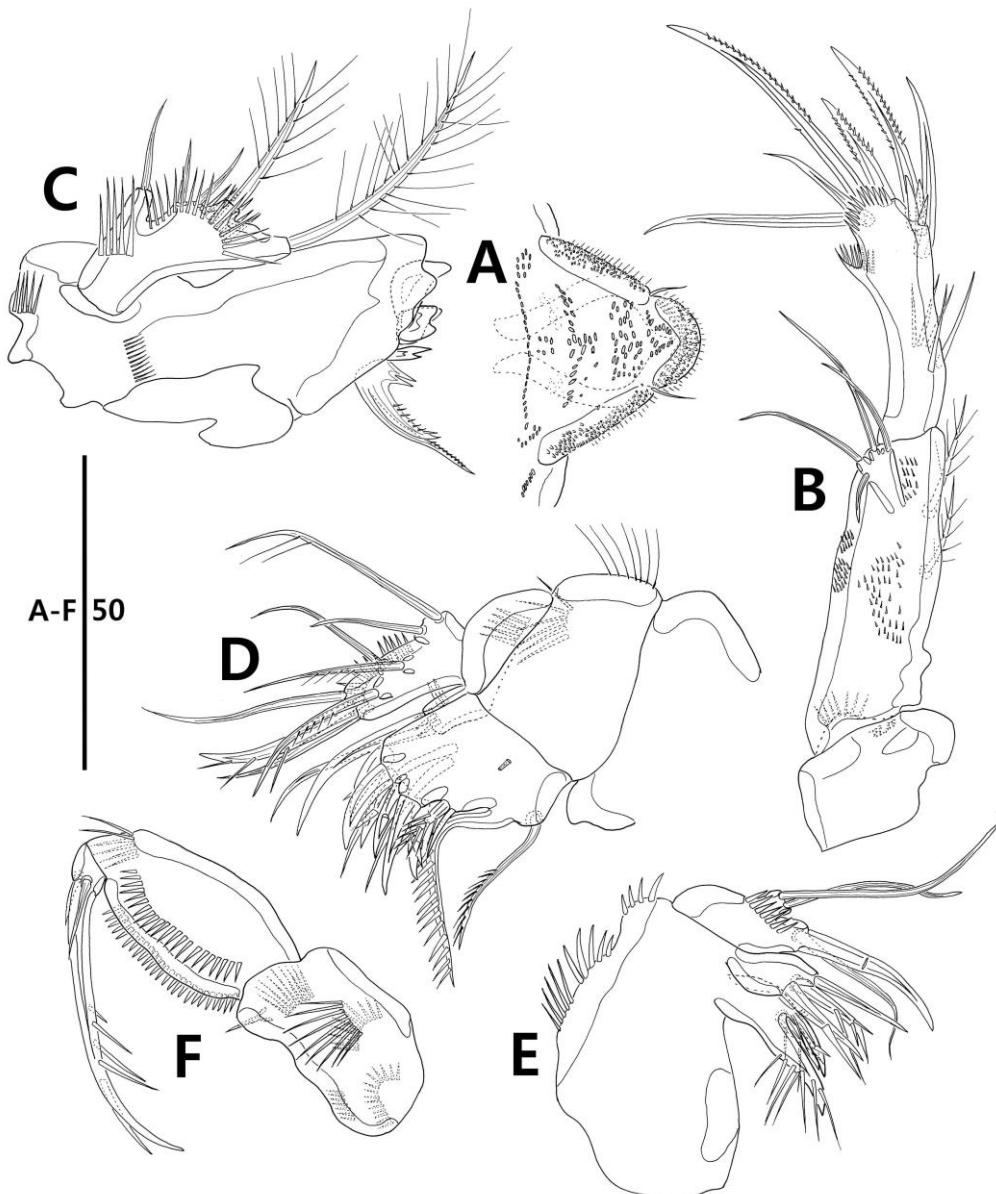
*Nannopus* sp. nov. is very closed to the original description of *N. palustris* by Brady (1880) in sharing a one-segmented endopod on P3-P4. However, it differs from the latter in the following features: all P1-P4 exp-3 have two outer spines, whereas *N. palustris* has three spines at P1 exp-3 (presently considered as P2); both P3-P4 endopods have a very small seta, whereas P3 (presently considered as P4) of *N. palustris* has a long plumose seta exceeding

the end of the exopod; and its body surface is ornamented with ridges, while the body surface of *N. palustris* is even without ridges.

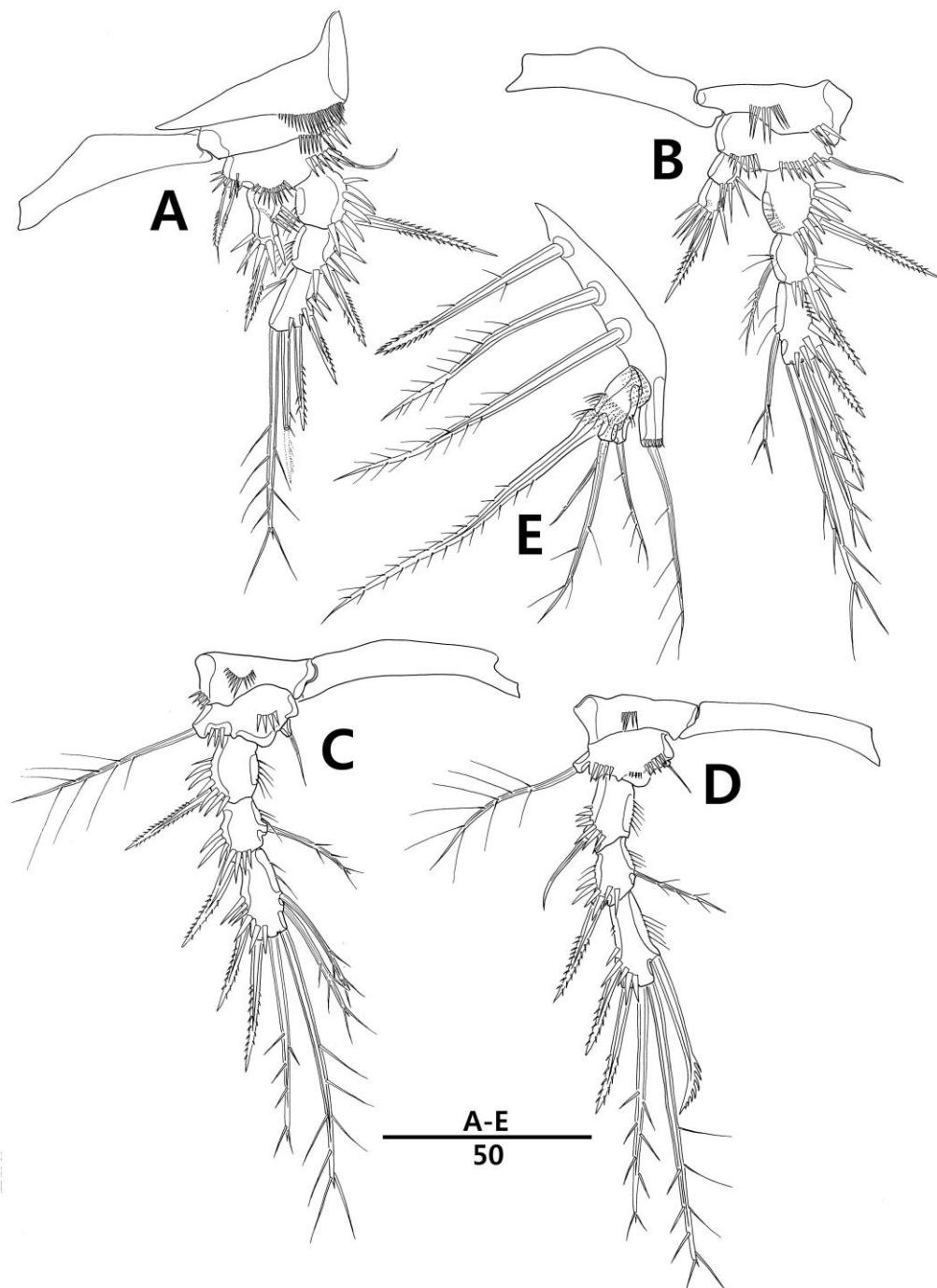
Fiers & Kotwicki (2013) identified divergent character states in *Ilyophilus* species and assumed that there are two groups characterized by conditions of the inner subdistal element on P4 exp-3 and the male genital apparatus. However, it was not supported by the disvory of *I. ganghwaensis* in discord with his assumption (Vakati et al. 2016). On the other hand, two species placed in *Ilyophilus* represent discrepancy from congeners. *Ilyophilus perplexus* differs from congeners by the following characteristic features: the posterior border of somites is smooth, while it is serrate in congeners; antennary exopod has three setae, while it has four setae in congeners; antennary allobasis has one abexopodal setae, while it has two setae in congeners; antennary endopoed with seven spines, while it has six spines in congeners; the P1 exp-2 has no inner seta, while it has one inner seta in congeners; the P4 endopod has only one long plumose setae, while it has one long plumose and 1 small setae in congeners; the female P5 exopod is fused to baseoendopod, while it is separate in congeners. *Ilyophilus unisegmentatus* is also discriminated from congeners by the number of setae on mandibular palp (5 setae in *I. unisegmentatus* vs. 3 or 4 setae in congeners) and the segmentation of P1 endopod (1-segmented in *I. unisegmentatus* vs. 2-segmented in congeners). Considering conditions of characteristics mentioned above within *Ilyophilus* species, this genus seems to be a polyphyletic group and could be subdivided into several groups by a further study.



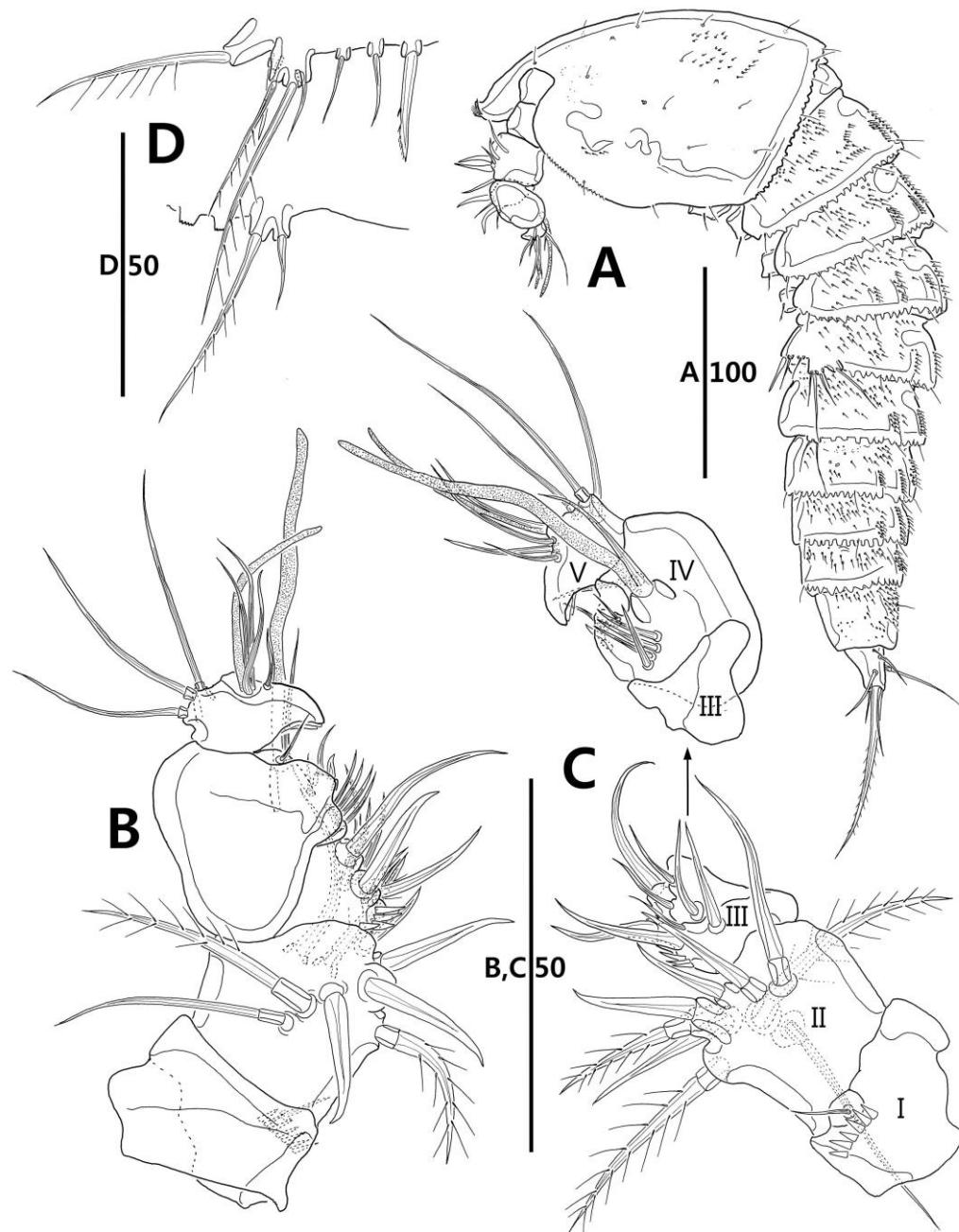
**Fig. 69.** *Nannopus* sp. nov., female. A, habitus, lateral; B, urosome, dorsal; C, urosome, ventral; D, ridge on body surface; E, caudal ramus, dorsal; F, genital field; G, antennule.



**Fig. 70.** *Nannopus* sp. nov., female. A, rostrum; B, antenna; C, mandible; D, maxillule; E, maxilla; F, maxilliped.



**Fig. 71.** *Nannopus* sp. nov., female. A-E, P1-P5.



**Fig. 72.** *Nannopus* sp. nov., male. A, habitus, lateral; B, antennule, anterior; C, antennule, posterior; D, P5 and P6.

**Family Rhizothricidae Por, 1986 모래털노벌레과**

**Genus *Rhizothrix* Brady & Robertson, 1876 모래털노벌레 속**

**모식종:** *Rhizothrix curvata* (Brady, 1880)

**65. *Rhizothrix sejongi* Nam & Lee, 2005 세종모래털노벌레**

*Rhizothrix sejongi* Nam & Lee, 2005, p. 693, figs. 1–6; Nam & Lee, 2009, p. 212, fig. 1.

**관찰재료:** 1♀, 경상남도 남해군 상주리, 상주해수욕장(모래사장; 모식산지), 2013.10.4; 1♀, 전남 여수시 화양면 이목리(잘피밭), 2016.5.29.

**분포.** 한국.

**고찰:** 이 종은 *Rhizothrix gracilis* (T. Scott, 1903)와 가장 유사하지만, 두 종은 제 3–4 흉지 내지 두 번째 마디의 강모수, 암수 모두의 제 5 흉지의 강모수 등에 의하여 서로 구분될 수 있다(Nam & Lee 2005). 최근, 브라질에서 *R. virginiae* Björnberg, 2014 가 보고되었는데, 세종모래털노벌레와는 몸 표면의 장식과 제 1 흉지 내지의 두 번째 마디에 존재하는 강모수에서 차이를 나타낸다(Björnberg 2014).

**Superfamily Laophontoidea T. Scott, 1905**

**Family incertae sedis**

**Genus *Apolethon* Wells, 1967 나도갈고리노벌레 속**

**모식종:** *Apolethon fumator* Wells, 1967

**66. *Apolethon articulatus* Lee & Chang, 2008 나도갈고리노벌레**

*Apolethon articulatus* Lee & Chang, 2008a, p. 249, figs. 2–7; Chang, 2009b, p.355, figs. 183–185, pl. 12B, 28; Chang, 2010, p. 221, figs. 116–121.

**관찰재료:** 1♂, 인천 강화군 삼산면 매음리, 민머루해수욕장, 2012.7.4; 1♀, 경기도 옹진군 영흥면 잠정리, 영흥도(사질, 니질), 2012.7.17; 1♀, 경기 옹진군 영흥면 선재리, 측도, 2012.7.17; 2♀♀, 1♂, 전남 전남 완도군 신지면 대평리, 2012.7.19; 2♀♀, 전남 진도군 임회면 남동리, 2013.4.9; 3♀♀, 충남 서천군 장항읍 송림리, 송림산림해수욕장(사질, 니질), 2013.8.13; 3♀♀, 1♂, 제주 서귀포시 표선면 표선리, 표선해수욕장(사질), 2014.6.26; 1♀, 전북 부안군 변산면 대항리, 2014.8.13; 1♀, 충남 보령시 오천면 장고도리, 장고도, 2014.11.15; 6♀♀, 인천 중구 운서동, 영종도, 용유해수욕장, 2016.6.3.

**분포:** 한국.

**고찰:** 나도갈고리노벌레 속(*Apolethon*)은 가혹노벌레 과(Laophontidae)에 위치하고 있었다. 그러나 Schizas & Shirley (2006)은 *A. hippoperus* 를 기록하면서 이 속의 분류학적 위치에 관한 문제점을 인식하였다. 그들은 이 속이 *Laophontoidea sensu* Huys, 1990 의 범주에는 속하지만, 이 상과의 어떤 과에도 포함되지 않는다고 주장하였다. 그 결과, 현재 나도갈고리노벌레 속은 가혹노벌레 상과에서 *incertae sedis* 상태로 남아있다.

본 연구에서 관찰한 시료들 중 대부분은 Lee & Chang (2008a)의 원기재문과 거의 모든 형질들에서 잘 일치하였으나, 제주도 표선해수욕장에서 채집된 시료는 암컷 제5흉지 외지에 존재하는 강모의 길이에서 미세한 차이를 보였다.

### Genus *Laophontoidea* gen. nov.

**Diagnosis.** *Laophontoidea*. Body, elongate, subcylindrical. A1 5-segmented; second segment with small protrusion; distal segment with 3 stout spinulose setae. A2, allobasis with 1 abexopodal seta; exopod rudimentary, with 3 setae. Mandibular exopod absent. P1 endopod 2-segmented; enp-1 elongate, with 1 small inner seta distally; exp-2 without inner seta. P3 exp-2 without inner seta; enp-2 with 1 outer and 1 apical setae. P3 endopod 3-segmented in

male; enp-2 in male produced into apophysis; exp-3 in male with 1 remarkably reduced inner seta. P4 exp-2 without inner seta; both rami representing sexual dimorphism, exopod broad, exp-1 elongate, exp-3 small, with 1 remarkably reduced inner seta. P6 represented by 1 small seta.

**Remarks.** The new genus is very similar to the genus *Apolethon* Wells, 1967 composed of five valid species in the typical structures of P1–P5. However, it can be differentiated from the latter on the basis of the following characteristics: the distal segment on antennule has three spinulose setae (vs. two spinulose setae in *Apolethon*); antennary exopod is rudimentary (vs. distinct in *Apolethon*); mandibular exopod is absent (vs. represented by a plumose seta in *Apolethon*); the inner seta on P3–P4 exp-2 is absent (vs present in *Apolethon*); P3 enp-2 has two setae (vs. three setae in *Apolethon* species); sexual dimorphisms on the inner seta on P3–P4 exp-3 and the elements on P4 exp-3 are remarkable (vs. weak in *Apolethon*).

The genus *Apolethon* is presently considered as the genus *incertae sedis* by Schizas & Shirley (2006) because *Apolethon* differs from five families of Laophontoidea in the difference of pre-copulatory behavior, urosome, A1, P1 endopod, and P5 of both sexes. This new genus also represents similar differences and possibly can not be placed in any families of Laophotoidea. A new family should be erected to accommodate *Apolethon* and Laophontoidea gen. nov. with further study.

## 67. Laophontoidea gen. nov. & sp. nov. (Figs. 73–77)

**Type locality:** Seomang beach ( $34^{\circ}21'58.4''N$ ,  $126^{\circ}08'06.0''E$ ), Seomang-ri, Imhoe-myeon, Jindo-gun, Jeollanam-do, Korea.

**Material examined:** Holotype ♀ (418.2  $\mu m$ ; mandible damaged), dissected on 9 slides. Allotype ♂ (401.5  $\mu m$ ), dissected 7 slides. Paratypes: 1 ♀ (484.8  $\mu m$ ), dissected on 12 slides. All materials were collected from the type locality on 7 July, 2016.

**Additional material examined:** 1 ♀, Cheongpodae baech (36°38'25.20"N, 126°17'57.70"E), Woncheong-ri, Taean-gun, Chungcheongnam-do on 28 May 2016.

**Description. Female:** Habitus (Fig. 73A, B) cylindrical, without conscious boundary between prosome and urosome; total body length (measured from tip of rostrum to end of caudal rami laterally) ranging from 418.2 to 484.8  $\mu m$  (mean 451.5  $\mu m$ , n = 2); prosome about

1.4 times longer than urosome in dorsal view; greatest width measured posterior border of cephalothorax, about 110.6  $\mu\text{m}$  in dorsal view. Rostrum (Fig. 73A, B) well-developed, sub-defined at base. Cephalothorax (Fig. 73A, B) as long as sum of 3 pedigerous somites, fused with P1-bearing somite, with 10 pairs of sensilla on surface and 3 pairs of sensilla on posterior border; posterior and ventral borders armed with setules. Pedigerous somites, each with 4 or 5 pairs of sensilla near posterior border, 1 group of small spinules, and armed with setules along posterior border. Urosome (Figs. 73A, B, 74A) comprising of P5-bearing somite, genital double-somite, and 3 abdominal somites; minute ornamentation on surface more distinctly seen than Prosomites. P5-bearing somite slightly trapezoid in dorsal view. Genital double-somite completely separated dorsally and laterally by notch, ventral surface vestigially divided by subcuticular border; each lateral and distal parts slightly expanded. Genital somite, posterior border with dorsally, 2 pairs of sensilla, ventral surface with 2 groups of spinules anteriorly and 2 groups of spinules laterally. First abdominal somite (urosomite 3) with 1 pair of sensilla on posterior margin dorsally and 1 row of spinules on posterior margin ventrally; lateral margin with 1 group of spinules and 1 tube pore. Genital field (Fig. 74A) with common genital slit anteriorly and copulatory pore medially; P6 represented by 1 plumose seta. Second and third abdominal somites (urosomites 4 and 5) expanded laterally and distally; ornamentation similar to that of first abdominal somite. Anal somite (Fig. 74A, B) smaller than preceding one, with deep cleft medially and convex operculum; dorsal surface with 1 pair of sensilla; ventral surface with 1 pair of pores; posterior border armed with spinules.

Caudal rami (Fig. 74A–C) about 1.4 times as wide as long, with 7 setae; outer distal surface armed with small spinules; seta I very small, vestigial; setae II and III slender, longer than caudal ramus; outer terminal seta IV about 3 times as long as caudal ramus, armed with small denticles distally, with 1 row of spinules; inner terminal seta V about 1.5 times as long as seta IV, armed with small denticles distally; seta VI slender, as long as seta II; dorsal seta VII tri-articulated, plumose, longer than seta II.

Antennule (Fig. 74D) short, 5-segmented; segment 1 with 2 rows of spinules and 1 slender seta; segment 2 longest, robust, with 8 bare setae; segment 3 with 5 bare setae and 1 peduncle bearing 2 long slender setae and 1 aesthetasc; segment 4 small with 1 long slender seta;

segment 5 as long as segment 3, with 3 stout pinnate setae, 8 bare setae (stout pinnate seta on apical margin fused with bare seta basally).

**Antenna** (Fig. 74E). Coxa small, with 1 group of small spinules on lateral margin. Allobasis 1 row of spinules and 1 slender seta on abexopodal margin. Exopod very small, with 3 setae apically. Endopod as long as allobasis, gradually broadening; outer margin armed with stout spinules, with 2 pinnate spines and 1 slender seta; surface with 1 frill subdistally and distal margin with 1 frill; distal armature composed of 2 pinnate spines, 3 geniculate setae, and 1 slender seta (fused with inner most geniculate seta at base).

**Mandible** (Fig. 74F). Gnathobase well-developed, armed with 1 bidentate, 2 tridentate and 2 unidentate teeth, and 1 pinnate seta, with 2 groups of spinules on surface. Palp elongate, composed of basis and endopod; basis with 2 plumose setae distally; endopod 1-segmented, fused into basis basally, with 1 small and 2 long setae.

**Maxillule** (Fig. 74G). Praecoxa with 1 row of spinules on distal margin; arthrite well-developed, with 5 spines, 1 seta, and 1 group of spinules on distal margin, and 1 seta on surface. Coxal endite with 1 spine and 1 seta apically. Basis with 1 seta on distal margin, 1 spine on distal margin, 2 setae on surface subdistally; peduncle on basis with 3 setae; endopod incorporated with basis, represented by 2 setae.

**Maxilla** (Fig. 74H). Syncoxa large, with 1 row of setules along outer margin and 1 group of small spinules on inner margin, bearing 1 seta (representing praecoxal endite) and 2 endites; proximal endite with 1 pinnate and 2 bare setae; distal endite with 3 elements. Allobasis drawn out into pectinate claw, with 2 setae on surface. Endopod small, with 2 apical setae.

**Maxilliped** (Fig. 74I). Syncoxa with 3 rows of spinules and 1 pinnate seta. Basis with 2 rows of spinules on surface. Endopod represented by 1 curved claw accompanying 1 accessory seta proximally.

**P1** (Fig. 75A). Intercoxal plate well-developed, triangular in shape. Praecoxa large, with 1 group of spinules on anterior surface distally. Coxa large, with 2 rows of stout spinules and 1 group of small denticles on anterior surface, and 1 row of stout spinules on outer margin. Basis bilobate; inner lobe small, with 1 stout spinulose spine on outer margin and 1 row of stout spinules on anterior surface; inner lobe large, with 1 row of spinules proximally and 1 plumose seta on anterior surface proximally, 1 group of stout spinules near distal margin. Exopod 3-segmented, reaching to half of emp-1; each segment armed with stout spinules along

outer margin and distal corner, and setules along inner margin; exp-1 largest, with 1 pinnate outer spine; exp-2 about half of exp-1 in length, with 1 pinnate outer spine; exp-3 as long as exp-1, with 2 pinnate outer spines, 1 geniculate apical seta, and 1 bare apical seta. Endopod 2-segmented; enp-1 elongate, about 10 times as long as greatest width, with 1 small seta subdistally and 1 row of setules on inner margin; exp-2 small, about 2.3 times as long as width, with 2 groups of spinules on anterior surface, and 1 small spine and 1 long bare seta on apical margin.

P2 (Fig. 75B). Coxa large, with 4 rows of spinules on anterior surface and 1 row of spinules on outer margin posteriorly. Basis smaller than coxa, with 2 rows of spinules and 1 tube pore on anterior margin, 1 plumose seta on outer margin, and 1 row of setules on inner margin. Exopod 3-segmented; exp-1 and exp-2 armed with stout spinules along outer margin and distal corner and setules along inner margin, respectively; exp-1 with 1 pinnate outer spine; exp-2 with 1 pinnate outer spine and 1 inner seta; exp-3 elongate, longest, armed with stout spinules along outer margin and setules on inner margin, with 2 pinnate outer spines, 1 stout pinnate apical seta, and 1 plumose apical seta. Endopod 2-segmented, reaching to 1/3 of exp-3; each segment armed with spinules along outer margin and setules along inner margin; enp-1 small, as long as width; enp-2 elongate, tapering distally, with 1 row of spinules on inner margin distally and 1 long plumose seta on apical margin.

P3 (Fig. 76A). Intercoxal plate well-developed, arched. Coxa with 5 rows of spinules on anterior surface and 2 rows of spinules on outer margin posteriorly. Basis smaller than coxa, with 2 rows of spinules and 1 tube pore on anterior margin, 1 plumose seta on outer margin, and 1 row of setules on inner margin. Exopod 3-segmented; exp-1 and exp-2 armed with stout spinules along outer margin and distal corner and setules along inner margin, respectively; exp-1 with 1 pinnate outer spine and 1 oblique row of stout spinules on anterior surface; exp-2 with 1 pinnate outer spine; exp-3 elongate, longest, armed with stout spinules along outer margin and setules on inner margin, with 2 pinnate outer spines, 1 stout pinnate apical seta, and 1 plumose apical seta. Endopod 2-segmented, reaching to about 1/5 of exp-3 proximally; each segment armed with spinules along outer margin and setules along inner margin; enp-1 small, slightly shorter than width; enp-2 elongate, tapering distally, with 1 row of spinules on inner margin distally, 1 small pinnate seta on outer margin subdistally, and 1 long plumose seta on apical margin.

P4 (Fig. 76B). Intercoxal plate well-developed, arched. Coxa with 3 rows of spinules on anterior surface, 1 row of spinules on posterior surface, and 1 row of spinules on outer margin posteriorly. Basis smaller than coxa, with 2 rows of spinules and 1 tube pore on anterior margin, 1 plumose seta on outer margin, and 1 row of setules on inner margin. Exopod 3-segmented; exp-1 and exp-2 armed with stout spinules along outer margin and distal corner and setules along inner margin, respectively; exp-1 with 1 pinnate outer spine and 1 oblique row of stout spinules on anterior surface; exp-2 with 1 pinnate outer spine; exp-3 elongate, longest, armed with stout spinules along outer margin and setules on inner margin, with 2 pinnate outer spines, 1 stout pinnate apical seta, and 1 plumose apical seta. Endopod 2-segmented, reaching to about 1/3 of exp-2 proximally; each segment armed with spinules along outer margin and setules along inner margin; enp-1 small, slightly shorter than width; enp-2 elongate, tapering distally, with 1 small pinnate seta on outer margin subdistally, and 1 long pinnate seta on apical margin.

P5 (Fig. 75C). Baseoendopod broad, with 1 outer peduncle bearing 1 slender seta, armed with long setules along inner margin; outer peduncle with 1 row of spinules anteriorly and 1 row of setules posteriorly; endopodal lobe triangular in shape, exceeding end of exopod, with 2 pinnate setae on apical margin, and 1 pinnate seta distally and 2 pectinate setae proximally on inner margin. Exopod small, about 2.1 times as long as width, distinctly separated from baseoendopod, armed with setules along inner and outer margin, with 1 apical and 2 subapical pinnate setae.

**Male.** Sexual dimorphism in urosome, A1, P2–P6.

Habitus (Fig. 73C) similar to that of female; genital somite and third urosomite (Fig. 77A, B) separate.

Antennule (Fig. 77C) 6-segmented; segment 1 with 1 group of spinules; segment 2 longest; segment 4 smallest; segment 5 stout, with 1 button-like process and 1 pointed process; segment 6 unguiform, hooked, with 1 spine-like process. Setal formula as follows: 1-[1], 2-[9], 3-[8], 4-[1], 5-[8 + ae], 6-[9].

P2 exp-2 with small inner seta like that of P3 (Fig. 76D).

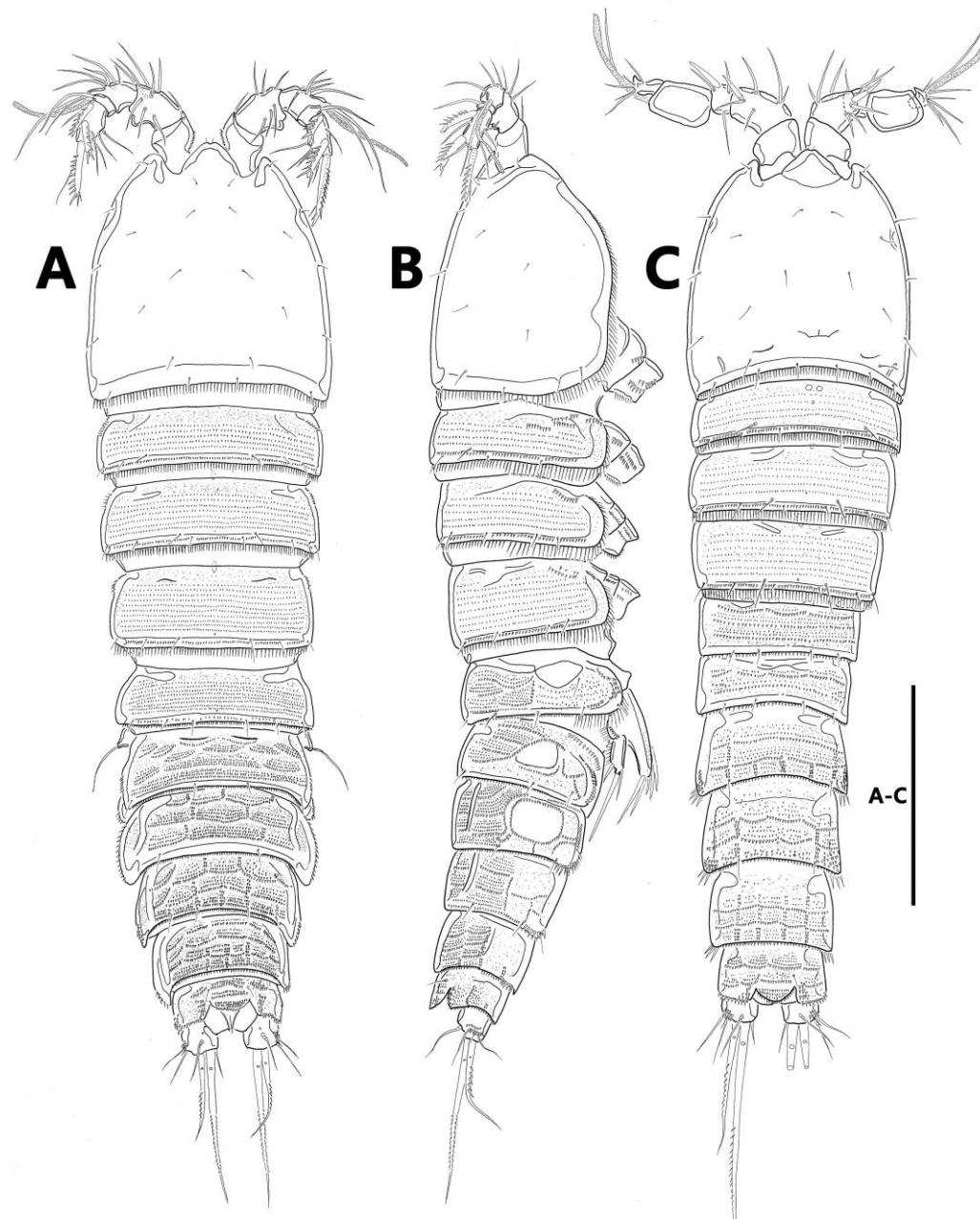
P3 endopod (Fig. 76C) modified, 3-segmented; distal margin of enp-2 forming apophysis; enp-3 elongate, with 1 small inner seta and 1 long apical seta. Inner seta on exp-3 smaller than that of female.

P4 (Fig. 77D). Exp-2 smaller than that of female; exp-3 smaller than that of female, with 1 small inner seta, 2 pinnate apical spines, and 1 pinnate outer spine.

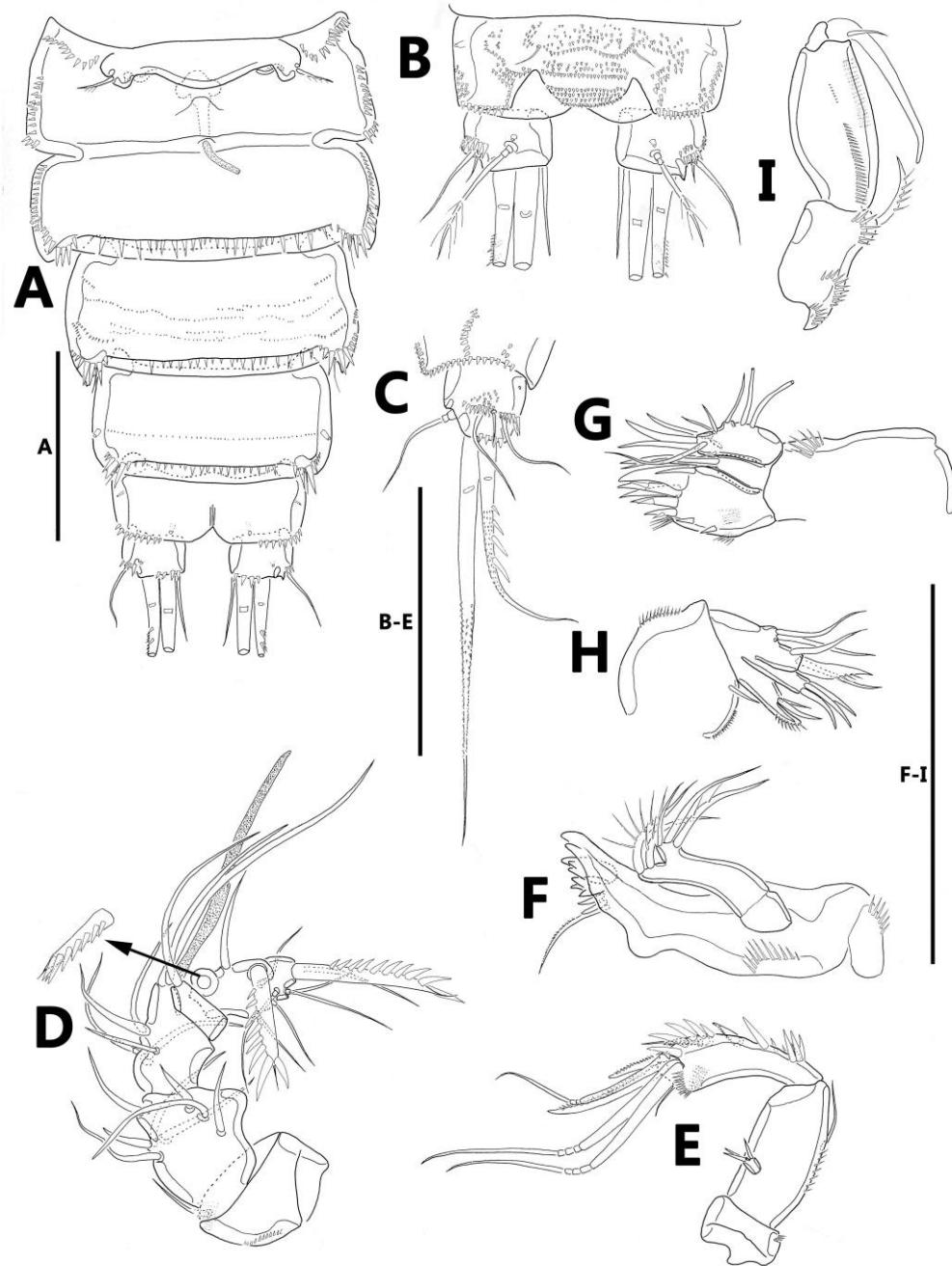
P5 (Fig. 77B), baseoendopod and exopod fused, plate-like, with 1 serrate, 2 plumose, and 2 bare setae on inner lobe (baseoendopodal lobe) and 1 long bare seta and 1 group of spinules on outer lobe.

P6 vestigial, without seta.

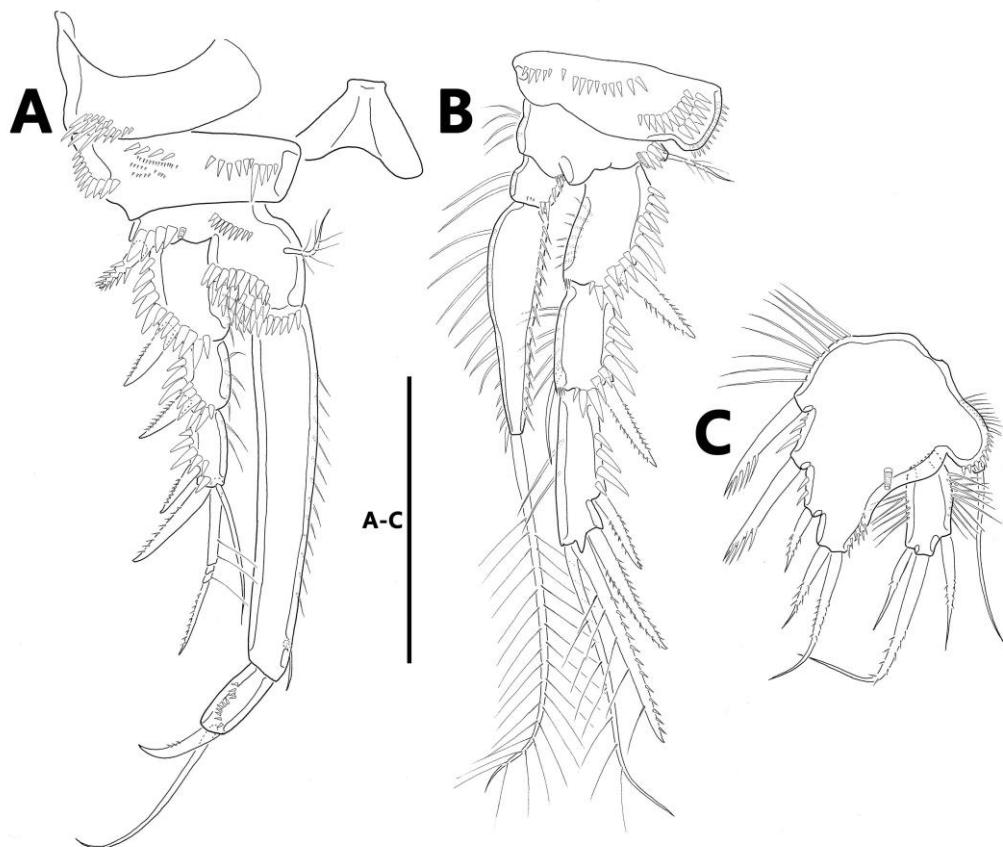
**Remarks.** This new species is mostly closed to *Alpolethon* species in the superfamily Laophontidea. However, it is clearly distinguishable from the latter by the characteristic feature of A1, A2, mandible, P3, P4, and sexual dimorphism of P4 in male (see remarks on Laophontoidea gen. nov.).



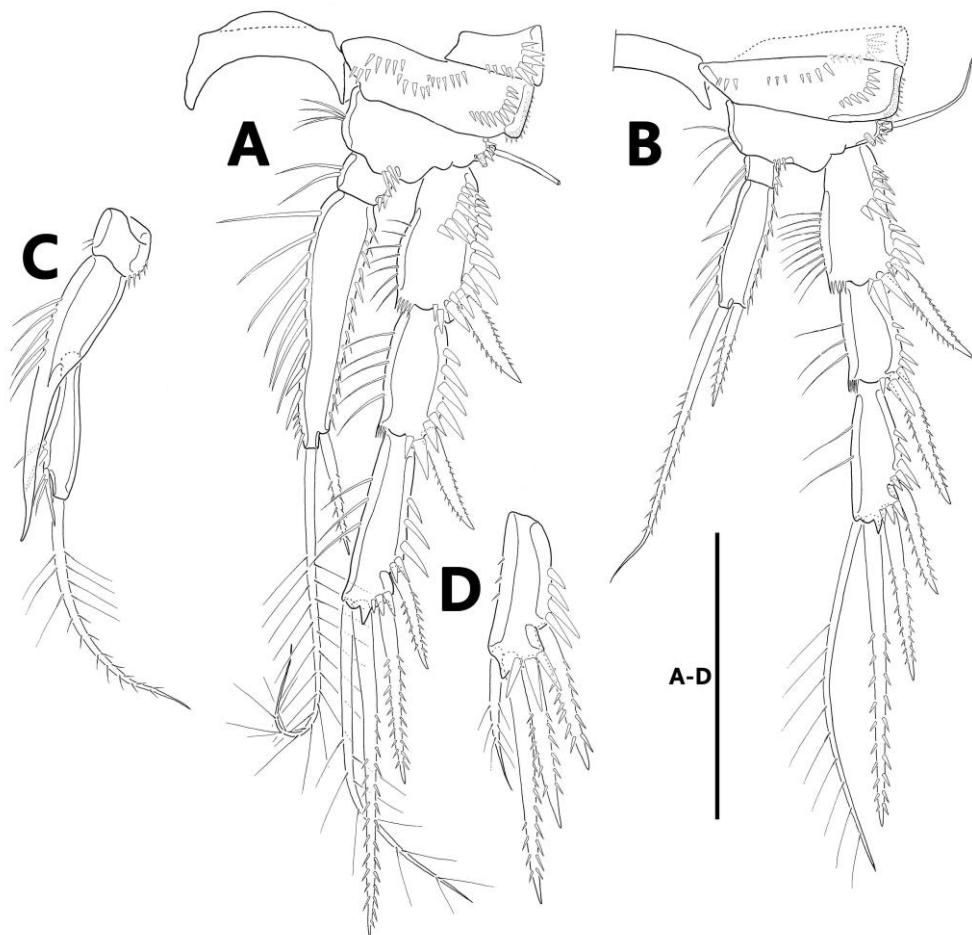
**Fig. 73.** *Laophontoidea* gen. nov. & sp. nov., female (A, B). A, habitus, dorsal; B, habitus, lateral. Male (C): C, habitus, dorsal. Scale bar: 100  $\mu$ m.



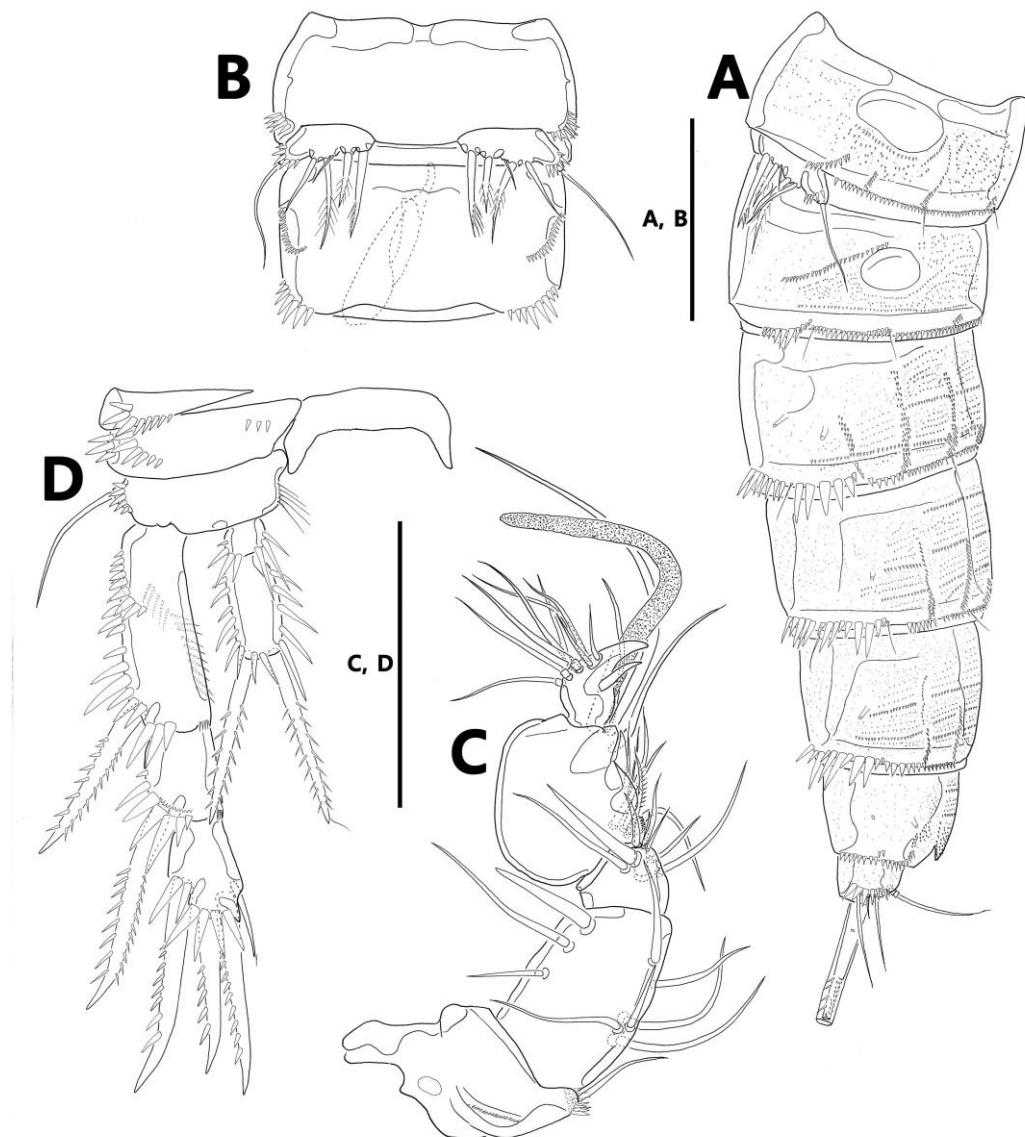
**Fig. 74.** *Laophontoidea* gen. nov. & sp. nov., female. A, urosome except for P5-bearing somite, ventral; B, anal somite and caudal rami, dorsal; C, caudal ramus, lateral; D, antennule; E, antenna; F, mandible; G, maxillule; H, maxilla; F, maxilliped. Scale bars: 50  $\mu$ m.



**Fig. 75.** *Laophontoidea* gen. nov. & sp. nov., female. A, P1; B, P2; C, P5. Scale bar: 50  $\mu$ m.



**Fig. 76.** *Laophontoidea* gen. nov. & sp. nov., female (A, B). A, P3; B, P4. Male (C, D): C, P3 endopod; D, P3 exp-3. Scale bar: 50  $\mu$ m.



**Fig. 77.** *Laophontoidea* gen. nov. & sp. nov., male. A, urosome, lateral; B, first and second urosomites, ventral; C, antennule; D, P4. Scale bars: 50  $\mu$ m.

## Family Laophontidae T. Scott, 1904 가혹노벌레 과

### 한국산 가혹노벌레 과(Laophontidae)의 속에 대한 검색표(공생성 제외)

1. 제 2 흉지 외지 세 번째 마디는 3 개의 강모를 가진다; 제 2 흉지 내지 두 번째 마디는 1 개의 강모를 가진다..... *Jejulaophonte*
  - 이 형질들을 나타내지 않는다..... 2
2. 제 2 촉각 외지는 잘 발달되어 있지 않다..... 3
  - 제 2 촉각 외지는 잘 발달되어 있다 ..... 4
3. 제 1 촉각은 7 마디로 이루어져 있다
  - ..... 이형가혹노벌레 속 *Heterolaophonte*
  - 제 1 촉각은 6 마디로 이루어져 있다
    - ..... 오가혹노벌레 속 *Quinquelaophonte*
4. 제 5 흉지 기내지는 3 개의 강모를 가진다
  - ..... 발톱칼고리노벌레 속 *Onychocamptus*
  - 제 5 흉지 기내지는 4-5 개의 강모를 가진다..... 5
5. 제 2-4 흉지 내지의 첫 번째 마디는 내측강모를 가지지 않는다; 제 4 흉지 내지의 마지막 마디는 4 개의 강모를 가진다
  - ..... 부가혹노벌레 속 *Paralaophonte*
  - 위의 형질들을 나타내지 않는다 ..... 가혹노벌레 속 *Laophonte*

### Genus *Laophonte* Philippi, 1840 가혹노벌레 속

모식종: *Laophonte cornuta* Philippi, 1840

### 한국산 가혹노벌레 속(*Laophonte*)의 종에 대한 검색표

1. 제 4 흉지 내지는 1 마디로 이루어져 있다..... 2

- 제 4 흉지 내지는 2 마디로 이루어져 있다 ..... 3
- 2. 미차의 길이는 그 너비의 약 1.5 배 정도이다 .....  
.....못난마디가혹노벌레 *L. inopinata*
- 미차의 길이는 그 너비의 약 6.0 배 정도이다 .....  
.....긴꼬리가혹노벌레 *L. longistylata*
- 3. 제 2 흉지 내지의 첫 번째 마디는 내측강모를 가진다; 항문절의 등면에  
돌기를 가진다 .....큰혹가혹노벌레 *L. cornuta*
- 제 2 흉지 내지의 첫 번째 마디는 내측강모를 가지지 않는다; 항문절의  
등면에 돌기를 가지지 않는다 ..... 4
- 4. 제 2 흉지 내지의 두 번째 마디는 강모 3 개를 가진다 .....  
.....긴더듬이가혹노벌레 *L. denticornis*
- 제 2 흉지 내지의 두 번째 마디는 강모 4 개를 가진다 ..... 5
- 5. 제 4 흉지 내지의 두 번째 마디는 내측강모 1 개를 가진다; 미차의  
길이는 그 너비의 약 4.0 배 이상이다 ..... 6
- 제 4 흉지 내지의 두 번째 마디는 내측강모 2 개를 가진다; 미차의  
길이는 그 너비의 약 2.0 배 정도이다 ..... 7
- 6. 제 3-4 흉지의 외지 세 번째 마디는 내측강모 1 개를 가진다 .....  
.....긴가혹노벌레 *L. thoracica*
- 제 3-4 흉지의 외지 세 번째 마디는 내측강모 2 개를 가진다 .....  
.....긴다리가혹노벌레 *L. elongate barbata*
- 7. 제 2-5 흉절의 등면에 쌍을 이루는 돌기를 가진다 .....  
.....등가시가혹노벌레 *L. dinocerata*
- 제 2-5 흉절의 등면에 쌍을 이루는 돌기를 가지지 않는다 .....  
.....꼬마가혹노벌레 *L. inornata*

### 68. *Laophonte cornuta* Phillippi, 1840 큰가혹노벌레

*Laophonte cornuta* Phillippi, 1840, p. 195, pl. 3, fig. 13 (cited from Lang 1948); Brady, 1910, p. 523, fig. 15, pl. 57:1; Lang, 1934, p. 36, figs. 88–90; Lang, 1948, p. 1347, figs. 543: 1, 544: 1; Lang, 1965, p. 448, figs. 242–243, pl. 5: c–e; Itô, 1968, p. 377, figs. 6–8; Gómez & Boyko, 2006, p. 5, figs. 1–10.

**관찰재료:** 2♀♀, 제주 제주시 우도면 연평리, 검멀레해수욕장(사질), 2014.6.24; 1♀, 전남 완도군 금일면 동백리, 금일도(light trap), 2015.3.18; 2♀♀, 경북 영덕군 축산면 경정리, 2014.9.17; 1♀, 충남 태안군 승언리, 꽃지해수욕장(조사웅덩이), 2015.10.30; 3♀♀, 경북 울릉군 울릉읍, 울릉도, 죽도(14m, 해조류), 2016.06.16.

**분포:** 범세계적.

**고찰:** 한국산 시료는 Lang (1934, 1948), Itô (1968) 그리고 Gómez & Boyko (2006)의 기재문과 각 부속지들의 형질에서 잘 일치한다. Lang (1965)과 Gómez & Boyko (2006)는 몸의 표면을 잘 묘사하였는데, 각각의 그림에 따르면 이들의 표본은 짙은 돌기들을 가지고 있다. 그러나 Kim (2013)의 사진에 의하면 강원도와 제주도 우도에서 채집된 표본은 각 체절의 뒤쪽 가장자리에 작은 돌기들이 조밀하게 배치되어 있다. 본 연구에서는 우도에서 채집된 개체군에서 위의 두 가지 형태가 모두 확인, 관찰되었다. 이 분류군에서 나타나는 몸의 장식의 차이의 의미를 파악하기 위하여 추후 연구가 더 필요할 것으로 판단된다.

### 69. *Laophonte inopinata* A. Scott, 1902 옻난마디가혹노벌레

*Laophonte inopinata* A. Scott, 1902, p. 413, pls. 1: 16, 2: 9–14; Thompson & A. Scott, 1903, p. 266; Gurney, 1927, p. 553; Lang, 1948, p. 1355, fig. 546; Kim, 2013, p. 18.

**분포:** 한국, 스리랑카, 홍해, 영국.

**관찰재료:** 10♀♀, 강원 삼척시 교동, 2014.9.16.

**고찰:** 본 연구에서 관찰한 시료는 제 4 흉지와 미차의 형질들에서 과거 문헌들(A. Scott 1902; Lang 1948)과 잘 일치하였다.

### Genus *Heterolaophonte* Lang, 1948 이형가혹노벌레 속

**모식종:** *Heterolaophonte stroemii* (Baird, 1837)

#### 70. *Heterolaophonte discophora sensu* Itô, 1974 꼬인이형가혹노벌레

*Heterolaophonte discophora*: Itô, 1974, p. 628, figs. 42–47; Kim, 2013, p. 25, fig. 9.

[non] *Laophonte discophora* Willey, 1929, p. 531, figs. 2, 3, 6.

[non] *Heterolaophonte discophora*: Lang, 1948, p. 1375, fig. 557: 1; Lang, 1965, p. 480, figs. 262–265.

**관찰재료:** 2♀♀, 1♂, 소량마을, 경남 남해군 상주면 양아리(해조류), 2014.3.14.

**분포:** 한국, 일본.

**고찰:** 꼬인이형가혹노벌레(*Heterolaophonte discophora*)는 Willey (1929)에 의해 최초로 캐나다에서 기록되었는데, 제 4 흉지 외지 세 번째 마디가 길고, 말단부위가 기저부보다 넓다는 것이 이 종의 특징이다. Lang (1965)와 Itô (1974)는 각각 미국과 일본에서 이 종을 보고하였는데, 이 마디의 일반적인 형태는 비슷하지만 그 길이 : 너비의 비가 매우 작아 서로 큰 차이를 보인다. Itô (1974)는 이를 변이로 여기고 일본산 개체를 *H. discophora*로 보고하였다. 한편, Bang et al. (2011)은 이 속의 종에 대한 검색표를 제시하였는데, 그들에 따르면 제 5 흉지 기내지의 강모수는 종을 구별하는 형질 중 하나이다. 이 점에서 일본산 개체들은 이 마디에 5 개의 강모를 가지고 있으나 Lang (1948, 1965)에 의해 *H. discophora*로 기록된 개체들은 4 개의 강모를 가지고 있다. Willey (1929)의 원기재문에서는 제 5 흉지 기내지의 형태를 다루지 않았다. Itô (1974)는 Lang

(1965)이 5개의 강모를 가지고 있는 *H. rotundipes* Chappuis, 1957 를 *H. discophora* 의 동종이명 처리한 점을 강조하였고, 이러한 맥락에서 일본산 개체를 같은 종으로 보았다. 그러나, 현대의 갈고리노벌레의 분류학적 관점과 Bang et al. (2011)의 검색표를 고려할 때, Itô (1974)가 종을 오동정한 것으로 보인다.

한국에서는 Kim (2013)에 의하여 *H. discophora* 가 해조류에서 서식하는 것으로 보고되었다. Kim (2013)의 보고는 제4흉지와 제5흉지의 형질들을 고려할 때 *H. discophora* sensu Itô, 1974 와 잘 일치하여 같은 종으로 판단된다. 한국산 시료의 분류학적 위치를 명확히 하기 위해서는 우리나라의 여러 지역의 개체들 사이의 비교 연구, 캐나다산 개체와의 비교 연구 등이 필요하다.

### Genus *Paralaophonte* Lang, 1948 부가혹노벌레 속

#### 한국산 부가혹노벌레 속(*Paralaophonte*)의 종에 대한 검색표

1. 제3흉지의 세 번째 마디는 내측강모 1개를 가진다 .....  
.....작은부가혹노벌레 *P. obscura*
- 제3흉지의 세 번째 마디는 내측강모 2개를 가진다.....2
2. 제1흉지의 외지는 두 마디로 이루어져 있다; 미차의 길이는 그 너비의 약 3.5 배이다 .....곧은꼬리부가혹노벌레 *P. macera*
- 제1흉지 외지는 세 마디로 이루어져 있다; 미차의 길이는 그 너비의 최대 2.0 배이다 .....3
3. 수컷 제5흉지 외지는 4개의 강모를 가진다 .....  
.....뭉친허리부가혹노벌레 *P. lacerdai*
- 수컷 제5흉지 외지는 5개의 강모를 가진다 .....  
.....동종부가혹노벌레 *P. congenera*

**71. *Paralaophonte congenera* (Sars, 1908) 동종부가혹노벌레**

*Laophonte congenera* Sars, 1908, p. 257, pl. 167

*Paralaophonte congenera*: Lang, 1948, p. 1391, fig. 565: 3; Yeatman, 1962, p. 267, figs. 61–75; Hamond, 1969, p. 9, figs. 32–36; Yoo & Lee, 1995, p. 45, fig. 17; Lee et al., 2012, p. 68, figs. 42–45; Gómez & Morales-Serna, 2013, p. 15, figs. 10–14.

**관찰재료:** 3♀♀, 울산시 을주군 서생면 진하리, 솔개해수욕장, 2012.5.18; 5♀♀, 1♂, 전남 완도군 신지면 대평리, 2012.5.20.

**분포:** 범세계적.

**고찰:** Huys & Lee (2009)는 부가혹노벌레 속(*Paralaophonte*)의 종에 대한 검색표와 형질비교표를 제시하고, 제 1 촉각의 두 번째 마디에서 돌기의 유무와 크기를 부가혹노벌레 속의 종을 구분하는 중요한 형질로 사용하였다. 그 예로 그들은 동종부가혹노벌레(*Paralaophonte congenera congenera*)와 *P. brevirostris* 를 제 1 촉각의 마디 수와 돌기의 유무로 구분하였다. 그러나, Gómez & Morales-Serna (2013)는 과거 문헌들에서 이 두 종은 위의 형질들에서 큰 변이를 보였다는 점을 강조하고, 제 1 촉각의 두 번째 마디에 작은 돌기를 가지고 있는 멕시코산의 시료를 잠정적으로 동종부가혹노벌레로 보고하였다. 본 연구에서 관찰한 시료도 멕시코산과 같이 이 마디에 작은 돌기를 가지고 있다.

**Genus *Jejulaophonte* Back & Lee, 2014**

**모식종:** *Jejulaophonte hyeopjaeensis* Back & Lee, 2014

**72. *Jejulaophonte hyeopjaeensis* Back & Lee, 2014**

*Jejulaophonte hyeopjaeensis* Back & Lee, 2014a, p. 4, figs. 1–8.

**관찰재료:** 1♀, 제주 제주시 구좌읍 김녕리, 김녕해수욕장(사질), 2014.6.23; 15♀♀, 5♂♂, 제주 제주시 한립읍 협재리, 협재해수욕장(사질), 2014.6.26; 1♀, 강원 고성군 죽왕면 오호리, 송지호해변, 2016.7.20.

**분포:** 한국.

**고찰:** Back & Lee (2014a)는 이 종을 모식종으로 지정하고 *Jejulaophonte* 를 새로이 설정하였다. 이 속은 가혹노벌레과에 위치하고 있는 속 가운데에서 *Carraroenia* McCormack, 2006, *Coullia* Hamond, 1973, *Hemilaophonte* Jakubisiak 1933, *Psammoplatus* Lee & Huys, 1999, *Robustumguis* Fiers, 1992 와 유사하지만, 제 3-4 흉지 외지의 두 번째 마디에 내측강모가 존재하는점, 제4 흉지 내지의 두 번째 마디에 4 개의 강모를 가지는 점, 제 3-4 흉지 내지의 두 번째 마디에 1 개의 내측강모를 가지는 점 등의 형질상태에서 다른 5 개의 속들과 차이를 나타내고 있다.

본 연구에서는 모식산지뿐만 아니라 강원도 고성에서도 *J. hyeopjaensis* 01 채집, 확인되었다. 이 종은 주로 사질 저질에서만 서식하는 것으로 추측된다.

#### Family Normanellidae Lang, 1944

#### Genus *Normanella* Brady, 1880

**모식종:** *Normanella dubia* Brady, 1880

#### 한국산 *Normanella* 속의 종에 대한 검색표

1. 꼬리강모 IV 와 V 는 internal fracture planes 을 가지지 않는다; 몸의 등면에 돌기들을 가진다 ..... *N. spinosa*
- 꼬리강모 IV 와 V 는 internal fracture planes 을 가진다; 몸의 등면에 돌기를 가지지 않는다 ..... *Normanella* sp. nov.

**73. *Normanella* sp.nov.** (Figs. 78–82)

**Type locality.** Off Jangsado Island ( $34^{\circ}42.80'N$ ,  $128^{\circ}33.65'E$ ), Hansan-myeon, Tongyeong-si, Gyeongsangnam-do, Korea.

**Type material examined.** Holotype ♀ (NIBRIV0000326497) dissected on one slide. Allotype ♂ (NIBRIV0000326498) dissected on one slide. Paratypes, 2 ♀♀ (NIBRIV0000326499, NIBRIV0000326500) dissected on each slide. All examined specimens were collected from the type locality by SCUBA diving on 23 March 2014.

**Description. Female.** Body (Fig. 78A, B) elongate, subcylindrical, and ornamented with delicate setules on surface except cephalothorax and paired sensilla; conspicuous boundary between prosome and urosome absent. Total body length in lateral view 627  $\mu m$  measured from anterior margin of rostrum to posterior margin of caudal rami. Rostrum (Fig. 74C) bell-shaped, defined at base, and with pair of sensilla subapically and tube pore near apex dorsally; apex triangular with pointed tip.

Prosome (Fig. 78A, B) 4-segmented. Cephalothorax ornamented with areolation and 33 sensilla on surface; posterior boundary and ventrolateral margin serrate. Each pedigerous somite ornamented with areolation anteriorly and minute setules posteriorly, and paired sensilla; posterior boundary and posterolateral corner serrate.

Urosome (Figs. 78A, B, 79A) 5-segmented. P5 bearing somite ornamented with areolation anteriorly and minute setules posteriorly; posterior boundary serrate, and with 2 pairs of sensilla. Genital double-somite (Figs. 78A, B, 79A) separated by suture, but fused ventrally; dorsal and lateral surfaces covered with minute setules; anterior somite with 3 pairs of sensilla dorsally and 2 or 3 small spinules ventrolaterally on posterior border; second somite with 3 pairs of sensilla dorsally and bump bearing sensillum ventrolaterally on posterior border; ventrolateral corner ornamented with row of spinules; genital field with large copulatory pore medially; genital apertures (Fig. 79B) covered by slit bearing 1 plumose and 1 small naked setae (represent P6). Urosomite 4 covered with minute setules; posterior margin serrated dorsally, and with row of ventral setules; ventral surface with paired sensilla; ventrolateral corner with bump bearing sensillum and row of spinules. Urosomite 5 similar to proceeding one except absence of paired sensilla on ventral surface. Anal somite with 2 paired sensilla on dorsal surface and 2 paired tube pores on ventral surface; posterior margin with 1 row of

spinules laterally and ventrally; operculum well-developed, rounded, and with 1 row of setules.

Caudal rami (Figs. 78A, B, 79A) cylindrical, approximately twice as long as wide, armed with spinules along outer margin proximally and setules along inner margin; each ramus with 3 tube pores, each inserted in inner margin medially, distal outer corner ventrally, and near caudal seta VII, respectively, and 7 setae: setae I and II bare, inserted midway in outer margin; seta III slender, bare and as long as caudal rami; setae IV fused with seta V (Fig. 78C) basally, and with internal fracture plane proximally; seta V well-developed, about 3 times as long as seta IV, and with internal fracture plane proximally; seta VI small and bare; seta VII tri-articulated basally.

Antennule (Fig. 79D, E) 5-segmented; segment 1 with 2 rows of spinules and 1 pinnate seta; segment 2 with 3 bare and 5 pinnate setae; segment 3 longest, with 4 pinnate spine-like, 1 long pinnate, 2 bare setae on anterior margin, 2 long bare setae on small peduncle, and aesthetasc fused with long seta basally on large peduncle; segment 4 shortest, and with 2 pinnate and 1 bare setae; segment 5 with 1 stout (spine-like) plumose, 2 plumose, 5 bare setae, and apical aesthetasc fused with long seta basally.

Antenna (Fig. 79F). Coxa small (omitted in figure). Allobasis elongate, partially separated by suture, and with 1 row of setules on proximal segment and pinnate abexopodal seta on distal segment. Exopod 1-segmented, slender, and with 2 lateral and 2 apical plumose setae. Endopod subequal to allobasis in length, outer margin armed with 1 spinular sets and 2 spines, distal margin armed with transverse hyaline frill, and with 1 pinnate spines, 3 geniculate setae, and 1 long spinulose seta fused with basally delicate seta.

Labrum (Fig. 79G) trapezoidal, and with paired rows of setules on posterior surface and row of serrate spinules along anterior margin.

Mandible (Fig. 80A). Gnathobase well-developed, with 2 bicuspид stout teeth, 2 multicuspид teeth, and 1 pinnate seta along distal margin. Basis with 2 long plumose setae and 2 rows of setules. Exopod 1-segmented, elongate, and with 1 plumose seta; lateral margin ornamented with 1 row of setules. Endopod 1-segmented, with 4 setae.

Maxillule (Fig. 80B). Praecoxa with 2 rows of setules along outer margin; arthrite well-developed, and armed with 6 spines, innermost one of which slender, and 1 pinnate seta along distal margin; anterior surface with 2 parallel setae. Coxal with setules along outer margin;

endite bearing 1 stout and 1 slender setae. Basal endite with 2 long pinnate and 1 long naked setae apically; small peduncle bearing 2 plumose setae; surface armed with setules. Exopod 1-segmented and with 2 plumose setae apically. Endopod incorporated into basis and represented by 3 plumose setae.

Maxilla (Fig. 80C). Syncoxa armed with 2 rows of setules along outer margin, with 3 endites; proximal endite small, cylindrical, and with 1 pinnate seta; middle endite with 2 naked and 1 plumose setae fused with endite basally; distal endite with 1 naked seta and 2 spines, each bearing small spinule. Allobasis drawn out into strong claw armed with spinules, with 1 bare and 1 naked setae, and 1 spine. Endopod incorporated into allobasis, and represented by 3 setae. Exopod absent.

Maxilliped (Fig. 80D). Syncoxa elongate, with 2 plumose setae at distal corner and 2 rows of setules on surface. Basis longer than syncoxa, with 1 row of setules on outer margin subdistally and 1 row of spinules on surface. Endopod 1-segmented, with 1 long and 1 small setae, and 1 pinnate claw.

P1 (Fig. 80E). Preacoxa small, with row of spinules along distal margin. Coxa large, with rows of spinules on anterior and posterior surfaces and row of setules on outer margin distally. Basis with 1 inner and 1 outer pinnate spines; anterior surface with 1 tube pore and 3 rows of spinules; inner margin with 1 row of setules. Exopod 3-segmented; exp-1 with 1 outer pinnate spine and rows of spinules on anterior surface and outer margin; exp-2 with 1 outer pinnate spine, rows of spinule on outer margin, and row of setule on inner margin; exp-3 with 3 pinnate spines and 2 geniculate setae. Endopod 2-segmented; enp-1 elongate, 1.6 times as long as exopod, and with 2 rows of setules along inner and outer margins, and 1 inner seta; enp-2 short, with 1 small seta on inner margin, 1 denticulate claw and 1 geniculate seta on distal margin, and few setules along outer margin.

P2–P4 (Figs. 80F, 81A, B). Preacoxa smaller than that of P1. Coxa large, with 2 rows of spinules and 1 tube pore on anterior surface. Basis smaller than coxa, with 1 spine (P2) or seta (P3, P4) on outer peduncle, 2 or 3 rows of spinules and 1 tube pore on anterior surface, and 1 row of setules along inner margin. Exopod 3-segmented, longer than endopod; each segment armed with spinules along outer margin; exp-1 and -2 armed with setules along inner margin, respectively. Endopod 2-segmented; each segment armed with setules along outer

and inner margins except P4 enp-1; enp-2 of P3 and P4 with 1 tube pore at distal corner, respectively.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.023	1.120
P2	0.1.123	1.321
P3	0.1.223	1.321
P4	0.1.223	1.221

P5 (Fig. 81C). Baseoendopod with outer peduncle bearing seta; endopodal lobe elongate, triangular in shape, extending to 5/6 of exopod, slightly curved outward, armed with setules on inner and outer margins, and with 3 tube pores and 5 setae; second innermost seta on endopodal lobe is half of third seta in length. Exopod elongate, 4.5 times as long as width, armed with setules on inner and outer margins, and with 1 inner, 1 apical, and 4 outer setae; apical seta on exopod about 2 times as long as inner seta.

**Male:** Body (Fig. 82A) smaller and slender than female; total body length 421  $\mu\text{m}$  measured from anterior margin of rostrum to posterior margin of caudal rami; ornamentation similar to that of female.

Urosome (Fig. 82A–C) 6-segmented, composed of P5 bearing-somite, genital somite, urosomites 3–5, and anal somite, and tapering posteriorly.

Antennule (Fig. 82D) 7-segmented and subchirocer; segment 1 with 2 spiny rows and 1 pinnate seta on distal anterior margin; segment 2 as long as proceeding one and with 11 elements; segment 3 with 4 naked and 2 pinnate setae; segment 4 smallest and with 1 pinnate and 1 bare setae; segment 5 largest, swollen, with 4 pinnate setae, 6 bare setae, and 1 spine along inner margin, and with peduncle bearing 2 long bare setae and 1 aesthetasc (fused to seta basally); segment 6 with 3 spine-like processes and 1 bare seta; segment 7 triangular in shape and with 8 setae and 1 aesthetasc.

P2 enp-2 (Fig. 80G) shorter than that of female; outer seta on apical margin half of inner one in length; seta on outer margin very small and reduced to setule.

P3 enp-2 (Fig. 81D) modified, with tube pore and recurved apophysis which slightly shorter than second endopod in length, and having 2 extremely reduced setae on apical margin; inner seta on apical margin longer than outer one.

P4 enp-2 (Fig. 81E) smaller than that of female.

P5 (Fig. 82B). Each baseoendopod fused medially and with small peduncle bearing outer seta; endopodal lobe with 2 pinnate apical setae on apical margin and 1 tube pore on inner margin. Exopod with 2 outer, 1 apical, and 1 inner setae.

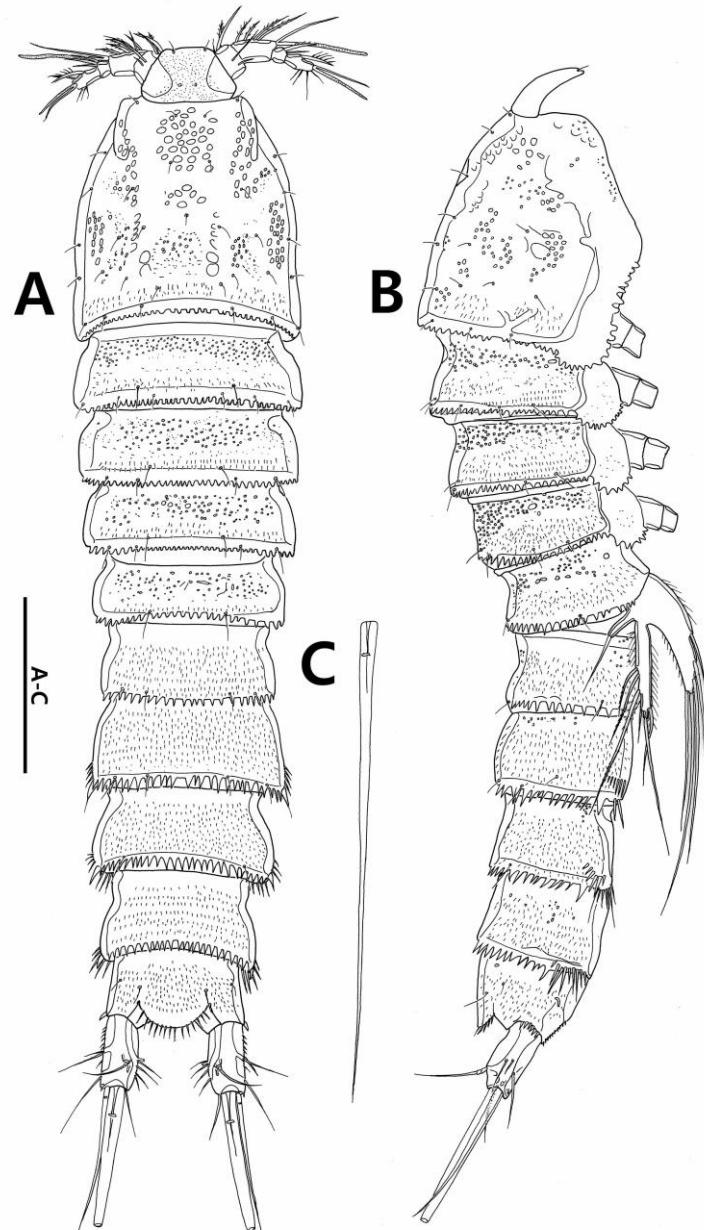
P6 (Fig. 82B) asymmetrical; each lobe with 3 slender setae.

**Remarks.** The present species collected from Korean waters can be placed in *Normanella* Brady, 1880 without doubt, based on having the generic characteristic features such as the five-segmented antennule in female, the mandibular endopod bearing two setae, the maxillular allobasis accompanied with two setae and one spine, the reduction of two apical elements on male P3 enp-2, and the sixth leg bearing three setae in male (Huys & Lee 1998; Lee & Huys 1999).

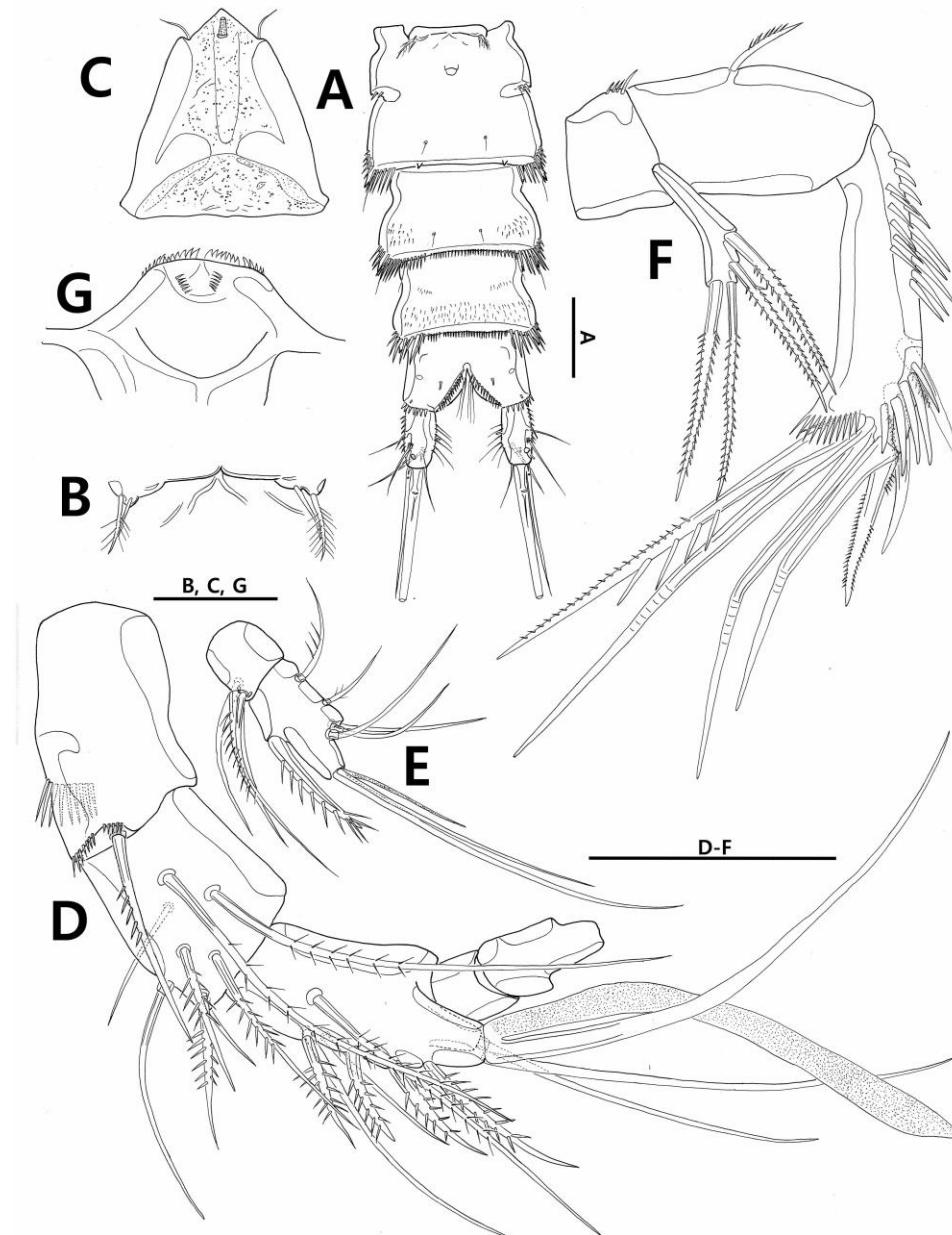
The genus *Normanella* is composed of 20 valid species worldwide (Kim et al. 2014) and is considered as a heterogeneous group composed of six lineages: *dubia*-, *mucronata*-, *minuta*-, *sarsi*-, *bolini*-, and *chanhoi*-lineages (Lee & Huys 1999; Lee et al. 2003). Among them, *Normanella* sp. nov. can be assigned in the *minuta*-lineage by the combination of following morphological features: a pointed apical tip on the rostrum, the five-segmented antennule, the female P5 exopod without a distinct notch on the outer margin, and well-developed caudal setae IV, V, each bearing internal fracture plane. Lee & Huys (1999) suggested that this *minuta*-lineages would be divided into several subgroups after the discovery of additional new species, and they gave two examples: the first group is characterized by the caudal rami more than three times as long as wide and the absence of an internal fracture plane on caudal seta IV, and comprises *N. tenuifurca* Sars, 1909a and *N. paratenuifurca* Lee & Huys, 2009; the second group is characterized by the female P5 endopodal lobe extending to the end of its exopod, containing *N. incerta* Lang, 1935, *N. porosa* Noodt, 1964, and *N. obscura* Lee & Huys, 1999.

Lee & Huys (1999) recommended that careful attention be paid to the features of rostrum, cephalic shield, P5 in both sexes, caudal rami, caudal setae IV and V, and male P2 endopod for accurate identification of normanellid species. Among this lineage (Table 3), the present

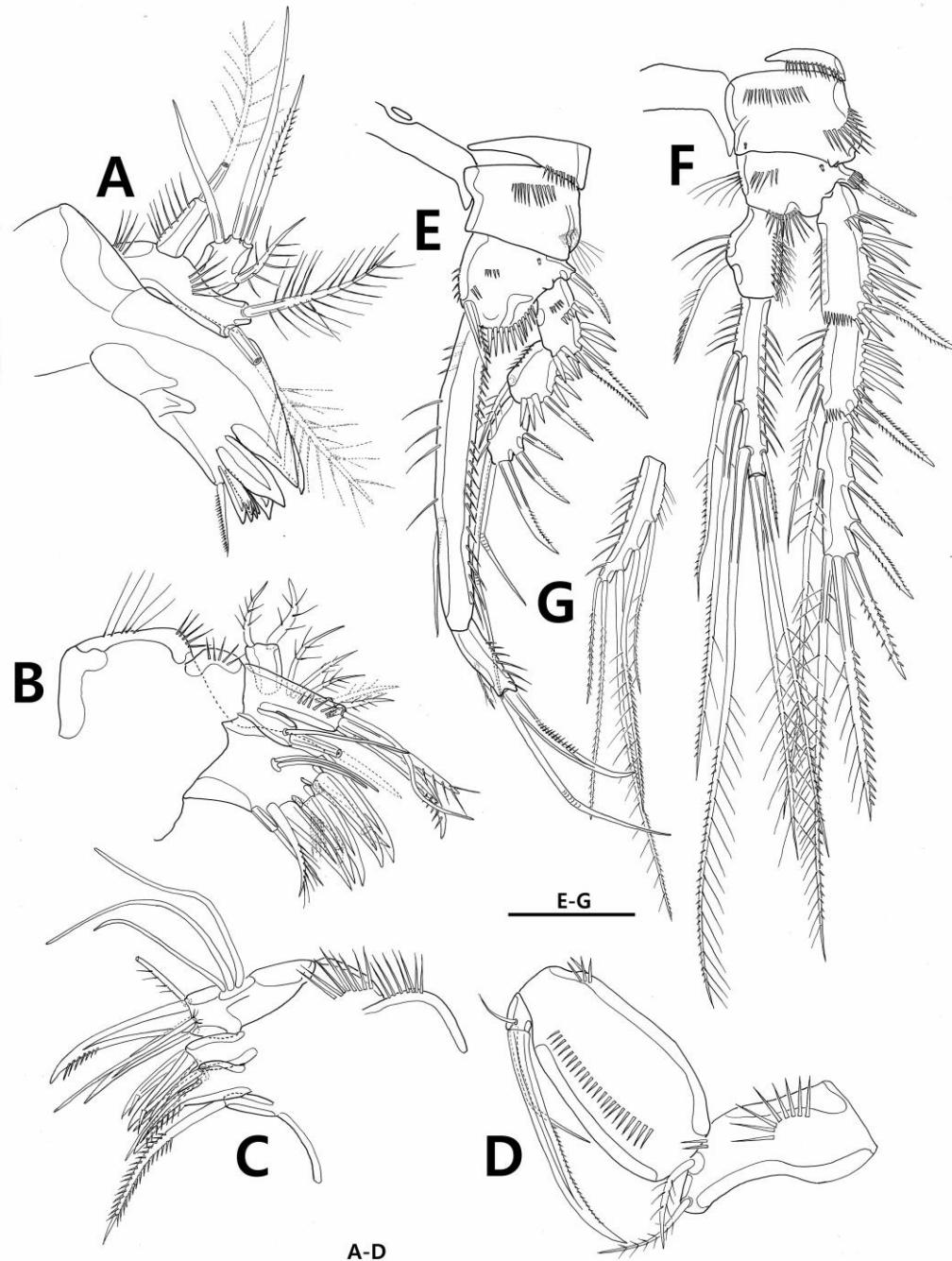
new species, *Normanella* sp. nov. has an elongate P5 exopod, which is 4.5 times as long as wide, like *N. tenuifurca* (4.4 times), *N. incerta* (4.3 times), and *N. pallaresae* (4.2 times) and an elongate P5 endopodal lobe reaching to 5/6 of exopod like *N. incerta*, *N. porosa*, and *N. obscura* in female. The length to width ratio of caudal rami in female of *Normanella* sp. nov. is approximately two times, like in females of *N. minuta*, *N. porosa*, *N. pallaresae*, and *N. obscura*. The new species is mostly similar to *N. incerta*, but it is clearly distinguished from the latter by the following features in female: the length of caudal rami is about two times as long as broad, while 2.5 times in *N. incerta*; the apical seta on exopod is about two times as long as the inner seta, while as long as in *N. incerta*; the second inner seta on the P5 endopodal lobe is half of the third one in length, while as long as in *N. incerta*. *Normanella* sp. nov. shows sexually dimorphic features in the male such that the outer seta on P2 emp-2 is remarkably reduced to a setule; the mucroniform process on the endopod of P3 is recurved and elongate, and as long as those in *N. paratenuifurca* and *N. spinosa* Kim et al., 2014. However, the author could not compare sexual dimorphic characteristics on male thoracic legs between *Normanella* sp. nov. and *N. incerta* because the latter was described on the basis of a single female specimen (Lee & Huys 1999).



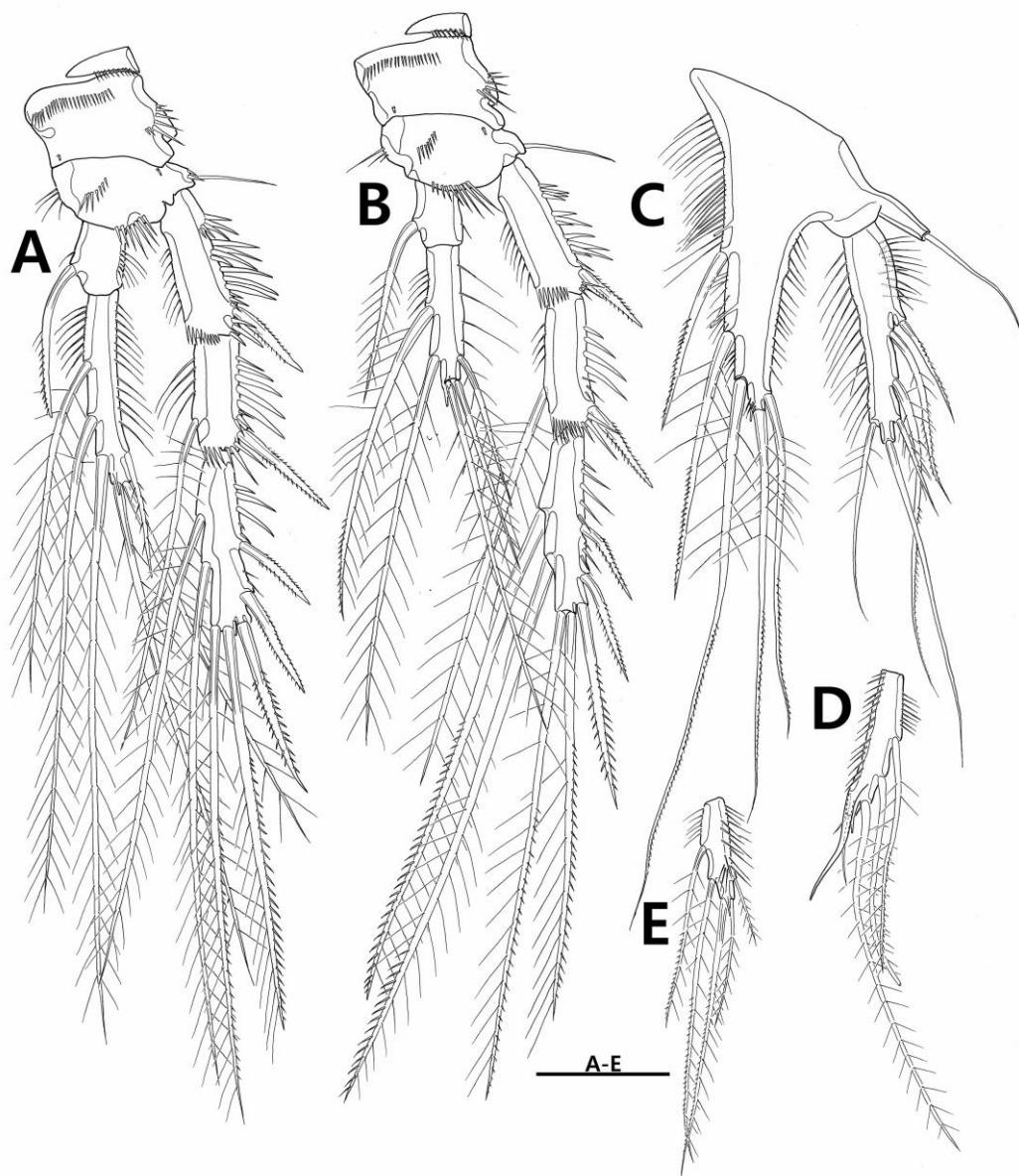
**Fig. 78.** *Normanella* sp. nov., female. A, habitus, dorsal; B, habitus, lateral; C, caudal seta V.  
Scale bar: 100  $\mu\text{m}$ .



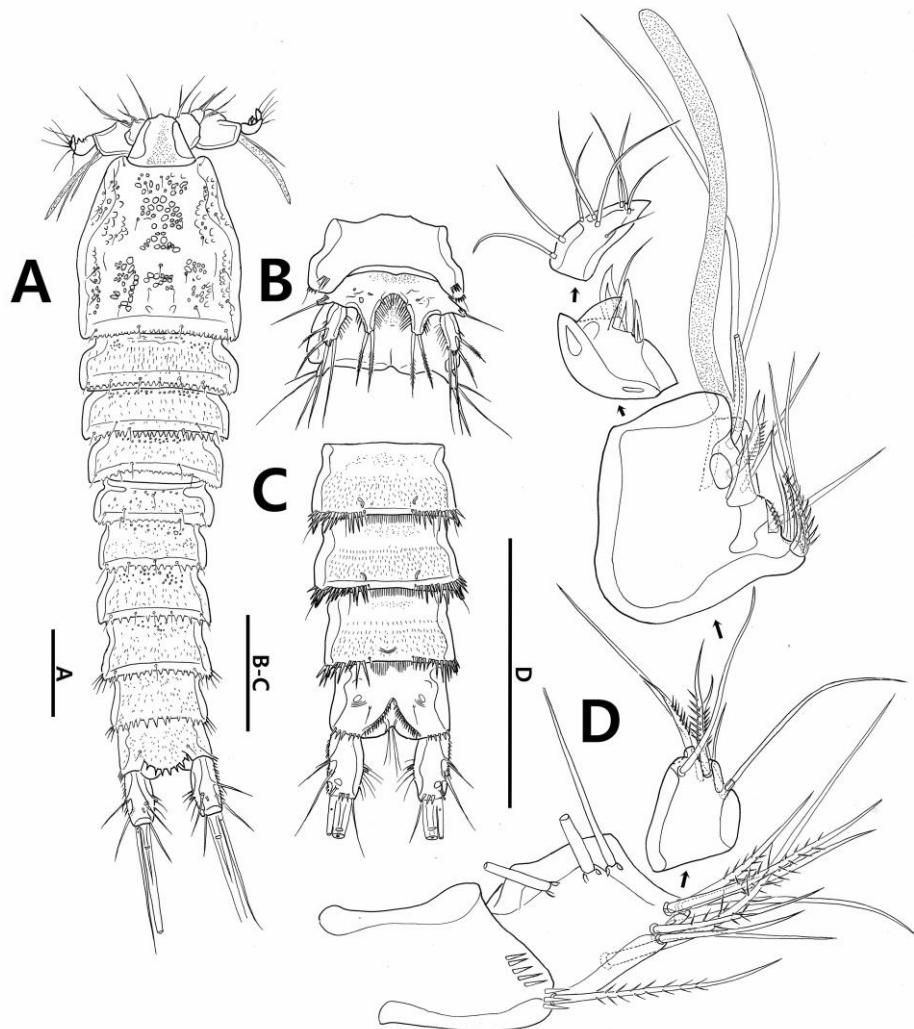
**Fig. 79.** *Normanella* sp. nov., female. A, urosome, ventral; B, genital field; C, rostrum; D, antennule; E, segments 4 and 5 of antennule; F, antenna (coxa omitted); G, labrum. Scale bars: 30 µm (B-G), 50 µm (A).



**Fig. 80.** *Normanella* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, maxilliped; E, P1; F, P2. Male: G, second endopodal segment of P2. Scale bars: 30  $\mu$ m.



**Fig. 81.** *Normanella* sp. nov., female. A, P3; B, P4; C, P5. Male: D, second endopodal segments of P3; E, second endopodal segments of P4. Scale bar: 30  $\mu\text{m}$ .



**Fig. 82.** *Normanella* sp. nov., male. A, habitus, dorsal; B, P5 and P6 bearing-somites, ventral; C, urosome except for P5 and P6 bearing-somites, ventral; D, antennule. Scale bars: 30  $\mu\text{m}$  (D); 50  $\mu\text{m}$  (A-C).

**Table 3.** Comparison of the morphological characteristics in female among *minuta*-lineage in the genus *Normanella* Brady 1880

Characters	<i>N. minuta</i>	<i>N. tenuifurca</i>	<i>N. incerta</i>	<i>N. porosa</i>	<i>N. pallaresae</i>	<i>N. paratenuifurca</i>	<i>N. obscura</i>	<i>N. brevispina</i>	<i>Normanella</i> sp. nov.
Body length (μm)	495-550	492-547	?	490	650-710	520-603	490-595	454-500	627
Cephalic shield surface areolation	without	With	with	with	with	with	with	with	with
A1, no. of segments	6-segmented	5-segmented	5-segmented	5-segmented	5-segmented	5-segmented	5-segmented	5-segmented	5-segmented
P5 endopodal lobe, length to exopod	reaching to half	reaching to half	reaching to apex	reaching to apex	reaching to half	reaching to half	reaching to apex	reaching to half	reaching to 5/6
P5 endopodal lobe, length of 2 <sup>nd</sup> inner seta to 3 <sup>rd</sup> inner seta	1/2	1/2	as long as	as long as	3/5	1/2	2/5	1/2	1/2
P5 endopodal lobe, apex	narrow	Narrow	narrow	narrow	slightly wide	narrow	narrow	wide	narrow
P5 exopod, length to greatest width ratio	3.7 times	4.4 times	4.3 times	3.5 times	4.2 times	3.8 times	3.0 times	3.7 times	4.5 times
P5 exopod, inner margin	straight	Straight	straight	straight	slightly swollen	swollen basally	swollen basally; flask-like	straight	straight
P5 exopod, length of apical seta to inner seta	as long as	as long as?	as long as	about 1.5 times	as long as	1.5 times	as long as	as long as	2.0 times
Caudal rami, length to greatest width ratio	2.0 times	4.6 times	2.5 times	2.0 times	2.0 times	3.0 times	1.9 times	2.5 times	2.1 times
Caudal setae IV and V, internal fracture	both present	only seta V	both present	both present	both present	only seta V	both present	both present	both present
Type locality	Norway	Norway	New Zealand	Egypt	Argentina	England	England	America	Korea
References	Lee & Huys 1999	Lee & Huys 1999	Lang 1948; Lee & Huys 1999	Noodt 1964	Lee & Huys 1999; Pallares 1975	Lee & Huys 1999	Lee & Huys 1999	Lee et al. 2003	Present study

Family Orthopsyllidae Huys, 1990 정벼룩노벌레 과

Genus *Orthopsyllus* Brady & Robertson, 1873 정벼룩노벌레 속

모식종: *Orthopsyllus linearis* (Claus, 1866)

#### 74. *Orthopsyllus cf. linearis* (Claus, 1866) 선상정벼룩노벌레

*Orthopsyllus cf. linearis*: Park et al., 2012, p. 57, figs. 1–12; Lee et al., 2012, p. 135, figs. 92–100.

**관찰재료:** 3♀♀, 전남 고흥군 금산면 어전리, 거금도, 2012.5.9; 1♀, 제주시 애월읍 꽉지리, 꽉지해수욕장, 2014.6.26; 1♂, 경상남도 거제시 남부면 갈곶리, 2014.10.21; 2♀♀, 전남 여수시 신덕동, 2015.5.16; 2♀♀, 경북 포항시 남구 동해면 입암리, 2015.5.19; 1♀, 전남 신안군 비금면 내월리, 비금도, 2015.4.7; 1♀, 제주 서귀포시 보문동, 기린여(SCUBA diving, 수심 약 20m), 2015.6.19.

**분포:** 한국.

**고찰:** 본 연구에서 확인된 표본들은 *Orthopsyllus cf. linearis* (Claus, 1866) *sensu* Park et al. (2012)와 잘 일치한다. Park et al. (2012)은 한국산 시료와 *O. linearis curvaspinata* 가 미차, 꼬리강모, 그리고 제 2–4 흉지의 형질들에서 차이를 나타내는 것을 확인하였다. 그러나, 그들은 이 속의 종들을 다루고 있는 문헌 대부분이 기재와 그림이 불충분하다는 문제점을 인식하고 잠정적으로 *Orthopsyllus cf. linearis*로 기재하였다. 현재 이 종의 변이형에 대하여 전세계적으로 논란이 되고 있으므로 추후에 분류학적 논의 및 연구가 필요할 것으로 보인다. 한편, Park et al. (2012)은 제주도에서 채집된 개체만으로 기재하였으나, 본 연구에서는 우리나라 전 해안의 해조류와 관련된 서식지에서 출현하는 것을 확인하였다.

**Infraorder Podogennonta****Family Cletopsyllidae Huys & Willems, 1999 어리뿔노벌레 과**

한국산 어리뿔노벌레 과(Cletopsyllidae)의 속에 대한 검색표(Bang et al. 2014)

1. 암컷 제 1 촉각의 세 번째 마디는 뒷가장자리가 텁니모양으로 장식되어 있다;  
수컷 제 5 흉지의 외지는 4 개의 가시/강모를 가진다 ..... 어리뿔노벌레 속 *Cletopsyllus*
- 암컷 제 1 촉각의 세 번째 마디는 뒷가장자리가 매끄럽다; 수컷 제 5 흉지의  
외지는 5 개의 가시/강모를 가진다 ..... 어리뿔노벌레붙이 속 *Isocletopsyllus*

**Genus *Isocletopsyllus* Huys & Lee, 1999 어리뿔노벌레붙이 속**

모식종: *Isocletopsyllus tertius* (Por, 1964)

**75. *Isocletopsyllus maximus* Song, Kim & Hwang, 2010 큰어리뿔노벌레붙이**

*Isocletopsyllus maximus* Song et al., 2010, p. 352, figs. 1–7.

**관찰재료:** 1♀, 서빈백사, 제주 제주시 우도면 서광리(해조류), 2014.6.24; 1♀, 경북 포항시 호미곶면 강사리(해조류), 2015.5.19; 1♀, 제주 서귀포시 대포동 대포항(light trap), 2015.5.22; 2♀♀, 제주 서귀포시 남원읍 위미리, 위미항(light trap), 2015.6.18.

**분포:** 한국.

**고찰:** 현재, 어리뿔노벌레붙이 속(*Isocletopsyllus*)은 *Isocletopsyllus tertius* (Por 1964), *I. quartus* (Soyer 1966), *I. maximus* Song, Kim & Hwang, 2010, *I. sardus* Addis, Floris & Carcupino, 2011 의 4 종 만을 포함하고 있는 작은 속이다. 각 종들은 미차의 길이, 이마뿔 끝의 형태, 제 1 촉각의 첫 번째 마디에 돌기의 존재 유무, 제 2 촉각 외지에 존재하는 강모의 길이 등의 형질상태에 의해 서로 구별된다(Bang et al. 2014). 본 연구에서 관찰한 시료는 Song et al. (2010)의 원기재문과 거의 모든 형질에서 잘 일치하였다.

**Superfamily Ectinosomatoidea Sars, 1903****Family Ectinosomatidae Sars, 1903 날씬장수노벌레 과**

한국산 날씬장수노벌레 과(Ectinosomatidae)의 속에 대한 검색표

1. 꼬리강모 V 는 몸의 길이 이상으로 길다 ..... 작은별노벌레 속 *Microsetella*
  - 꼬리강모 V 는 몸의 길이 이하이다 ..... 모래날씬장수노벌레 속 *Halectinosoma*

**Genus *Microsetella* Brady & Robertson, 1873 작은별노벌레 속**

모식종: *Microsetella norvegica* (Boeck, 1865)

한국산 작은별노벌레 속(*Microsetella*)의 종에 대한 검색표(Lee et al. 2012)

1. 꼬리강모 V 는 몸의 길이와 비슷하다; 암컷 제 5 흉지 내지역의 안쪽 강모는 바깥 강모의 길이보다 짧다 ..... 노르웨이작은별노벌레 *M. norvegica*
  - 꼬리강모 V 는 몸의 길이의 두 배 정도이다; 암컷 제 5 흉지 내지역의 내측강모는 바깥 강모의 길이와 유사하다 ..... 장미작은별노벌레 *M. rosea*

**76. *Microsetella norvegica* (Boeck, 1865) 노르웨이작은별노벌레**

*Setella norvegica* Boeck, 1865, p. 281 (cited from Lang, 1948).

*Ectinosoma atlanticum* Brady, 1880, p. 13, pl. 38, figs. 11–19.

*Microsetella norvegica*: Pesta, 1932, p. 21, fig. 15; Lang, 1948, p. 230, fig. 122: 1; Itô, 1968, p. 369, fig. 1; Lee et al., p. 27, figs. 16–17.

관찰재료: 1♀, 경북 포항시 장기면 모포리(사질), 2013.8.5; 1♀, 양양군 강현면 주청리, 낙산해수욕장, 2014.9.14; 1♀, 경북 울진군 매화면 덕신리, 덕신해수욕장, 2016.07.22.

분포: 범세계적.

고찰: 이 종은 플랑크톤성으로 알려져 있지만, 본 연구에서는 모래사장의 저질에서 채집되었다.

### Genus *Halectinosoma* Vervoort, 1962 모래날씬장수노벌레 속

모식종: *Halectinosoma sarsi* (Boeck, 1873)

#### 한국산 모래날씬장수노벌레 속(*Halectinosoma*)의 종에 대한 검색표

1. 제 1 촉각은 5 마디로 이루어져 있다; 제 2 촉각 외지의 첫 번째 마디는 강모를 가진다; 제 5 흉지 외지의 말단 가장자리는 깊은 홈을 가진다..... 구멍모래날씬장수노벌레 *H. perforatum*
- 제 1 촉각은 6 마디로 이루어져 있다; 제 2 촉각 외지의 첫 번째 마디는 강모를 가지지 않는다; 제 5 흉지 외지의 말단 가장자리는 홈을 가지지 않는다 ..... *Halectinosoma* sp. nov.

#### 77. *Halectinosoma perforatum* Itô, 1981 구멍모래날씬장수노벌레(Figs. 83–86)

*Halectinosoma perforatum* Itô, 1981, p. 431, figs. 7–11; Kim et al., 2015, p. 133, figs. 1–4.

**Materials examined:** 4♀♀, Sangju beach ( $34^{\circ}43'15''N$ ,  $127^{\circ}59'21''E$ ), Sangju-ri, Sangju-myeon, Namhae-gun, Gyeongsangnam-do, Korea, 3 Oct. 2013.

**Description. Female.** Body (Fig. 83A) fusiform, greatest width 206~216  $\mu m$  (mean=210  $\mu m$ , n=4) at second free somite, without boundary between prosome and urosome; total length 1,146~1,212  $\mu m$  (mean=1,190  $\mu m$ , n=4) measured from distal margin of rostrum to posterior margin of caudal rami; surfaces of all somites and thoracic legs densely perforated (omitted in figure). Rostrum (Fig. 83A) well-developed, subtriangular in shape, fused to cephalothorax.

Prosome (Fig. 83A) 4-segmented, comprising cephalothorax and 3 free pedigerous somites. Cephalothorax as long as 3 succeeding somites combined; surface and posterior border with 22

sensilla dorsally; posterior border with row of fine setules. Each free prosomite with row of vertical creases, 1~3 rows of setules and 4~6 sensilla on dorsal surface.

Urosome (Fig. 83A, B) 5-segmented, comprising P5-bearing somite, genital double-somite, 3 postgenital somites. P5-bearing somite with 2 rows of setules dorsally; posterior border serrated. Genital double-somite (Fig. 83A, B) subdivided ventrally by transverse chitinous stripe, with 4 rows of setules, 4 pairs of sensilla on dorsal and lateral surfaces; ventral surface with row of setae and row of conspicuous scales; genital field with copulatory pore located in median and common plate bearing pair of setae (represented P6). Urosomite 4 with 4 rows of setules on dorsal margin, 2 rows of ventral setae and row of conspicuous scales. Posterior borders of genital double-somite and urosomite 4 serrated. Urosomite 5 with 2~4 rows of setules on surface; dorsal posterior margin with row of spinules laterally; pseudoperculum semicircular, reaching to end of anal somite, with row of vertical creases along posterior margin. Anal somite (Fig. 83B, C) cleft medially, with row of delicate setules proximally and 2 pairs of sensilla on dorsal margin; posterior margin with row of spinules laterally; cleft part with 2 rows of setules.

Caudal rami (Fig. 83A-C) longer than anal somite, with dorsal and ventral lappets, furnished with 7 setae: seta I stout; seta II and III short and slender, latter longer than former; setae IV well-developed, spinulose along its outer margin; seta V also well-developed, longer than seta IV (not exceeding total body length); seta VI stout, as long as caudal rami in length, spinulose along its inner margin; seta VII short and slender, issuing from inner distal corner dorsally.

Antennule (Fig. 83D) 5-segmented, short; segment 1 short with spinule on anterior margin; segment 2 thickest; segments 3 and 5 with aesthetasc fused with seta at its base, respectively; setal formula as follows: 1-[1], 2-[10], 3-[8+ae], 4-[1], 5-[9+ae].

Antenna (Fig. 83E). Coxa short. Basis with set of long setules and row of small setules. Exopod 3-segmented; proximal segment with bare stout seta; middle segment shortest, with spinulose seta; distal segment longest, longer than proximal and middle segments combined, with 2 long spinulose setae apically. Endopod 2-segmented; proximal segment longer and slender than basis in length; distal segment shorter than proximal segment, abexopodal margin furnished with 2 rows of spinules and 2 spinulose setae, distal margin furnished with 2 short, 4 long spinulose and 1 short, slender plumose setae and row of spinules.

Labrum (Fig. 84A) well developed, with spinous projection.

Mandible (Fig. 84B). Gnathobase with 2 uicuspid and 1 tricuspid stout teeth on cutting edge and 1 spinulose seta at ventral corner; surface ornamented with small papillae. Basis 3 times as long as greatest width, with row of setules and long seta proximally; distal corner with 1 spinulose, 1 pinnate and 1 naked setae. Exopod 1-segmented, short, with 2 spinulose and 1 plumose setae. Endopod 1-segmented, elongate, with 7 long and 1 short setae.

Maxillule (Fig. 84C). Praecoxal arthrite with 3 stout, spinulose claws on distal margin and 2 naked parallel and 1 spinulose setae on surface. Coxa small, with naked seta. Basis with long spinular set and 2 endites, each represented by 3 setae, respectively. Exopod 1-segmented, with row of spinules along lateral margin, and 1 spinulose and 1 plumose setae terminally. Endopod 1-segmented, with 3 pairs of long setae fused at base.

Maxilla (Fig. 84D). Syncoxa with 1 spinule, 3 rows of spinules, and 3 endites; proximal one with 2 spinulose and 2 bare setae, middle one with 2 bare setae, distal one with 2 spinulose and 1 naked setae. Allobasis swollen medially, longer than basis, with 2 spinulose setae. Endopod composed of 2 geniculate and 1 smooth long setae, with 2 slender, 1 three-forked setae.

Maxilliped (Fig. 84E). Syncoxa short, with 1 long, plumose and 1 short, bare setae. Basis elongate furnished with spinules and setules. Endopod as long as syncoxa in length, length ratio to greatest width 1.5:1, and with 2 stout spinulose setae on lateral margin and 2 naked apical setae.

P1 (Fig. 85A). Coxa subrectangular, with row of delicate spinules on distal margin and anterior surface, respectively. Basis with small outer seta and spinulose inner spine and set of spinules on surface; distal margin with row of delicate setules behind endopod and row of stout spinules behind exopod. Both rami 3-segmented, endopod longer and wider than exopod; outer margin of each segment with row of spinules, respectively; exp-1 and enp-1 with row of spinules on surface, respectively; exp-1 without inner seta.

P2–P4 (Figs. 85B, 86A, B). Coxa subrectangular, with 2 rows of spinules on distal margin and distal edge. Basis subrectangular, wider than that of P1; outer seta on P4 stout and elongate, reaching end of exp-2; ornamentation similar to that of P1 except presence of protrusion on distal margin. Both rami 3-segmented, endopod longer than exopod; outer margin of each segment with row of spinules; enp-1 with row of long spinules on anterior surface; distal inner setae on enp-3 of P3 and P4 stout, spinulose and spine-like; exp-1 with inner seta.

Setal formula of thoracic legs as follows:

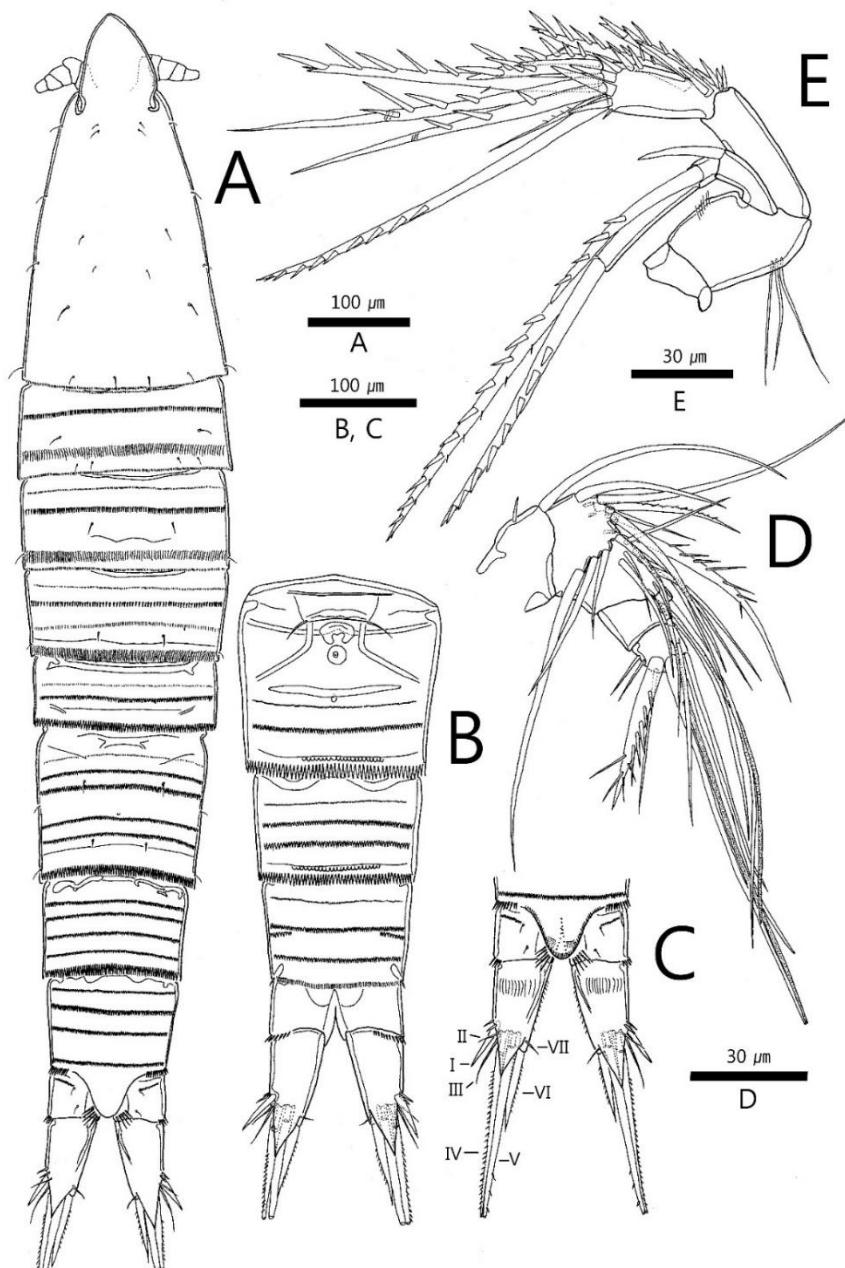
	Exopod	Endopod
P1	0.1.123	1.1.221
P2	1.1.223	1.1.221
P3	1.1.323	1.1.221
P4	1.1.323	1.1.221

P5 (Fig. 86C). Baseoendopod shorter than width, with outer peduncle bearing slender naked seta; endopodal lobe reaching 3/4 of exopod, with 2 spinulose setae apically, inner one of which longer than outer one; inner margin with row of spinules. Exopod longer than width, confluent with baseoendopod anteriorly, with 3 spinulose apical and 1 surface setae; among 3 apical setae, innermost one short, 1/3 of outermost one in length; surface seta slender, inserted near basal margin, bearing 4 stout spinules on its base; distal margin with deep incision between outermost and middle setae; anterior surface covered with stout spinules distally (Kim et al. 2015).

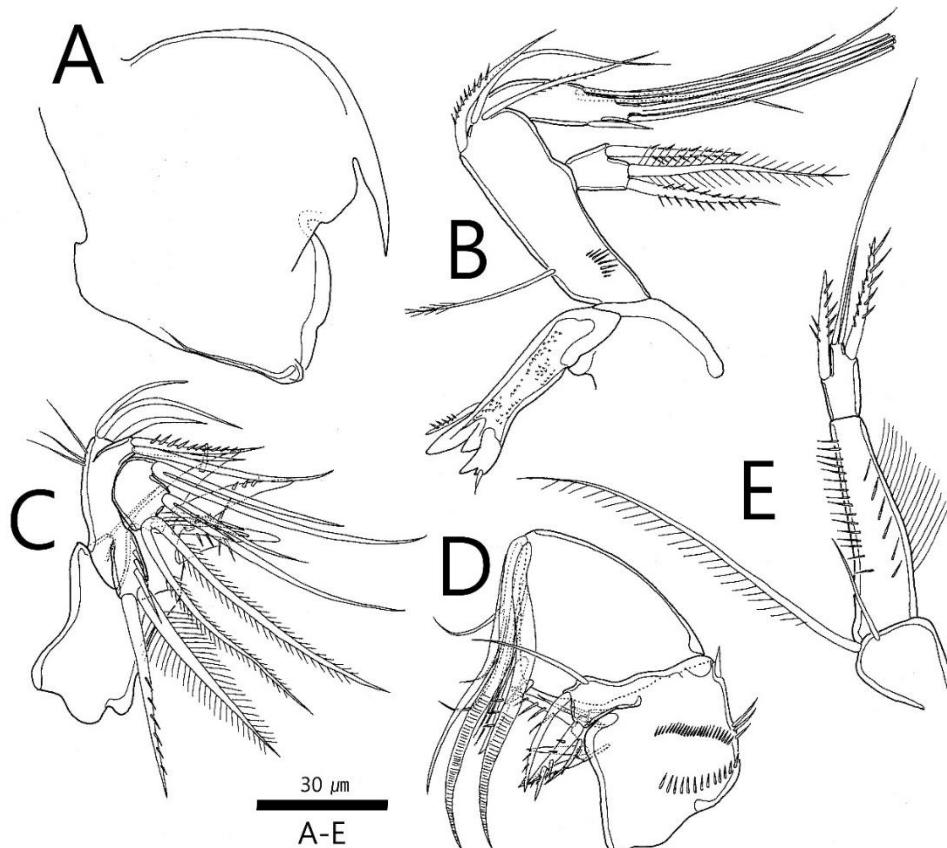
**Male.** Unknown.

**Remarks.** *Halectinosoma perforatum* Itô, 1981 of the present study is the first record of the genus *Halectinosoma* Vervoort, 1962 from Korean waters. Unfortunately, the author could find only female specimens from the materials collected from Sangju beach on the south coast of Korea, but the author is confident in the validity of identification based on the comparison with original description of Itô (1981) at characteristic features as follows: the antennule is five-segmented; the first segment of antennal exopod is not furnished with a row of spinules; the outer distal seta among three setae on the mandibular exopod is similar to the others in shape; the maxillipedal syncoxa is furnished with two setae; the third segment on P4 exopod has three inner setae; the exopod of female P5 is remarkably bilobated with a small innermost seta on the distal margin; genital double-somite is ornamented with a row of conspicuous scales on the ventral surface; and the caudal ramus is 1.5 times as long as broad. However, the Korean specimens show some minor differences in that the anterior margin of rostrum is triangular (like male of Japanese materials), the antennary basis is ornamented with a set of long setules and the anal somite is furnished with spinular rows on dorsal cleft, while those features are not found in the original description (Itô 1981). *Halectinosoma perforatum* has some affinities with *H. brunneum* (Brady, 1905), *H. canaliculatum* (Por, 1964), *H. crenulatum* Clément & Moore, 1995, and *H. denticulatum* Clément & Moore, 1995 in that the presence of scale-like spinules on the urosomites ventrally and the shape of female P5 (Clément &

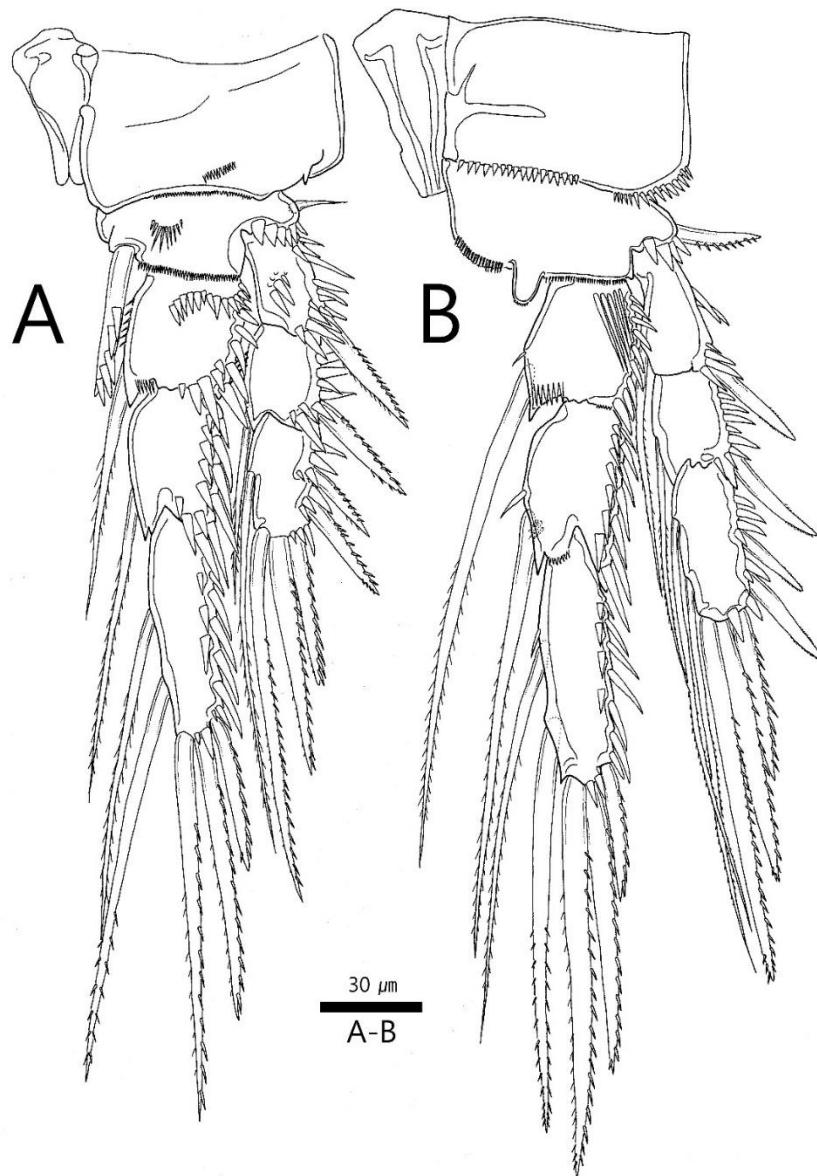
Moore 1995). However, *H. perforatum* is easily distinguished from them by the following morphological characteristics: the P5 exopod is remarkably bilobated by a deep incision; the length ratio to the width of caudal ramus (1.5:1) is larger than those of other four species (1.0:1 in *H. brunneum* and below 1.0:1 in remaining species); and the mandibular basis is furnished with a long seta instead of a set of long setules. In the original description of *H. perforatum*, Itô (1981) mentioned that the scientific name of this species was derived from the perforated body ornamentation. However, this feature is occasionally ignored in many other species before the revision of Clément & Moore (1995) who paid attention to the detailed morphological features of body and appendages in *Halectinosoma* species. According to their revision, most species related with *H. sarsi* Boeck, 1873 have the similar perforations on the body surface. Thus, this perforated body ornamentation of *H. perforatum* seems not to be a key characteristic feature in spite of its scientific name (Kim et al. 2015).



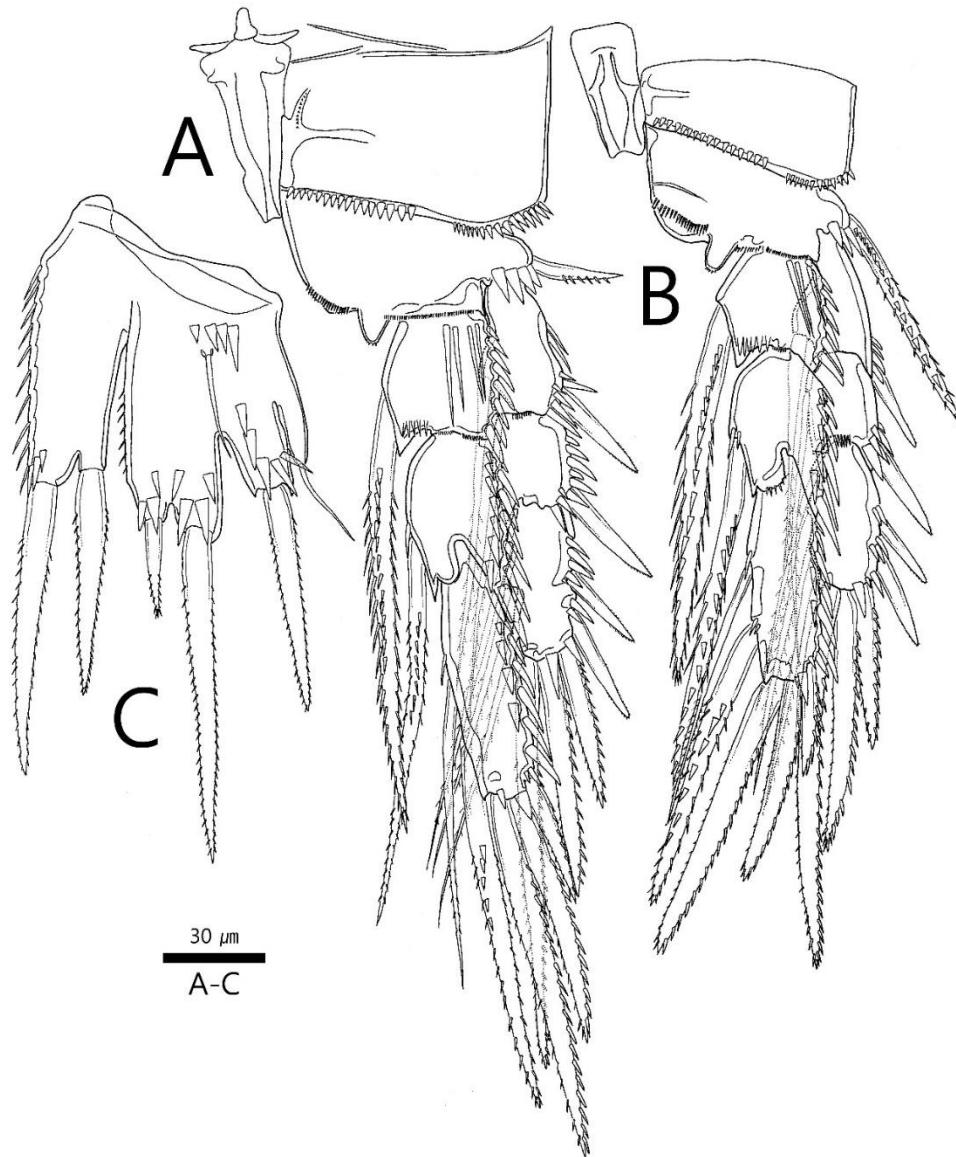
**Fig. 83.** *Halectinosoma perforatum* Ito, 1981, female. A, habitus, dorsal; B, urosome, ventral; C, anal somite and caudal rami; D, antennule; E, antenna (cited from Kim et al. 2015).



**Fig. 84.** *Halectinosoma perforatum* Ito, 1981, female. A, labrum; B, mandible; C, maxillule; D, maxilla; E, maxilliped (cited from Kim et al. 2015).



**Fig. 85.** *Halectinosoma perforatum* Ito, 1981, female. A, P1; B, P2 (cited from Kim et al. 2015).



**Fig. 86.** *Halectinosoma perforatum* Ito, 1981, female. A-C, P3-P5 (cited from Kim et al. 2015).

**78. *Halectinosoma* sp. nov. (Figs. 87–95)**

*Halectinosoma arenicola* (Rouch, 1962): Itô, 1973, p. 524, figs. 5–7.

**Type locality.** Myeongsasipri beach ( $34^{\circ}19'35.87''N$ ,  $126^{\circ}48'34.67''E$ ), Sin-ri, Sinji-myeon, Wando-gun, Jeollanam-do, Korea.

**Type materials examined.** Holotype ♀ (NIBRIV0000326509), allotype ♂ (NIBRIV0000326510), both undissected and preserved in 99.9% ethyl alcohol. Paratypes: 1 ♀ (NIBRIV0000326511) dissected and mounted on nine slides; 1 ♀ (NIBRIV0000326512), dissected and mounted on two slides; 1 ♂ (NIBRIV0000326513) dissected and mounted on three slides; 26♀♀, 11 ♂♂ (NIBRIV0000470359) preserved in 99.9% ethyl alcohol. All materials were collected from the type locality on 25 Jun 2013.

**Additional materials examined.** Korea: 9♀♀, 2♂♂ (NIBRIV0000470362), Sangju beach ( $34^{\circ}43'14.90''N$ ,  $127^{\circ}59'19.90''E$ ), Sangju-ri, Sangju-myeon, Namhae-gun, Gyeongsangnam-do on 15 Mar 2014; 8♀♀, 2♂♂, (NIBRIV0000470361), Hyeopjae beach ( $33^{\circ}23'41.05''N$ ,  $126^{\circ}14'25.10''E$ ), Hyeopjae-ri, Hallim-eup, Jeju-si, Jeju-do on 25 Jun 2014; 17♀♀, 3♂♂ (NIBRIV0000470360), Haedanghwa beach ( $34^{\circ}19'35.51.07''N$ ,  $127^{\circ}3'31.40''E$ ), Wolsong-ri, Geumil-eup, Wando-gun, Jeollanam-do on 30 Jun 2014; 2♀♀ (NIBRIV0000470363, NIBRIV0000470364), Duu-ri ( $35^{\circ}14'43.20''N$ ,  $126^{\circ}18'18.80''E$ ), Yeomsan-myeon, Yeonggwang-gun, Jeollanam-do on 20 Apr 2015; 5♀♀, 3♂♂, Cheongpodaebaech ( $36^{\circ}38'25.20''N$ ,  $126^{\circ}17'57.70''E$ ), Woncheong-ri, Taean-gun, Chungcheongnam-do on 28 May 2016; 4♀♀, Daejin beach ( $38^{\circ}30'16.00''N$ ,  $128^{\circ}25'32.90''E$ ), Daejin-ri, Hyeonnea-myeon, Goseong-gun, Gangwon-do on 19 Jul 2016. Japan: 1♀, 5♂♂, Siki beach ( $32^{\circ}31'15.70''N$ ,  $130^{\circ}01'53.20''E$ ), Amakusa, Kumamoto, Kyushu on 13 Aug 2016.

**Description. Female.** Body (Figs. 87A, B, 93A) fusiform; total length including tip of rostrum and caudal rami about 798  $\mu m$  in lateral view (range, 662.4 to 872.8  $\mu m$ , mean = 752.5  $\mu m$ , n = 62); surface sculptured with longitudinal furrows (Fig. 93F). Rostrum (Fig. 88C) well-developed, subrectangular in shape, separated from cephalothorax at its base, twice as long as wide, and with 1 pair of lateral sensilla subdistally.

Prosome (Figs. 87A, B, 93A–D) 4-segmented, comprising cephalothorax and 3 free pedigerous somites. Cephalothorax slightly shorter than 3 succeeding somites combined; surface (Fig. 93B) ornamented with small foveae, with 13 pairs of sensilla. P2-bearing somite with row of fine spinules

and 5 pairs of sensilla on surface. P3- and P4-bearing somites with row of fine spinules and 4 pairs of sensilla, respectively. Each surfaces of 3 free pedigerous somites ornamented with small foveae.

Urosome (Figs. 87A, B, 88A, 93D–F, 94A–C) 5-segmented, comprising P5-bearing, genital double-, and 3 postgenital somites. P5-bearing somite with row of fine spinules and 2 pairs of sensilla on dorsal surface; posterior margin serrate minutely. Genital double-somite (Fig. 88A) subdivided by cuticular suture ventrally and laterally, while fused dorsally; anterior somite with 2 rows of fine spinules and 2 pairs of sensilla on dorsal surface; each posterior somite with rows of dorsal, lateral and ventral fine spinules, and 2 pairs of sensilla on surface; posterior margin of posterior somite serrate minutely. Genital field with copulatory pore medially and vestigial P6 represented by seta. Urosomite 4, dorsal surface with 1 row of fine spinules and 3 sensilla; lateral surface with 2 rows of fine spinules; ventral surface with 2 rows of fine spinules and 1 pair of sensilla. Urosomite 5, dorsal surface with 1 row of fine spinules; lateral surface with 2 rows of fine spinules; ventral surface with 1 row of fine spinules and 1 pair of sensilla. Anal somite (Figs. 88B, 94D–F), dorsal surface deeply cleft medially, with several rows of delicate setules, 1 row of spinules, 2 small pores, and 2 sensilla; ventral surface with pair of large and small pores on each side; lateral surface with small pore; posterior border ornamented with spinules; operculum obscure, with row of delicate setules.

Caudal rami (Figs. 88B, 94D–F) as long as anal somite in dorsal view, with dorsal and ventral transparent lappets, and furnished with 7 setae: seta I short and stout; seta II short and slender; seta III about 3.6 times of seta I in length and slender; setae IV and V (Fig. 95A) well-developed, each side ornamented with spinules; seta VI stout, shorter than seta III, and furnished with outer setules proximally; seta VII short, slender, and articulated.

Antennule (Fig. 88D) 6-segmented, short, and slender; segment 1 short; segment 2 shorter than preceding one; segment 3 longest, with 1 peduncle at distal corner; peduncle on segment 3 with aesthetasc; segment 6 incompletely separated from preceding one, with long peduncle-like process bearing long seta and aesthetasc; each aesthetasc fused with seta basally. Setal formula as follows: 1-[1], 2-[10], 3-[7 + ae], 4-[1], 5-[1], 6-[8 + ae].

Antenna (Fig. 88E). Coxa small. Basis with 1 group of long setules on anterior margin and 1 group of small spinules on inner margin. Exopod 3-segmented; proximal segment elongate, fused to basis, with 1 row of spinules medially; middle segment shortest, with 1 spinulose seta; distal segment longest, with 2 long spinulose setae. Endopod 2-segmented; proximal segment elongate, longer than basis, without ornamentation; distal segment with 2 groups of spinules and 1 row of small spinules

on surface, 2 spinulose setae on abexopodal margin, and 6 spinulose and 1 slender plumose setae on distal margin.

Mandible (Fig. 89A). Gnathobase well-developed, with 5 unicuspid teeth on cutting edge, 3 sclerite protrusions (see arrowheads in Fig. 4A) on dorsal margin, and 2 rows of small spinules on surface; ventrodistal corner with 1 group of spinules. Basis elongate, 3.5 times as long as greatest width, and with 1 row of long setules proximally on lateral margin and 3 setae on distal corner. Exopod 1-segmented, small, with 1 spinulose, 1 plumose, and 1 small naked setae. Endopod 1-segmented, elongate, and with 10 naked and 1 plumose setae; lateral margin ornamented with row of long hairs.

Maxillule (Fig. 89B). Praecoxal arthrite with 4 stout spinulose claws on distal margin and 2 naked setae on surface. Coxa small, with 1 seta. Basis with 4 spinulose setae distally and subdistally; surface with 2 bare setae. Exopod 1-segmented, small, and with 2 apical plumose setae. Endopod 1-segmented, bilobate; small lobe with 2 setae and large lobe with 4 setae; each seta on lobes fused with neighboring one at its base.

Maxilla (Fig. 89C). Syncoxa with 3 spinules on outer margin and 2 rows of spinules on surface, and bearing 3 endites (Fig. 89D–F); proximal endite with 1 slender, 1 spinulose, and 2 plumose setae; middle endite slender, with 1 spinulose and 1 bare setae; distal endite with 2 spinulose and 1 plumose setae. Allobasis with 4 bare and 1 spinulose setae, and 1 spinulose spine fused with lateral margin basally; surface with 1 row of long setules. Endopod composed of 3 setae; proximal and middle setae spinulose and geniculated; distal seta divided into 4 small setae.

Maxilliped (Fig. 89G). Syncoxa small, with 1 long seta. Basis elongate, furnished with setules along each lateral margin. Endopod small, about 3 times as long as greatest width, and with 1 long and 1 short bare setae on apical margin and 1 subdistally and 1 medially inserted spinulose setae on lateral margin.

P1 (Fig. 90A). Intercoxal sclerite small, without ornamentation. Coxa large, subrectangular, and with 1 row of spinules along distal corner. Basis smaller than coxa, with 1 outer seta and 1 inner spine; outer margin with 1 row of stout spinules; anterior surface with 1 row of stout spinules and 1 row of minute spinules; distal margin behind endopod with hyaline frill. Both rami 3-segmented; each segment ornamented with outer spinules; exp-1 without inner seta; distal margins of exp-1 and exp-2 with hyaline frill; enp-1, anterior margin with 1 row of horizontal spinules, distal margin

partially protruded, with hyaline frill; enp-2, posterior surface with several stout spinules, and distal margin with small hyaline frill.

P2–P4 (Figs. 90B, 91A, B). Intercoxal sclerite larger than that of P1. Coxa subrectangular, with row of spinules along distal corner. Basis smaller than coxa, with 1 row of stout spinules along outer margin and 1 (P4) or 2 (P2 and P3) rows of minute spinules on anterior margin; distal margin midway produced, with small hyaline frill and notch. Both rami 3-segmented; each segment ornamented with outer spinules; distal margins of exp-1 and exp-2, with hyaline frill; enp-1 with 1 row of horizontal spinules on anterior surface; distal margins of enp-1 and enp-2 midway concave, with small hyaline frill; enp-2 except for P4 with several stout spinules on posterior margin.

Setal formula of P1–P4 as follows:

	Exopod	Endopod
P1	0.1.123	1.1.221
P2	1.1.223	1.1.221
P3	1.1.323	1.1.221
P4	1.1.323	1.1.221

P5 (Figs. 88F, 95C, D). Baseoendopod shorter than width, with 2 rows of spinules on anterior surface and 1 plumose outer seta; endopodal lobe reaching to approximately 1/3 of exopod, with 1 row of spinules along inner margin and 2 stout pinnate setae on distal margin; outer seta on distal margin partially fused with endopodal lobe. Exopod slightly longer than wide, fused to baseoendopod anteriorly, with incomplete posterior separation; inner margin ornamented with spinules; distal margin with 3 pinnate setae bearing row of spinules basally; anterior surface with small peduncle bearing 1 seta near outermost distal seta.

**Male.** Body (Fig. 92A) smaller than female; total length about 546 µm (range, 502.1 to 623.8 µm, mean = 550.8 µm, n = 18).

Urosome (Fig. 92A) 6-segmented.

Antennule (Fig. 92B) 7-segmented, haplocer. Segment 1 as long as width. Segment 2 smallest. Segment 3 narrower than preceding one. Segment 4 slightly shorter than segment 1, gradually broad towards distal margin. Segment 5 longest, slightly swollen proximally; surface with 1 spine-like process, 1 tube-like seta, 1 row of minute spinules, and 1 aesthetasc. Segment 6 fused with preceding one. Segment 7 elongate, with peduncle bearing aesthetasc fused with seta basally. Setal formula as follows: 1-[1], 2-[1], 3-[8], 4-[3], 5-[6 + ae], 6-[1], 7-[6 + ae].

P5 (Fig. 92C). Baseoendopod small, with 1 finely bipinnate outer seta; endopodal lobe small, reaching to approximately 1/3 of exopod, and with 2 subequal pinnate setae on distal margin. Exopod separated from baseoendopod, slightly longer than wide, and with 3 terminal and 1 surface setae.

P6 (Fig. 92D) represented by 1 bare and 1 spinulose stout setae.

**Variability.** Most morphological features are conservative except for the female P5. Ovigerous females lack a row of spinules on the P5 exopod (Fig. 88F), and some ovigerous specimens have small spinules or the vestiges of spinules positioned near the surface seta (arrowhead in Fig. 95D). Among seven populations examined in the present study, the non-ovigerous form with a distinct spinular row (Fig. 92E) was observed from two specimens collected from Baekbawi beach, Yeonggwang-gun. Especially, these two specimens of the non-ovigerous form display additional variability in the detailed characteristics of the female P5 as follows: the outer peduncle has a tube pore (vs. a small pore in the ovigerous form); two spinular rows on the baseoendopod are in a line (vs. two distinguishable rows in the ovigerous form); the boundary between the distal margin of the baseoendopodal lobe and its inner seta is completely separated (vs. partially fused in the ovigerous form); both setae on the baseoendopodal lobe are longer than the length of the baseoendopodal lobe (vs. as long as the baseoendopodal lobe in the ovigerous form); the baseoendopodal lobe has a pore near the outer margin (vs. absent in the ovigerous form).

**Remarks.** Lang (1948) proposed the division of *Halectinosoma* into the *sarsi*- (where the P3–P4 exp-3 have three outer spines) and *curticone*-groups (where the P4 exp-3 has two outer spines) on the basis of the number of outer spines on the P1–P4 exp-3. However, Lang (1965) subsequently declared that it was impracticable because of the uncertainty of these characteristics. Later, Clément & Moore (2000) proposed the *herdmani*-group in the genus based on the body shape, the setal formula of P1–P4, and the structures of the antennule, antennary exopod, mandibular exopod, and maxillipedal syncoxa. Among these three groups, only the *herdmani*-group is currently acknowledged in the genus, but additional groups could be recognized with further studies as previously observed in the revision for the species related with *H. sarsi* (Boeck, 1873) (present in the species inquirendae) by Clément & Moore (1995).

Within the genus, *Halectinosoma* sp. nov. is close to the species belonging to the *herdmani*-group in the following characteristics: (1) the rostrum is elongate; (2) the body surface is sculptured with longitudinal furrows; (3) the female antennule is composed of six segments; (4) the first exopodal segment of antenna has a row of spinules; (5) the outer distal seta on the mandibular exopod is smaller

than the other two setae; (6) the maxillipedal syncoxa has only one seta; (7) the surface seta on the P5 exopod clearly beyond its distal margin; (8) the setal formula of P1–P4 coincides with those of species belonging to the *herdmani*-group (Clément & Moore 2000). However, *Halectinosoma* sp. nov. differs from the *herdmani*-group by the absence of chitinous patches near the posterior margin of the cephalothorax and the first exopodal segment of antenna has no seta.

Most *Halectinosoma* species not dealt in the revisions by Clément & Moore (1995, 2000, 2007) have more or less incomplete and inaccurate descriptions. This presently causes a problem in the taxonomy of the genus (Clément & Moore 1995, 2000, 2007; Kihara & Huys 2009; Suárez-Morales & Fuentes-Reinés 2015). Nevertheless, the author believe that previous descriptions for antenna, antennary exopod, mandibular gnathobase, setal formula of P1–P4, and female P5 were relatively exact because of their simple structures.

In most *Halectinosoma* species, the armature formula of the antennary exopod is a typical “1.1.2”, but the seta on the first segment is known to be absent in several species as well as *Halectinosoma* sp. nov. However, this new species differs from other species by the presence of a row of spinules on the first exopodal segment of antenna. As far as we know, the combination of the absence of seta and the presence of a row of spinules on the proximal segment is first recognized in *Halectinosoma* sp. nov. However, the author assumes that the latter characteristic was possibly unnoticed or overlooked by previous authors before Clément & Moore (1995, 2000, 2007).

In ectinosomatid copepods, the mandibular gnathobase is armed with a dorsal seta, a character considered to be present in the ground pattern, which is considered an autapomorphy of the family (Seifried 2003; Seifried et al. 2007). *Halectinosoma* species typically possess one or two dorsal setae on the gnathobase and its cutting edge is composed of a unidentate pars incisiva and a multidentate lacinia. However, this structure of *Halectinosoma* sp. nov. is composed of five chitinous teeth without dorsal seta. This type of mandibular gnathobase is a unique characteristic of the new species among *Halectinosoma* species except for *H. paraspinicauda* Bodin, 1979 (see Bodin 1979, Fig. 3Md). The new species represents another remarkable characteristic in having three protrusions on the mandibular gnathobase dorsally, which has not yet been reported in *Halectinosoma* species.

The structure of female P5 has been considered as a useful diagnostic character to distinguish *Halectinosoma* species (Lang 1965; Clément & Moore 1995, 2000; Wells 2007). The general shape of the female P5 for *Halectinosoma* sp. nov is similar to those of *H. arenicola* (Rouch, 1962), *H. dimorphum* Coull, 1970 (in the ovigerous female), *H. pterinum* Moore, 1974, *H. britannicum*

Clément & Moore, 2000, and *H. itoi* Clément & Moore, 2000 (Rouch 1962; Coull 1970; Moore 1974; Clément & Moore 2000). However, *Halectinosoma* sp. nov. clearly differs from these five species by the position of the surface seta inserted near the distal margin on the exopod, the presence of spinular rows on the baseoendopod, and the incomplete boundary between the baseoendopod and the exopod. Especially, *Halectinosoma* sp. nov. shows variability in detailed features of the distal setae on the baseoendopodal lobe, the row of spinules on the exopod, and the tube pore on the outer peduncle. This kind of variability has been reported only from *H. dimorphum*, which represents a difference in the female P5 between ovigerous and non-ovigerous individuals (Coull 1970).

Taking into account the characteristic features, *Halectinosoma* sp. nov. mostly resembles *H. dimorphum* described from Barbados in sharing the 6-segmented and elongate antennule, the first exopodal segment of antenna without seta, the position of surface seta (inserted distally) on the female P5 exopod, and the setal formula of P1–P4. However, the new species shows clear differences from *H. dimorphum* by the following characteristics: (1) the third segment of antennule is longest (vs. the fourth segment is longest in *H. dimorphum*); (2) the first segment exopod of antenna has a row of spinules (vs. with only one seta in *H. dimorphum*); (3) the cutting edge of mandibular gnathobase is composed of chitinous teeth (vs. a typical cutting edge comprising pars incisiva and lacinia in *H. dimorphum*); (4) the female P5 has an incomplete boundary (separated in the posterior part only) between the exopod and baseoendopod (vs. completely separated in *H. dimorphum*); (5) the female P5 baseoendopod has two rows of spinules (vs. absent in *H. dimorphum*). Furthermore, the new species shows distinct features not known from *Halectinosoma* species such as the foveate ornamentation on the body surface of the prosome (see Figs. 87A, B, 93B, C) and the presence of three protrusions on the mandibular gnathobase (see Fig. 89A).

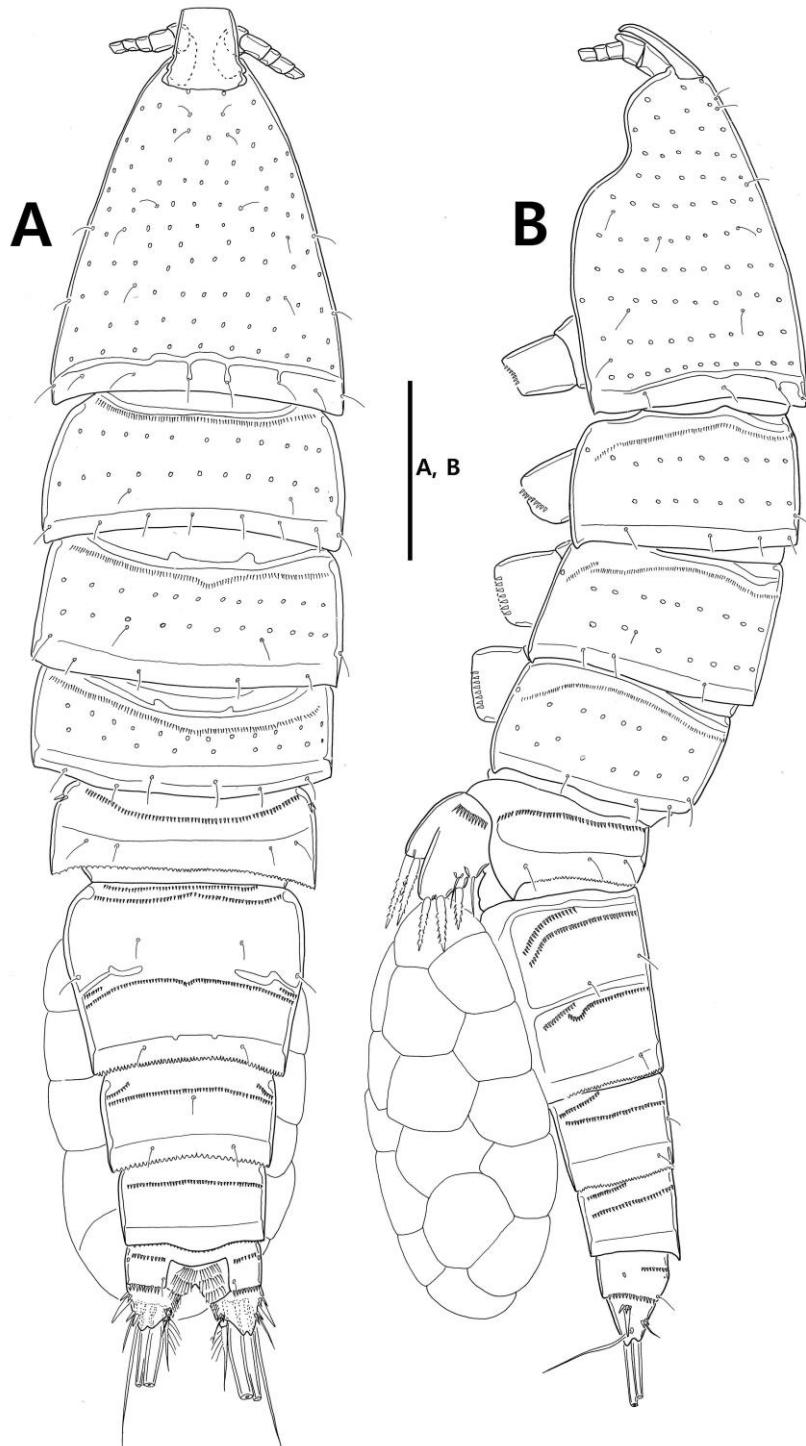
Among *Halectinosoma* species, *H. arenicola* have been reported only from Brazilian and Japanese coasts (Rouch 1962; Itô 1973). However, Clément & Moore (2000) suggested that *H. arenicola* sensu Itô (1973) from Japan might not be conspecific with Brazilian species of the original description on the basis of the discrepancy in the first exopodal segment of antenna. They realized that the morphological characteristics of the body surface and cephalosomal appendages are important characters to distinguish *Halectinosoma* species through the series of their revisions (Clément & Moore 1995, 2000, 2007). In this respect, *Halectinosoma arenicola* was poorly and incompletely described in the original description by Rouch (1962). This author did not describe the habitus, antennary endopod, mandible, and maxillule of this species. Additionally, the structures of other

appendages were also described and figured with some errors in the original description of the species. Itô (1973) subsequently reported *H. arenicola* from Japanese coast although he was aware that the Japanese specimens differ from Brazilian species in the structures of the maxillule and maxilliped, which were not considered to be key characteristics at that time. In modern view of *Halectinosoma* taxonomy, *H. arenicola sensu* Itô (1973) clearly differs from *H. arenicola* in the following features: (1) the female P5 baseoendopod has spinules, but it is naked in *H. arenicola*; (2) the female P5 exopod is fused to the baseoendopod anteriorly, but they are discrete in *H. arenicola*; (3) the surface seta on the female P5 exopod is inserted near the distal margin, while it is located near the proximal margin of the exopod in *H. arenicola*; (4) the first exopodal segment of antenna has only a spinular row without seta, while it has a delicate seta without spinules in *H. arenicola*; (5) the third exopodal segment of antenna is at least three times of second one in length, but it is about twice in *H. arenicola*.

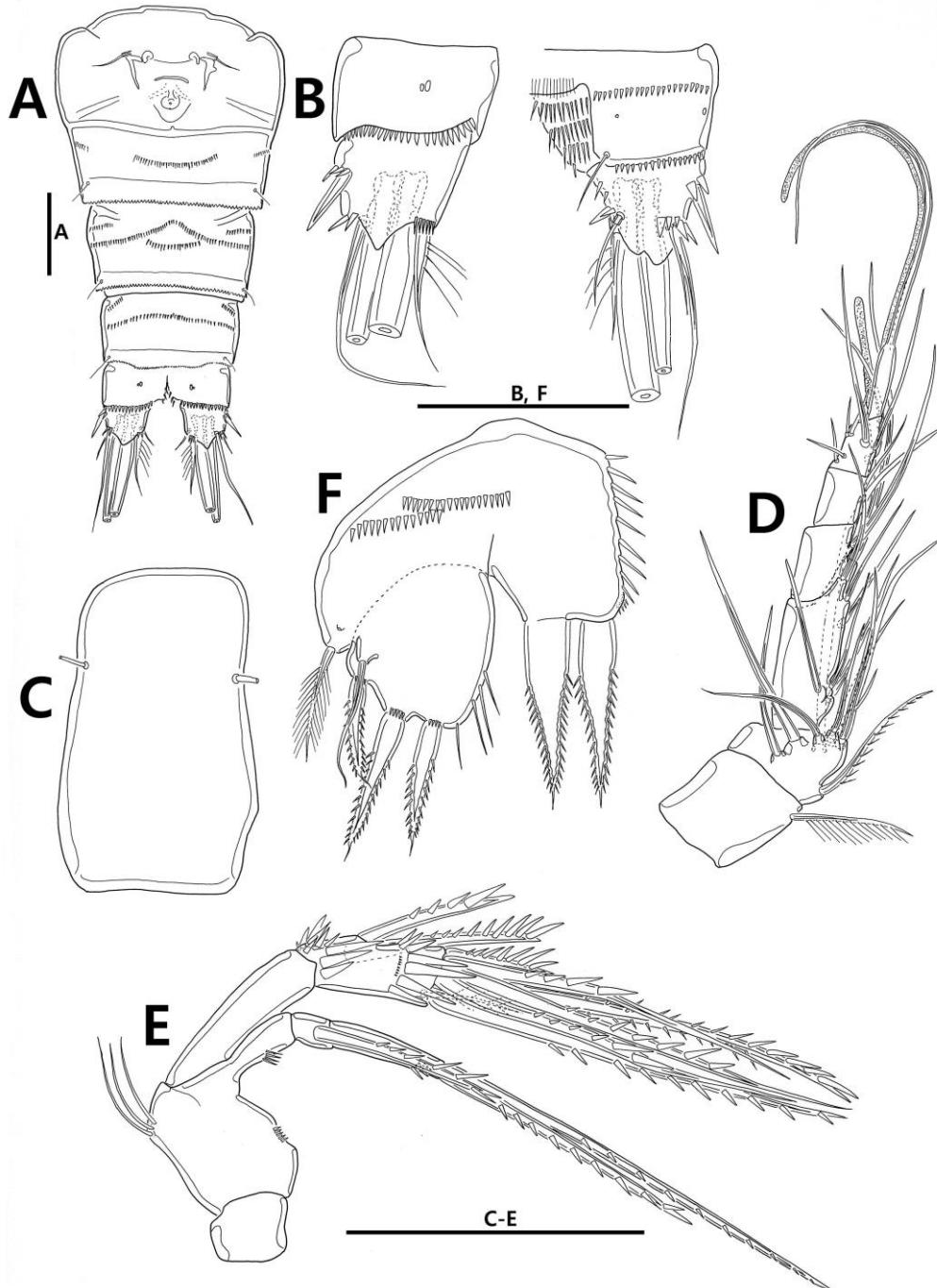
*Halectinosoma* sp. nov. is very similar to *H. arenicola sensu* Itô (1973) reported from Japanese beach, but several minor differences exist between them in the structures of maxillule, maxilla, and body surface. To clarify whether this Korean species is conspecific with *H. arenicola sensu* Itô (1973), the author tried to obtain Itô's (1973) materials. However, Itô's materials of *H. arenicola sensu* Itô (1973) does not exist any longer. So, the author collected Japanese materials of *H. arenicola sensu* Itô (1973) from the beach on Siki, Amakusa in Japan, the sampling station of Itô (1973), and compared them with the Korean specimens of *Halectinosoma* sp. nov. The result revealed that *Halectinosoma* sp. nov. and Japanese specimens of *H. arenicola sensu* Itô (1973) are conspecific in almost aspects including the characteristic features of body surface and cephalosomatic appendages.

Among 70 nominal *Haectinosoma*, the taxonomic positions of four species still having only poor descriptions are doubtful. Three species, *H. curticone* (Boeck, 1873), *H. concinnum* (Akatova, 1935), *H. pterinum* Moore, 1974, seem to be closed to the members of the genus *Pseudobradya* Sars, 1904 in morphology of the antennule and maxilliped. Their antennules have a pigment spot and their maxillipeds are relatively short and robust (Boeck 1873; Akatova 1935; Moore 1974). These are presently used as key characteristics of the genus *Pseudobradya* after the identification key to ectinosomatid genera given by Kihara & Huys (2009). Karanovic & Pesce (2001) discussed the status of *H. littorale* (Nicholls, 1939) showing the absence of the surface seta on female P5 exopod and suggested that it might have resulted from simple falling of the seta during dissection of the specimen. The author founds an additional doubtful point of the setal formula of P1–P4 (see Nicholls 1939, p. 246), provided by total elements of spine and setae together) in the original description of *H. littorale*

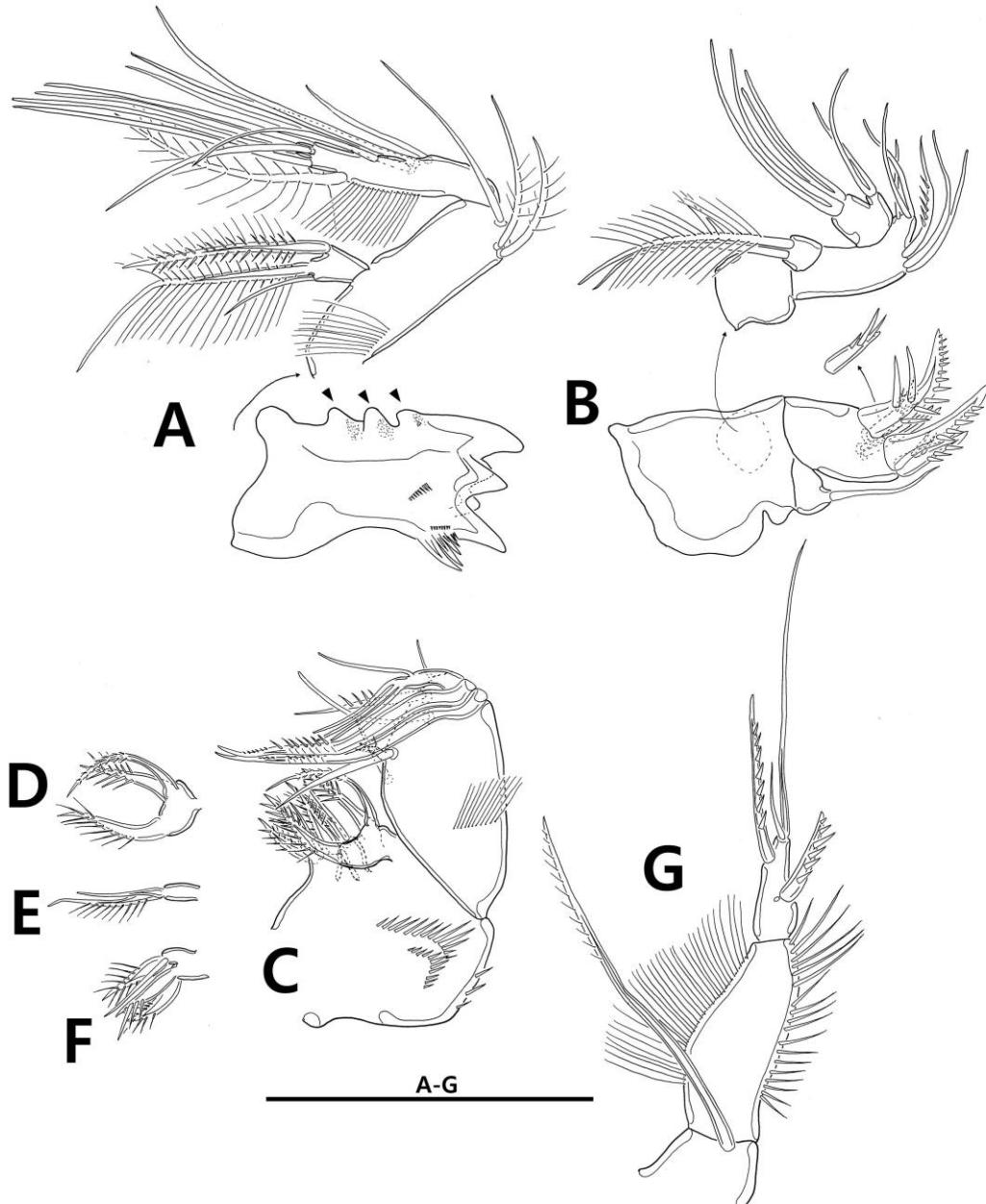
by Nicholls (1939). Considering ancestral character states of harpacticoids (Huys & Boxshall 1991), the setal formula indicates that *H. littorale* has the P3 exp-2 without inner seta and the P4 enp-1 with two inner setae in the original description. However, it is clearly con to general setal formula of *Halectinosoma* species as well as our knowledge for the ancestral condition of harpacticoid copepods. In this respect, these four species should be re-examined to clarify their taxonomic standings.



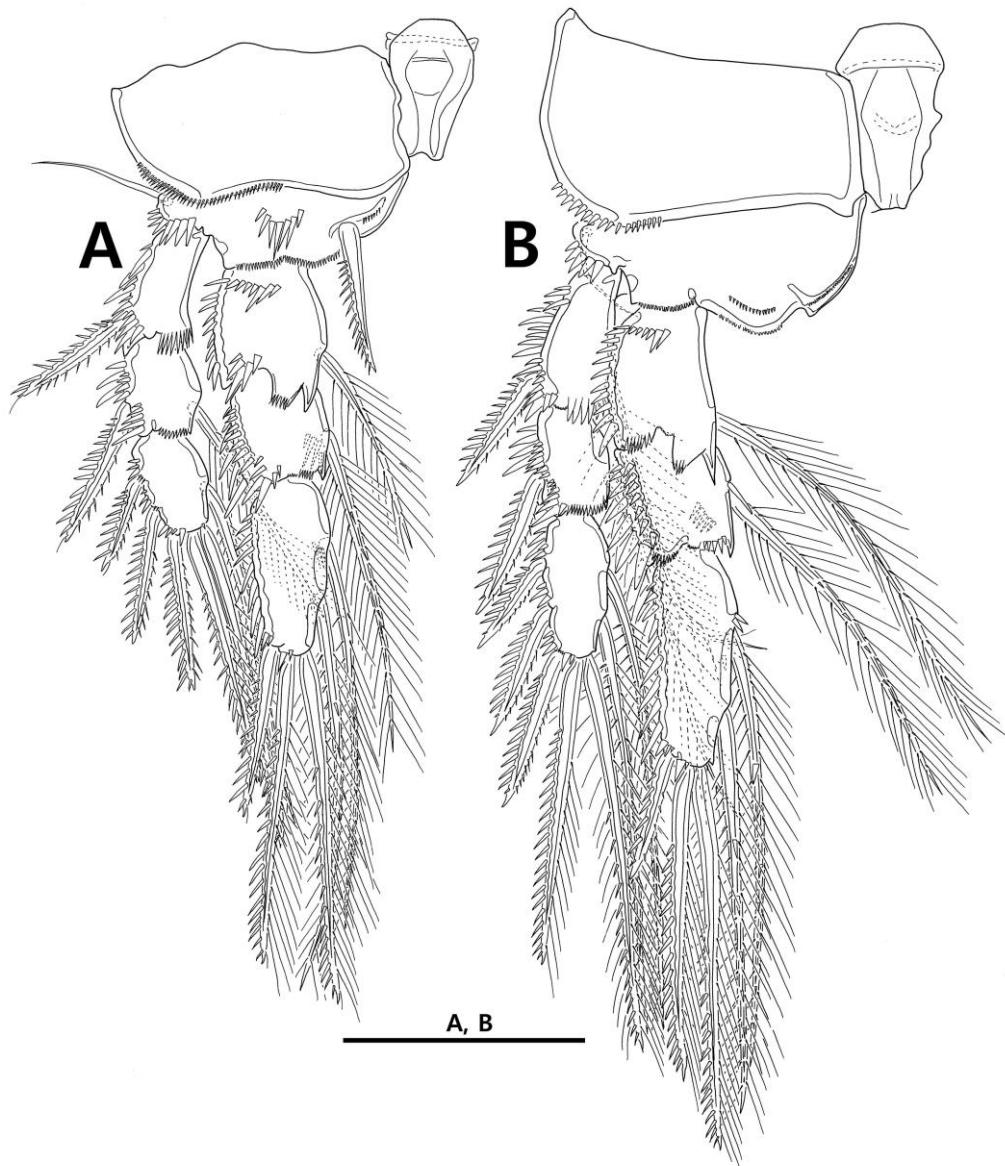
**Fig. 87.** *Halectinosoma* sp. nov., female. A, habitus, dorsal; B, habitus, lateral. Scale bar: 100  $\mu\text{m}$ .



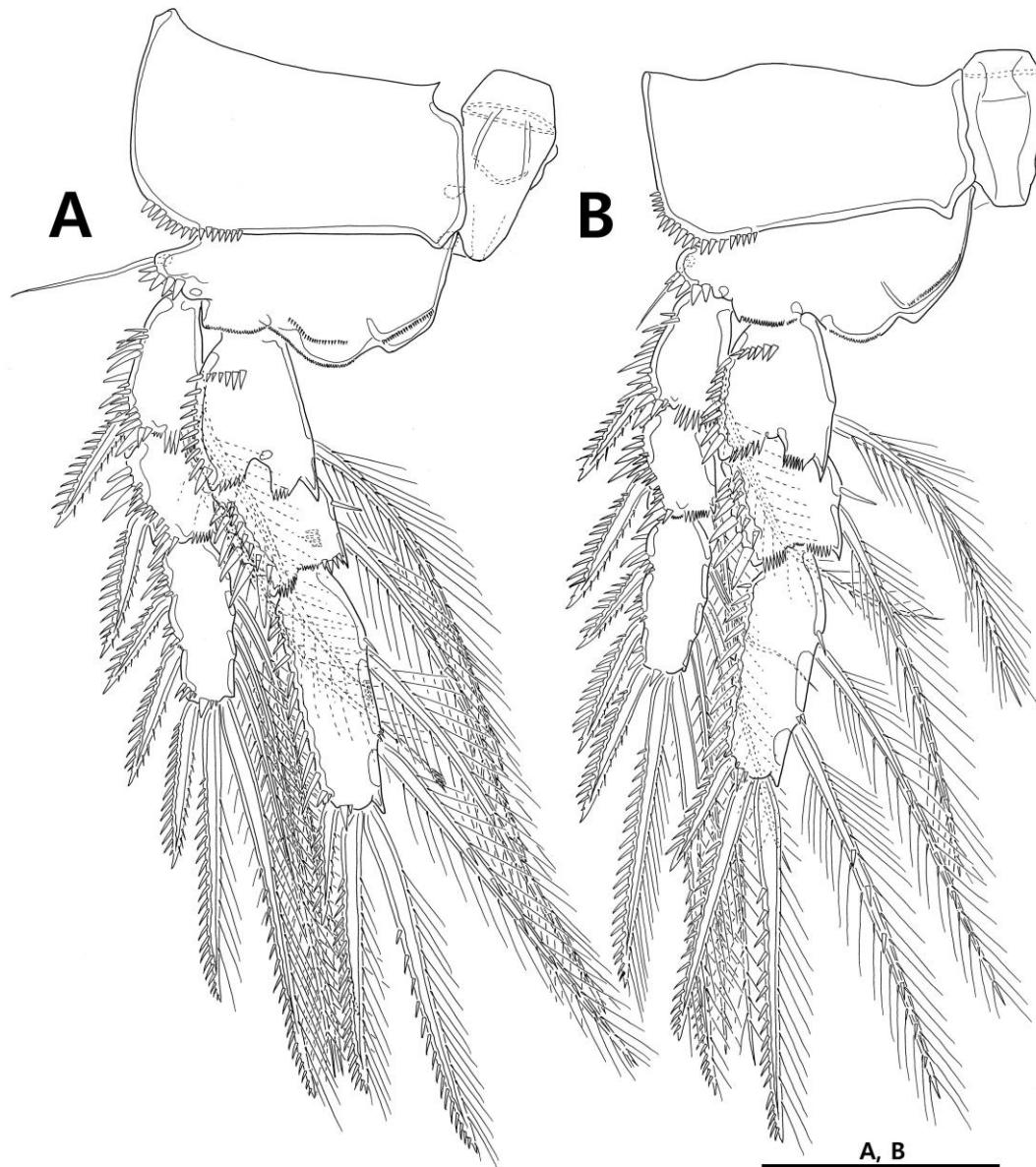
**Fig. 88.** *Halectinosoma* sp. nov., female. A, urosome, ventral; B, anal somite and caudal rami, dorsal (right) and ventral (left); C, rostrum; D, antennule; E, antenna; F, P5. Scale bars: 50  $\mu$ m.



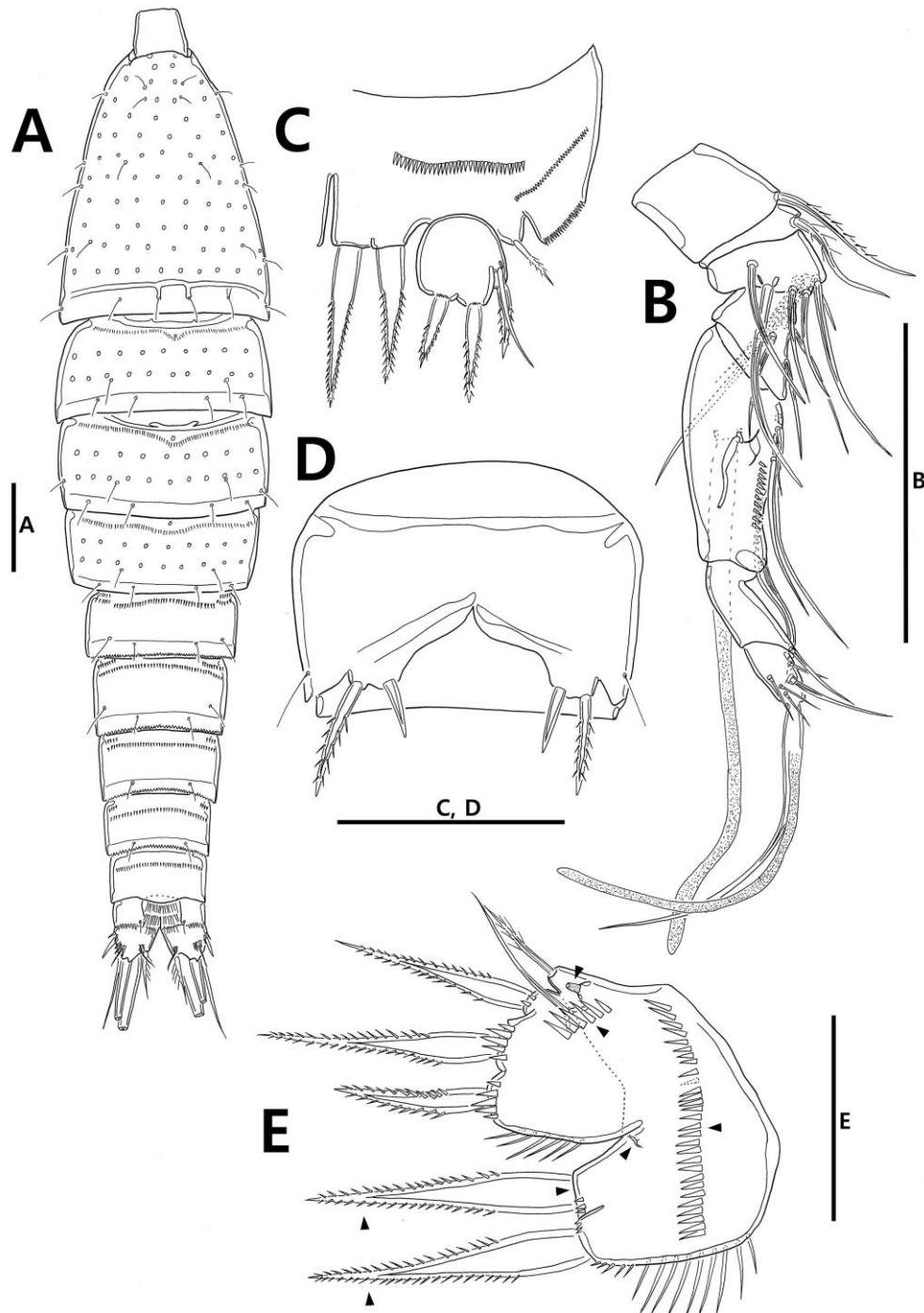
**Fig. 89.** *Halectinosoma* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, distal endite on syncoxa of maxilla; E, middle endite on syncoxa of maxilla; F, proximal endite on syncoxa of maxilla; G, maxilliped. Scale bar: 50  $\mu$ m. Arrowheads indicate the unique feature on the mandibular gnathobase.



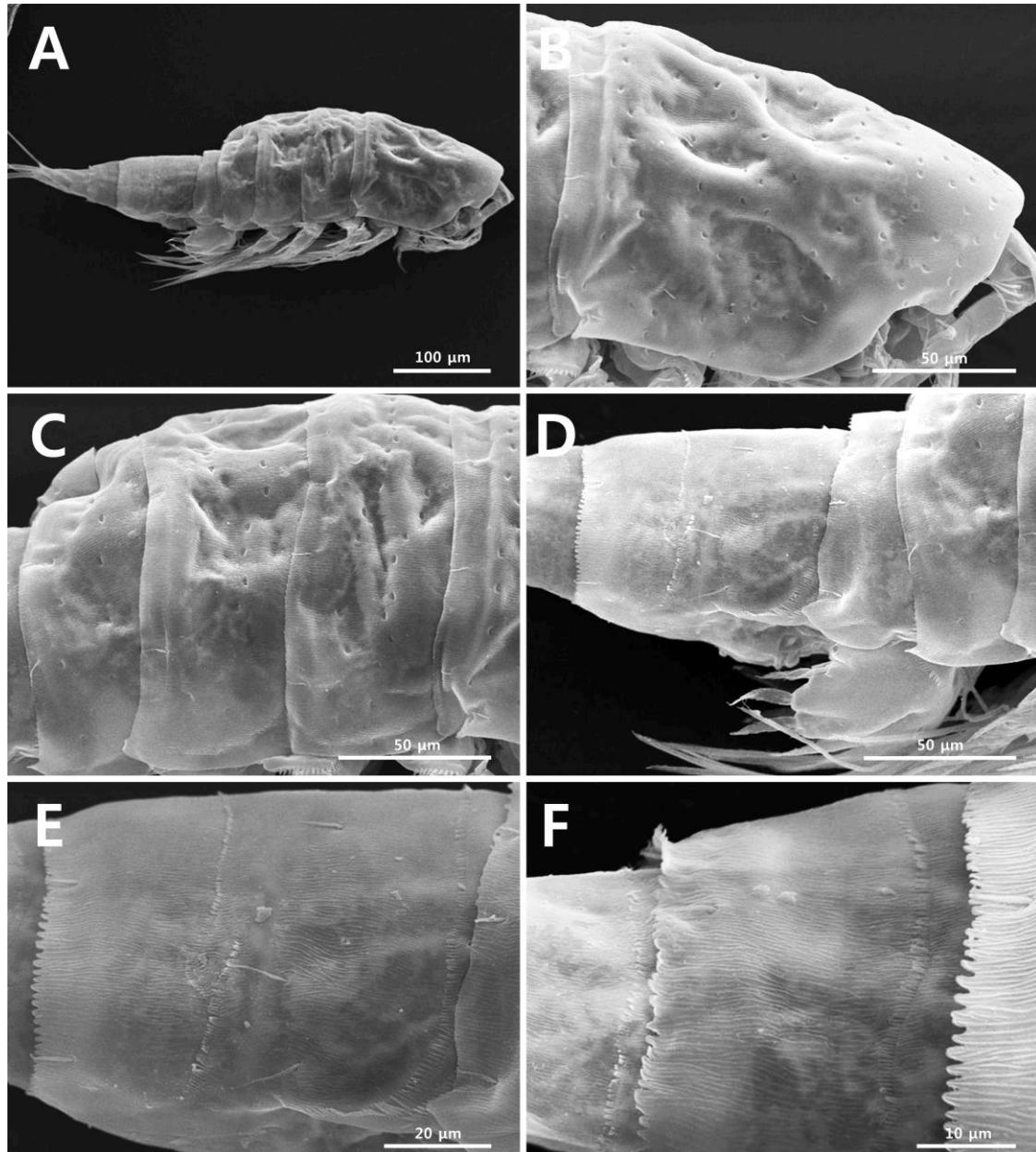
**Fig. 90.** *Halectinosoma* sp. nov., female. A, P1; B, P2. Scale bar: 50  $\mu\text{m}$ .



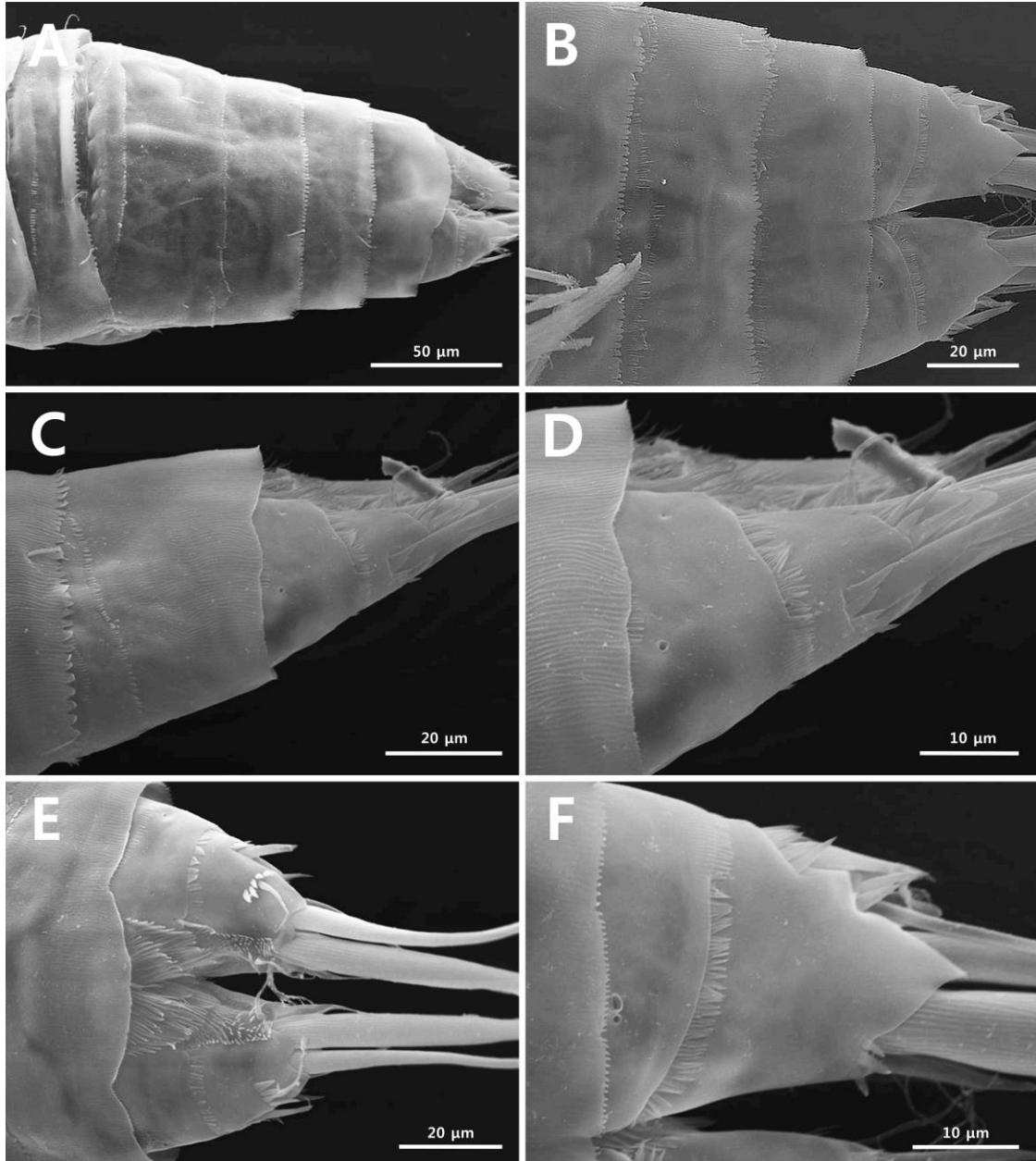
**Fig. 91.** *Halectinosoma* sp. nov., female. A, P3; B, P4. Scale bar: 50  $\mu\text{m}$ .



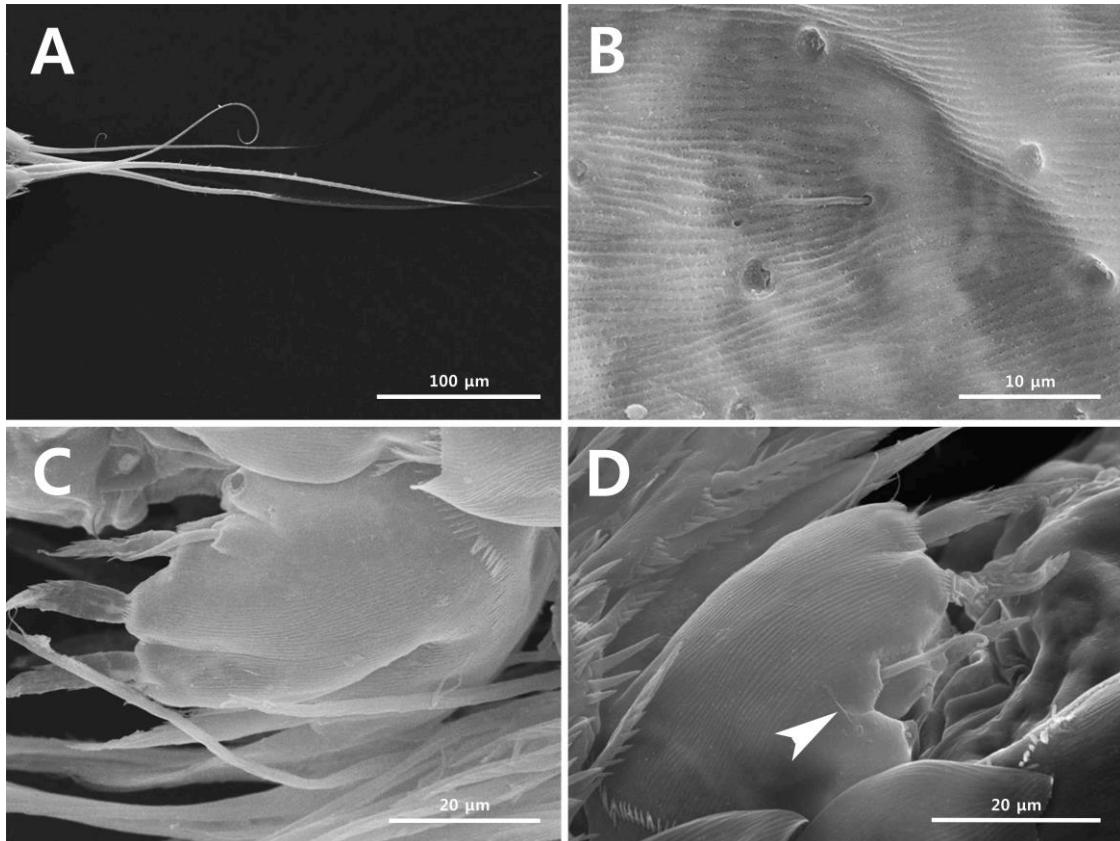
**Fig. 92.** *Halectinosoma* sp. nov., female. A, habitus; B, antennule; C, P5, D, urosomite 2, ventral; E, P5 of specimen collected from Yeonggwang. Scale bars: 50  $\mu$ m.



**Fig. 93.** Scanning electron microscope photographs of *Halectinosoma* sp. nov., female. A, habitus, lateral (rostrum hidden); B, cephalothorax, lateral (rostrum hidden); C, thoracic somites 2-4, lateral; D, P5 bearing-somite and genital double somite, lateral; E, genital double somites, lateral; F, urosomite 4, lateral.



**Fig. 94.** Scanning electron microscope photographs of *Halectinosoma* sp. nov., female. A, urosome, dorsal; B, postgenital somites, ventral; C, urosomite 5, anal somite and caudal ramus, lateral; D-F, anal smite and caudal rami, lateral (D), dorsal (E), ventral (F).



**Fig. 95.** Scanning electron microscope photographs of *Halectinosoma* sp. nov., female. A, caudal setae; B, surface of cephalosome; C, D, P5. Arrowhead indicates the vestiges of spinules.

**Infraorder Exanechentera Lang, 1944**

**Idyanthidimorpha Seifried, 2003**

**Family Zosimeidae Seifried, 2003**

**Genus *Zosime* Boeck, 1973**

**모식종:** *Zosime typica* Boeck, 1873

**79. *Zosime destituta* Kim, Jung & Yoon, 2016 (Figs. 96–99)**

*Zosime destituta* Kim et al., 2016b, p. 324, figs. 1–4.

**Type locality.** Off Hansando Island ( $34^{\circ}46'17.4''N$ ,  $128^{\circ}27'46.9''E$ ), Tongyeong-si, Gyeongsangnam-do, Korea.

**Material examined.** Holotype ♀ (NIBRIV0000326501) dissected on a slide. Paratypes: 1♀ (NIBRIV0000326502), dissected on 13 slides; 2♀ (NIBRIV0000364128, NIBRIV0000364129), undissected and preserved in 99% ethanol. All material has been deposited in the National Institute of Biological Resources (NIBR) in South Korea and was collected from the type locality on 24 March 2014.

**Description. Female.** Body (Fig. 96A, B) fusiform, subcylindrical, tapering posteriorly, with narrow constriction between prosome and urosome; total body length 667  $\mu m$  measured from anterior margin of rostrum to posterior margin of caudal ramus laterally; surface with reticulate ornamentation (Fig. 96C), covered by minute setules except for cephalothorax. Posterior border of each somite crenate except for pre-anal and anal somites, with 3–8 sensilla; pseudoperculum (Fig. 98C) on pre-anal somite (urosomite 5) with 10 well-developed spinous projections. Rostrum (Fig. 96A) triangular, fused at base to cephalothorax; anterior and lateral margins concave; with paired sensilla and small apical protrusion. Cephalothorax with 31 sensilla; ventrolateral margin crenate. Ventrolateral margin of thoracic somites crenate, possessing sensillum, with row of setules anteriorly. All urosomites except for pre-anal and anal somites with well-developed pleurotergite, bearing one sensillum (Fig. 98A). Original segmentation of genital double-somite marked by dorsal and lateral subcuticular ridges (Figs. 96A, B), fused ventrally (Fig. 98A); posterior margin with 2 small processes ventrally, each bearing sensilium. Genital field (Fig. 98A, B) with median copulatory pore, with paired genital apertures; P6 represented by 1 plumose and 2 naked setae. Posterior margin of pre-anal somite crenulate ventrally. Anal somite (Fig. 98C) small; dorsal surface with 2 sensilla; anal opening triradiate, fringed with deeply incised frill.

Caudal ramus (Fig. 98A, C) cylindrical, 1.8 times as long as greatest width, with slightly convex inner and outer lateral margins, and possessing with 7 setae: seta I small, inserted ventrally at about halfway down outer margin; seta II twice as long as seta I, inserted distally at 3/4 distance of outer margin; seta III as long as seta II, inserted subdistally at outer corner; distal setae IV and V well-developed, covered with minute spinules except for proximal part; seta VI as long as seta III, inserted distally at inner corner; seta VII tri-articulated at base, inserted distally on dorsal surface.

Antennule (Fig. 97A) robust, short, 6-segmented: segment 1 with 2 rows of spinules on anterior margin; segment 2 longest, with subcuticular ridge medially; segments 4 and 6 with aesthetasc;

segment 6 with transverse suture, indicating former division between segments 6 and 7. Setal formula as follows: 1-[1], 2-[15], 3-[3], 4-[3 + ae], 5-[5], 6-[8 + ae].

Antenna (Fig. 97B). Coxa small. Basis elongate, with 2 rows of spinules, with 1 pinnate abexopodal seta. Exopod 3-segmented; proximal segment with small plumose seta; middle segment shortest, with 1 spinulose seta; distal segment longer than preceding segments combined, with 3 spinulose and 1 pinnate setae. Endopod 2-segmented; proximal segment with long spinulose inner seta; distal segment longer than proximal one, inner margin with 2 long spinulose and 1 short delicate setae, and 2 groups of spinules, distal margin with 1 long spinulose, 4 long pinnate and 1 delicate pinnate setae, inner distal corner with row of spinules.

Mandible (Fig. 97C). Gnathobase well-developed, armed with 6 teeth and 1 pinnate seta; outermost tooth largest and multicuspidate, innermost one small and spinule-like. Palp consisting of basis, exopod, and endopod; basis with 3 plumose setae distally; exopod small, 1-segmented, bilobate, inner and outer lobes with 1 and 2 apical plumose setae, respectively; endopod 1-segmented, with 4 plumose setae.

Maxillule (Fig. 97D). Praecoxal arthrite well-developed, with 7 pinnate or spinulose spines on distal margin and 2 setae on anterior surface. Coxa with pinnate outer seta; coxal endite with 3 pinnate setae distally. Basal endite elongate, with 5 pinnate setae distally, with row of spinules on surface. Exopod 1-segmented, with 3 plumose setae. Endopod 1-segmented, wide, with 6 plumose setae.

Maxilla (Fig. 97E). Syncoxa with row of outer spinules proximally, with 3 endites: proximal endite bilobate, each lobe with 2 pinnate and 1 bare setae; middle endite with 1 pinnate and 2 bare setae; distal endite with 2 spine-like elements and 1 bare seta. Basal endite with 2 spine-like elements and 2 bare setae. Endopod 1-segmented, elongate, with 3 apical and 2 lateral elements.

Maxilliped (Fig. 97F). Syncoxa elongate, with row of setules along lateral margin proximally. Basis shorter and narrower than syncoxa, with pinnate seta at distal corner and row of setules on lateral margin distally. Endopod 1-segmented, small, with 1 plumose and 1 pinnate setae apically, with 1 delicate and 1 long bare setae laterally.

P1 (Fig. 98D). Intercoxal sclerite wide and arched. Coxa with 3 rows of spinules on anterior surface. Basis slightly smaller than coxa, with 3 rows of spinules on anterior surface, 1 plumose outer seta, and 1 long pinnate inner spine. Exopod 3-segmented; outer margin of each segment with spinules as shown; exp-1 with row of inner setules and 1 spinulose outer spine; exp-2 with 1 spinulose outer spine and 1 plumose inner seta; exp-3 with 1 plumose inner and 2 spinulose apical elements, and 2

outer spinulose spines. Endopod 2-segmented, reaching to end of exopod; outer margin of each segment with spinules as shown; enp-1 slightly longer than wide, with plumose inner seta; enp-2 narrower and longer than preceding segment, with 1 plumose inner and 1 spinulose apical setae and 1 outer spinulose spine.

P2–P4 (Figs. 98E, 99A, B). Intercoxal sclerite wide, arched. Coxa with 4 rows of spinules on anterior surface. Basis smaller than coxa, with 1–3 rows of spinules on anterior surface and 1 plumose outer seta. Both rami 3-segmented; exopod longer than endopod; each exopodal segment with outer spinules and inner setules; exp-1 and exp-2 each with 1 plumose inner seta and 1 spinulose outer spine, exp-3 with 2 plumose inner setae, 2 apical elements, and 3 spinulose outer spines; each endopodal segment with setules or spinules along outer margin; enp-2 and P4 enp-3 with inner setules; enp-1 and enp-2 each with 1 plumose inner seta, enp-3 except for P4 with 1 plumose inner seta, 2 apical elements, and 1 spinulose outer spine; P4 enp-3 with 2 apical elements and 1 spinulose outer spine.

P5 (Fig. 99C). Intercoxal sclerite small. Baseoendopod wide, with outer cylindrical peduncle bearing pinnate seta; endopodal lobe reaching halfway down of exopod, with 2 long pinnate setae. Exopod fused to baseoendopod, with 3 marginal and 1 surface setae (Kim et al. 2016b).

**Male.** Unknown.

**Remarks.** *Zosime destituta* Kim, Jung & Yoon, 2016 is very similar to *Z. valida* Sars, 1919 which was originally described outside the Oslofjord (Sars 1919). Females of both species share the presence of 5 elements on P1 exp-3 and 2 setae on P5 endopodal lobe, and the similar length to width ratio of caudal ramus (about 2.0). However, *Zosime destituta* and *Z. valida* can be differentiated by the combination of the following features: number of segments of the antennule (6 in *Z. destituta* vs. 7 in *Z. valida*); the absence of the inner seta on P4 enp-3 in *Z. destituta*, but it is present in *Z. valida*; P6 being represented by 3 setae in *Z. destituta*, but with 2 setae in *Z. valida*. The absence of the inner seta on P4 enp-3 in *Z. destituta* is unique within the genus. The only other species that displays 3 elements on P4 enp-3 is *Z. bathyalis* Por, 1967, but in this species the outer spine appears to be absent and the inner seta present (Por 1967).

Bodin (1968) described *Zosime bathybia* from the Gulf of Gascogne and mentioned that this species differs from *Z. incrassata* in the number of setae on the distal exopodal segment of the antenna (with 3 setae in *Z. bathybia*, but 2 in *Z. incrassata*). Apostolov & Petkovski (1980) doubted the validity of this character as a criterion to separate these species and relegated *Z. bathybia* to a

subspecies of *Z. incrassata*. However, these two species are clearly different in body size, the former (550 µm) being smaller than the latter (745 µm), and the morphology of the maxilliped in the female. Unfortunately, Sars (1910) omitted the illustration of the maxilliped in the original description of *Z. incrassata*, and mentioned that it was similar to that of the type species, *Z. typica* Boeck, 1873. According to his redescription of *Z. typica*, Sars (1903) shows 2 apical and 1 small lateral setae on the endopod of the maxilliped, and 1 long terminal seta on the basis. On the other hand, *Z. bathybia* has 2 long apical setae on the endopod and 1 small seta on the basis (Bodin 1968). These differences are considered here enough to separate *Z. incrassata* and *Z. bathybia*.

The potential polyphyly of the genus *Zosime* was first commented upon by Koller & George (2011) who identified divergent character states in some species: *Z. anneae* Koller & George, 2011 has an 8-segmented antennule instead of 6- or 7-segmented and shows unique characters in the caudal setae such as the reduction of setae I, II and VII in size and the peculiar position of setae I and II affected by elongation of the caudal rami; *Z. reyssi* Dinet, 1974 lacks the seta on the exopodal surface of P5 in the female (this characteristic is shared also by *Z. incrassata* and *Z. bathybia*); the caudal rami of *Z. incrassata*, *Z. bathybia*, and *Z. reyssi* are as long as wide (Koller & George 2011).

To verify the taxonomic relationships within *Zosime*, the morphology of all the *Zosime* species currently known was compared based on the available literature (Boeck 1873; Sars 1903, 1910, 1919; Monard 1937; Lang 1948; Por 1964, 1967; Bodin 1968; Drzycimski 1968; Coull 1973; Dinet 1974; Becker & Schriever 1979; Apostolov & Petkovski 1980; Fiers 1991; Wells 2007; Kornev & Chertoprud 2008; Koller & George 2011). This comparison revealed that the genus can be subdivided into three provisional groups, *anneae*-, *incrassata*-, and *typica*-group, based on differences in the structure of the antennule, antennary exopod, mandibular rami, armature of the swimming legs, fifth leg, and caudal rami. Three groups of the genus *Zosime* are proposed as follows:

1) ***anneae*-group.** This group is characterized by the combination of the following characteristics: 8-segmented antennule in the female; second segment of antennary exopod with 1 seta; mandibular exopod and endopod with 3 and 4 setae, respectively; P3–P4 exp-3 with 2 inner setae; P5 exopod in the female with 3 marginal and 1 surface setae; caudal rami four times as long as wide. This group comprises only 1 species: *Z. anneae*.

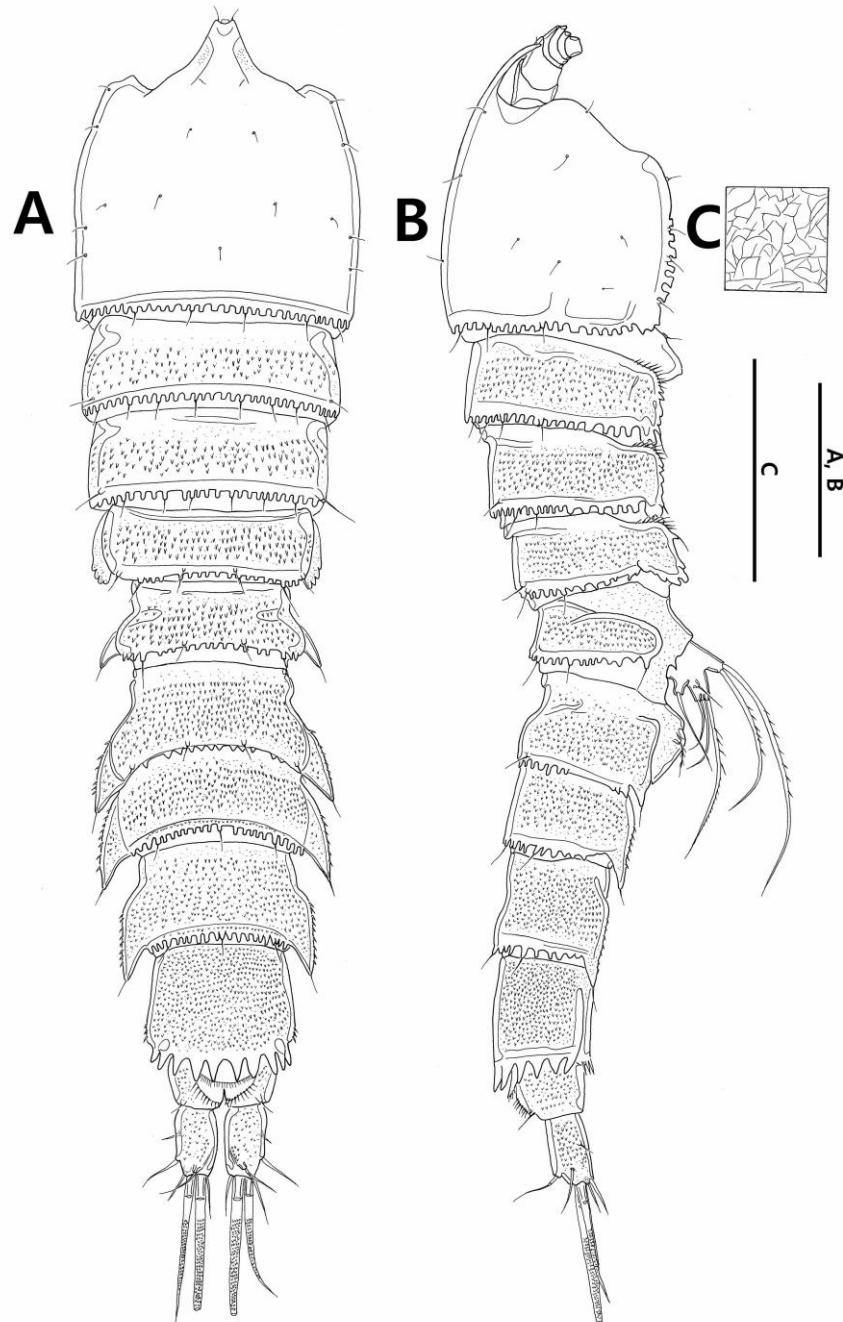
2) ***incrassata*-group.** This group is characterized by the combination of the following characteristics: 7-segmented antennule in the female; second segment of antennary exopod without seta; mandibular exopod and endopod with 1 or 2 setae, respectively (*Z. reyssi* was shown with only

1 seta on the palp (see Dinet 1974, Fig. 8), but this condition may be based on an observational error); P3–P4 exp-3 with 3 inner setae; P5 exopod in the female with 4 marginal setae; caudal rami about as long as wide. This group comprises 3 species: *Z. incrassata*, *Z. bathybria*, and *Z. reyssi*.

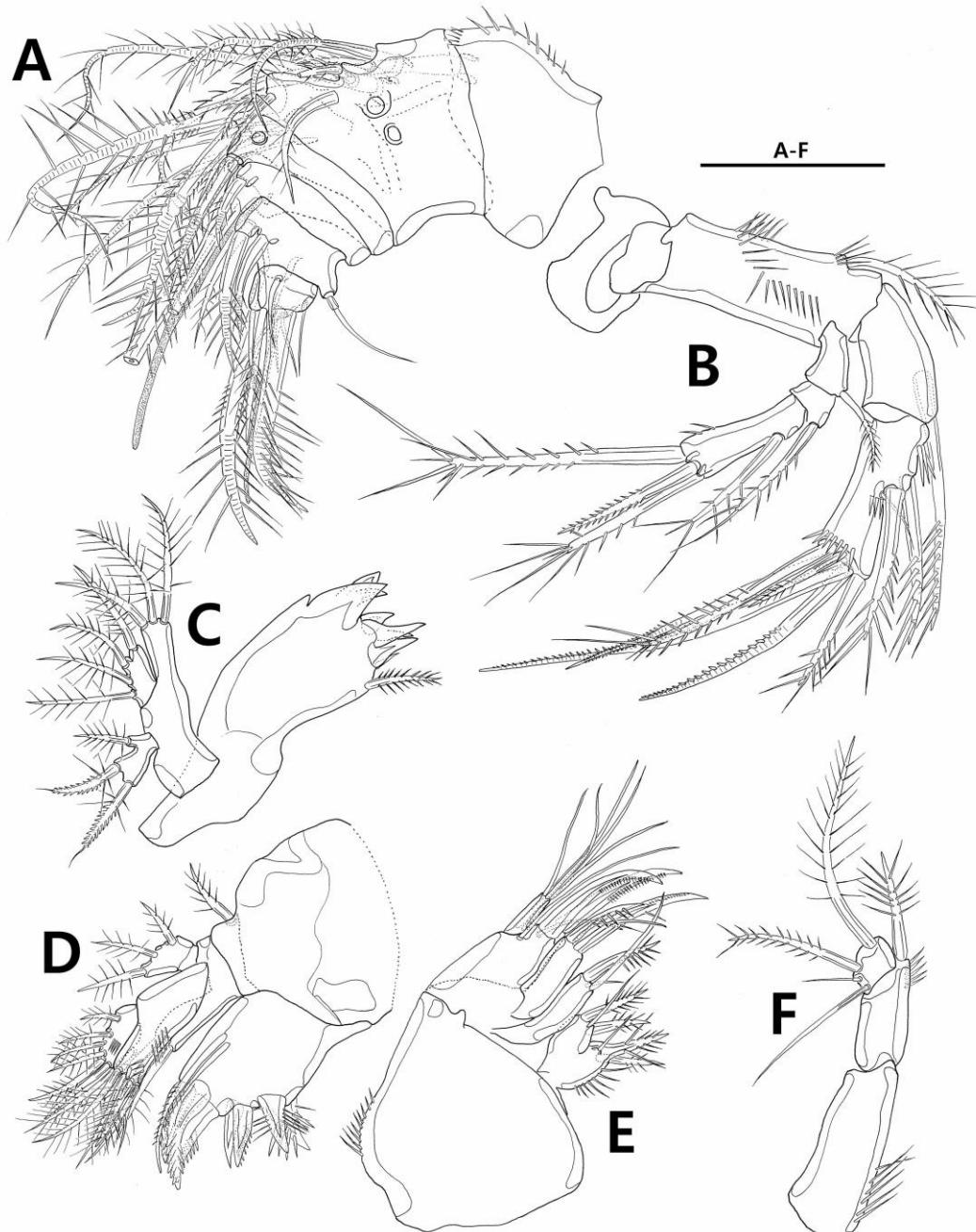
3) ***typica*-group.** This group is characterized by the combination of the following characteristics: 6- or 7-segmented antennule in the female; second segment of antennary exopod with 1 seta; mandibular exopod and endopod have 3 or 4 setae, respectively; third exopodal segments of P3 and P4 have 2 inner setae; P5 exopod in the female with 3 marginal and 1 surface setae; caudal rami at least 1.7 times as long as wide. This group comprises 13 species: *Z. typica*, *Z. major* Sars, 1919, *Z. valida*, *Z. gisleni* Lang, 1948, *Z. mediterranea* Lang, 1948, *Z. bathyalis*, *Z. erythraea* Por, 1967, *Z. atlantica* Bodin, 1968, *Z. bergensis* Drzycimski, 1968, *Z. paramajor* Bodin, 1968, *Z. paratypica* Becker & Schriever, 1979, *Z. pacifica* Fiers, 1991, and *Z. destituta*.

Koller & George (2011) mentioned that *Z. anneae* has several unique features in the caudal setae which may be derived character states: (1) setae I and II are apart from each other; (2) seta I is minute and setule-like; (3) seta I is inserted in the middle of the caudal rami ventrally; (4) seta II is minutized; (5) seta VII is minutized and very slender. These features were excluded for the definition of the above groups because for some *Zosime* species the caudal rami have been inadequately described (Sars 1910, 1919; Lang 1948; Por 1967; Drzycimski 1968; Becker & Schriever 1979).

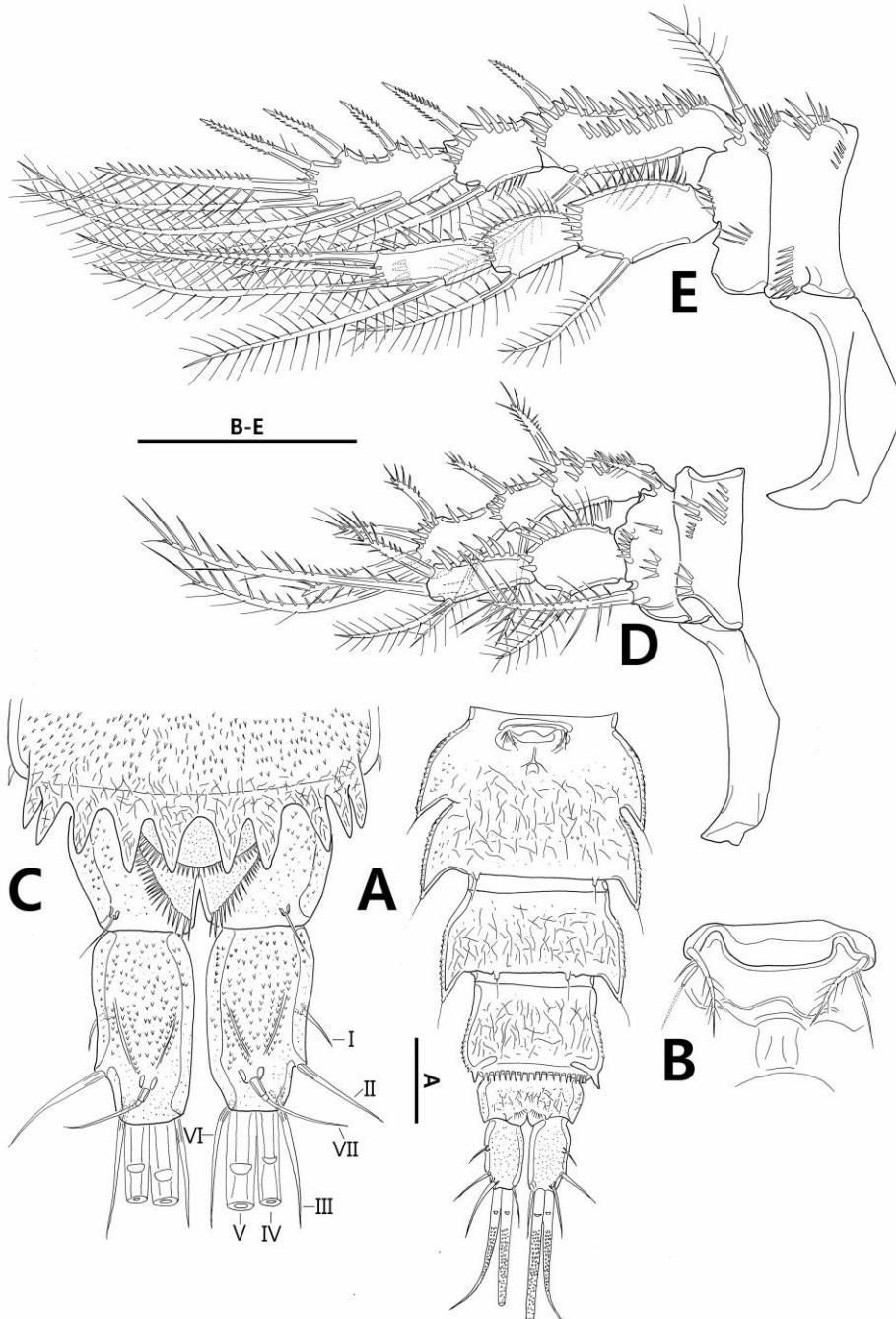
If more species of *Zosime* are described, the *typica*-group could be divided into subgroups. Among 13 species belonging to the *typica*-group, two species, *Z. atlantica* and *Z. bathyalis*, show discrepancy in the mandibular rami with remaining species of this group. The exopod has 4 setae instead of 3 in *Z. atlantica* and the endopod has 3 setae instead of 4 in *Z. bathyalis*. Especially, the latter presents additional differences from other species in the following characteristics: (1) the proximal segment of antennary exopod is bare, but present in other species; (2) the third exopodal segments of P2–P4 have 2 outer spines instead of 3; (3) the third endopodal segments of P3–P4 have 3 elements instead of 4. In addition, there are some differences of the armature of P1 between members of this group: the third exopodal segment is armed with 6 elements in *Z. typica*, *Z. major*, *Z. gisleni*, *Z. mediterranea*, *Z. atlantica*, *Z. bergensis*, *Z. paratypica*, and *Z. pacifica*, but with 5 ones in *Z. valida*, *Z. bathyalis*, *Z. paramajor*, and *Z. destituta* (in *Z. erythraea*, Por (1967) described this species with 6 elements, but provided the figure of P1 exp-3 armed with 5 elements in his original description); the second endopodal segment is armed with 4 elements in *Z. typica*, *Z. major*, *Z. gisleni*, *Z. paratypica*, and *Z. pacifica*, but remaining eight species have only 3 (Kim et al. 2016b).



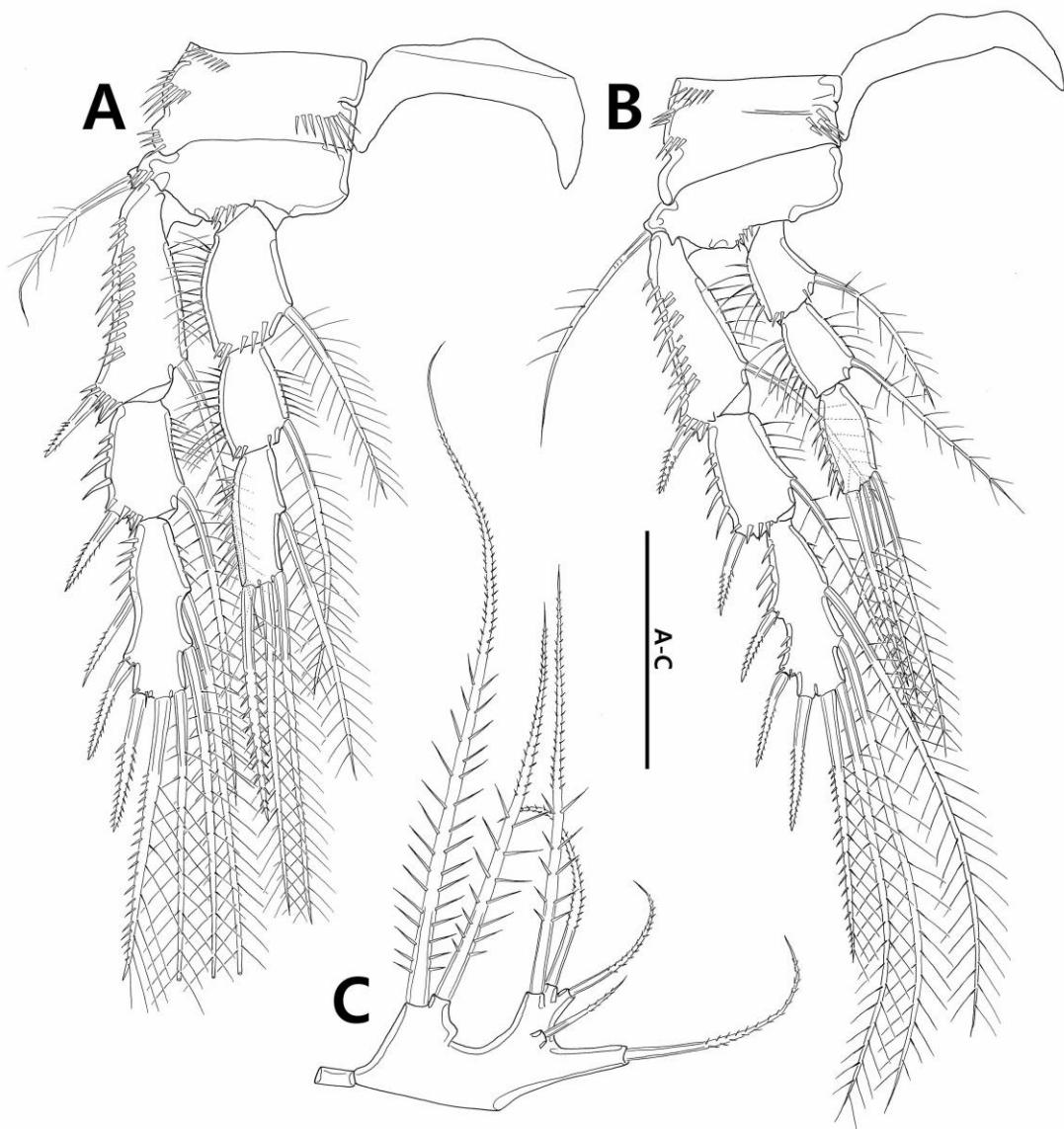
**Fig. 96.** *Zosime destituta* Kim, Jung & Yoon, 2016, female. A, habitus, dorsal; B, habitus, lateral; C, detail of the surface of the cephalothorax. Scale bars: 50  $\mu\text{m}$  (C); 100  $\mu\text{m}$  (A, B) (cited from Kim et al. 2016b).



**Fig. 97.** *Zosime destituta* Kim, Jung & Yoon, 2016, female. A, antennule; B, antenna; C, mandible; D, maxillule; E, maxilla; F, maxilliped. Scale bar: 30  $\mu$ m (cited from Kim et al. 2016b).



**Fig. 98.** *Zosime destituta* Kim, Jung & Yoon, 2016, female. A, urosome (excluding P5-bearing somite), ventral; B, genital field; C, posterior margin of pre-anal somite, anal somite, and caudal rami; D, P1; E, P2. Scale bars: 50  $\mu$ m (cited from Kim et al. 2016b).



**Fig. 99.** *Zosime destituta* Kim, Jung & Yoon, 2016, female. A, P3; B, P4; C, P5. Scale bar: 50  $\mu$ m (cited from Kim et al. 2016b).

**Table 4.** List of valid species of *Zosime* Boeck, 1873, with some of the most commonly used morphological features and newly proposed groups (based on females only) (cited from Kim et al. 2016b)

Subgroup	Species	A1	A2	Md	Setal formula of thoracic legs (exp/enp)					P5	P6	CR,	Reference
		no. of seg.	exp, setal formula	exp/en p, no. of setae	P1	P2	P3	P4	P5	exp, surface seta	rami	no. of setae	L/W ratio
<i>anneae</i> -group	<i>Z. anneae</i>	8	1.1.4	3/4	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/4	present	fused	3	4.0
	<i>Z. incrassata</i>	7	1.0.2	1/2	0.1.122/1.121	1.1.223/1.1.121	1.1.323/1.1.221	1.1.323/1.1.121	4/3	absent	separate	unknown	1.1
<i>incrassata</i> -group	<i>Z. bathybia</i>	7	1.0.3	1/2	0.1.122/1.121	1.1.223/1.1.121	1.1.323/1.1.221	1.1.323/1.1.121	4/3	absent	separate	1	1.2
	<i>Z. reyssi</i>	7	1.0.2	1/-	0.1.122/1.020	1.1.223/1.1.121	1.1.323/1.1.1(2) 21	1.1.323/1.1.121	4/4	absent	partially separate	unknown	1.2
<i>typica</i> -group	<i>Z. typica</i>	6	1.1.3	3/4	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121 <sup>a)</sup>	1.1.223/1.1.121	4/3	present	fused	unknown	2.6
	<i>Z. major</i>	6	1.1.3 <sup>(b)</sup>	3/4 <sup>(b)</sup>	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121 <sup>b)</sup>	1.1.223/1.1.121	4/4	present	fused	unknown	3.0
	<i>Z. valida</i>	7	1.1.4	2 or 3/4	0.1.122/1.111	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/2	present	fused	2	1.7
	<i>Z. gisleni</i>	6	unknown	3/4 <sup>(c)</sup>	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121 <sup>d)</sup>	1.1.223/1.1.121	4/3	present	fused	unknown	3.0

**Table 4.** (Continued).

Subgroup	Species	A1	A2	Md exp/en p, no. of setae	Setal formula of thoracic legs (exp/enp)					P5	P6	CR,	Reference	
		no. of seg.	exp, setal formula	P1	P2	P3	P4	P5	exp, surface seta	rami	no. of setae	L/W ratio		
typica -group	<i>Z. mediterranea</i>	6 <sup>(e)</sup>	1.1.3 <sup>(e)</sup>	3/4 <sup>(e)</sup>	0.1.123/1.111	1.1.223/1.1.121 <sup>(e)</sup>	1.1.223/1.1.121 <sup>(e)</sup>	1.1.223/1.1.121 <sup>(e)</sup>	4/4	present	fused	unknown	2.0	Monard (1937), Lang (1948), Wells (2007)
	<i>Z. bathyalis</i>	6	0.1.5	3/3	0.1.122/1.111	1.1.222/1.1.121	1.1.222/1.1.120	1.1.222/1.1.120	4/4	present	fused	unknown	2.3	Por (1967)
	<i>Z. erythraea</i>	6	unknown	3/4	0.0.122(3)/1.111 <sup>1</sup>	1.1.223/1.1.121 <sup>(f)</sup>	1.1.223/1.1.121 <sup>(f)</sup>	1.1.223/1.1.121 <sup>(f)</sup>	4/4	present	fused	unknown	4.0	Por (1967)
	<i>Z. atlantica</i>	7	1.1.3	4/4	0.1.123/1.111	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/4	present	fused	unknown	2.2	Bodin (1968)
	<i>Z. paramajor</i>	6	1.1.4	3/4	0.1.122/1.111	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/4	present	fused	2	2.9	Bodin (1968)
	<i>Z. bergensis</i>	6 <sup>(g)</sup>	1.1.3 <sup>(g)</sup>	3/4 <sup>(g)</sup>	0.1.123/1.111 <sup>g)</sup>	1.1.223/1.1.121 <sup>(g)</sup>	1.1.223/1.1.121 <sup>(g)</sup>	1.1.223/1.1.121 <sup>(g)</sup>	4/3	present	fused	unknown	3.3	Drzycimski (1968) Becker & Schriever (1979)
	<i>Z. paratypica</i>	7	1.1.4	3/4	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/3 or 4	present	fused	unknown	4.0	Fiers (1991)
	<i>Z. pacifica</i>	6	1.1.4	3/4	0.1.123/1.121	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.121	4/2	present	fused	2	2.0	Kim et al. 2016b
	<i>Z. destituta</i>	6	1.1.4	3/4	0.1.122/1.111	1.1.223/1.1.121	1.1.223/1.1.121	1.1.223/1.1.021	4/2	present	fused	3	1.8	

<sup>(a)</sup>Boeck (1873) described inadequately the type species, *Z. typica*, without illustration. Sars (1903) described subsequently *Z. typica* and provided the illustrations of most appendages without P3. According to Well's (2007) keys, the exp-3 and enp-2 of P3 have 7 and 4 setae in *Z. typica*, respectively.

<sup>(b)</sup>Sars (1919) mentioned that the antenna, mouth parts, and P1–P4 of *Z. major* are similar to those of type species.

<sup>(c)</sup>Lang (1948) mentioned that the mandible of *Z. gisleni* is normal.

<sup>(d)</sup>Lang (1948) mentioned that the P1–P4 of *Z. gisleni* are similar to those of type species.

<sup>(e)</sup>This species was first described as *Z. major* by Monard (1937) and subsequently revised to a new species as *Z. mediterranea* on the basis of the differences in the caudal rami, pseudoperculum, and P1 by Lang (1948). According to Well's (2007) keys, the exp-3 and enp-2 of P2–P4 have 7 and 4 setae in *Z. mediterranea*, respectively.

<sup>(f)</sup>Por (1967) mentioned that the P2–P4 of *Z. erythraea* are similar to those of *Z. gisleni*.

<sup>(g)</sup>Drzycimski (1968) mentioned that the antennule, antenna, mouth parts, and P2–P4 of *Z. bergensis* are similar to those of type species.

**Superfamily [as yet unnamed in Wells (2007)]****Family Paramesochridae Lang, 1944**

한국산 **Paramesochridae** 과의 속에 대한 검색표(Back & Lee 2012)

1. 제 1 흉지의 외지는 세 마디로 이루어져 있다 ..... *Remanea*
- 제 1 흉지의 외지는 두 마디로 이루어져 있다 ..... 2
2. 제 2–3 흉지의 내지는 두 마디로 이루어져 있다 ..... *Paramesochra*
- 제 2–3 흉지의 내지는 한마디로 이루어져 있다 ..... 3
3. 제 4 흉지는 내지를 가진다 ..... *Wellsopsyllus*
- 제 4 흉지는 내지를 가지지 않거나 1 개의 강모만을 가진다 ..... *Apodopsyllus*

**Genus *Remanea* Klie, 1929**

모식종: *Remanea arenicola* Klie, 1929

**80. *Remanea naksanensis* Back, Lee & Huys, 2011**

*Remanea naksanensis* Back et al., 2011, p. 2941, figs. 1–7.

관찰재료: 2♀♀, 강원 고성군 근덕면 문암리, 문암해수욕장, 2016.7.20.

분포: 한국.

고찰: 현재, *Remanea* 속에는 단 3 종만이 위치하고 있다: *Remanea arenicola* Klie, 1929, *R. plumose* Pennak, 1942, *R. naksanensis* Back, Lee & Huys, 2011. 각 종들은 제 2–3 흉지의 강모식, 암컷 제 5 흉지의 외지에 존재하는 강모의 길이, 수컷 제 5 흉지의 외지에 존재하는 강모의 종류에 따라 서로 구분될 수 있다 (Back et al. 2011). 본 연구에서는 모식산지와 인접한 정점에서 이 종을 채집, 확인하였다.

**Genus *Wellsopsyllus* Kunz, 1981**

모식종: *Wellsopsyllus gigas* (Wells, 1965)

한국산 *Wellsopsyllus* 속의 종에 대한 검색표(Back & Lee 2014b)

1. 제 4 흉지의 내지는 1 마디로 이루어져 있다; 제 2, 3 흉지의 내지는 매우 작은 돌기로 이루어져 있다 ..... *W. (Wellsopsyllus) egregius*
- 제 4 흉지의 내지는 2 마디로 이루어져 있다; 제 2, 3 흉지의 내지는 일반적인 마디로 이루어져 있다 ..... *W. (Scottopsyllus) koreanus*

**81. *Wellsopsyllus (Scottopsyllus) koreanus* Back & Lee, 2014**

*Wellsopsyllus (Scottopsyllus) koreanus* Back & Lee, 2014b, p. 354, figs. 7–11.

관찰재료: 4♀♀, 제주 제주시 애월읍 곽지리, 곽지해수욕장, 2014.06.26.

분포: 한국.

고찰: 현재, *Wellsopsyllus* 속에는 3 개의 아속(*Wellsopsyllus* Kunz, 1981, *Scottopsyllus* Apostolov & Marinov, 1988, *Intermediopsyllus* Huys, 2009)이 있는데 이들은 제 2–4 흉지의 외지와 내지의 마디수에서 크게 구분될 수 있다(Back & Lee, 2014). 이 종이 속한 *Scottopsyllus* 아속에는 7 종과 1 아종이 위치하고 있으며, 제 2 촉각 외지의 강모수, 제 1 흉지 저절에 잔강모열의 존재 유무, 제 1 흉지 내지의 두 번째 마디에 존재하는 강모수, 미차의 길이 등에 의하여 서로 구분될 수 있다.

**Superfamily Tachidioidea Boeck, 1865**

Family Tachidiidae Boeck, 1865 날래장수노벌레 과

**한국산 날래장수노벌레 과(*Tachidiidae*)의 속에 대한 검색표(Boxshall & Halsey 2004)**

1. 제 1 흉지 외지 세 번째 마디는 5개의 가시/강모를 가진다; 수컷 제 2 흉지 내지 두 번째 마디는 안쪽 가장자리 끝에 돌기를 가진다 ..... 2  
- 제 1 흉지 외지 세 번째 마디는 5개의 가시/강모를 가진다; 수컷 제 2 흉지 내지 두 번째 마디는 안쪽 가장자리 끝에 돌기를 가지지 않는다 ..... 3
2. 제 1 흉지 내지 세 번째 마디는 5 개의 가시/강모를 가진다; 제 5 흉지는 이엽형이다..... 날래장수노벌레 *Tachidius*  
- 제 1 흉지 내지 세 번째 마디는 4 개의 가시/강모를 가진다; 제 5 흉지는 삼각형이다..... 세모날래장수노벌레 *Neotachidius*
3. 암컷의 생식절과 제 6 흉지를 가지는 체절은 융합하여 생식이중절을 이룬다;  
제 1-4 흉지 내지의 첫 번째 마디는 내측강모를 가지지 않는다.....  
.....조막마디날래장수노벌레 속 *Microarthridion*  
- 암컷의 생식이중절을 형성하지 않는다; 제 1-4 흉지 내지의 첫 번째 마디는 내측강모를 가진다 ..... 뾰족날래장수노벌레 속 *Geeopsis*

**Genus *Tachidius* Lilljeborg, 1853 날래장수노벌레 속**

**모식종:** *Tachidius discipes* Giesbrecht, 1881

**82. *Tachidius discipes* Giesbrecht, 1881 날래장수노벌레**

*Tachidius discipes* Giesbrecht, 1882, p. 108 (cited from Lang 1948); Lang, 1948, p. 292, fig. 143: 1;  
Dussart, 1967, p. 172, fig. 61; Chang, 2008, p. 230, fig. 1; Chang, 2009b, p. 158, pl. 6F, fig. 55;  
Chang, 2010, p. 26, fig. 9.

*Tachidius* (*Tachidius*) *discipes*: Tai & Song, 1979, p. 193, fig. 88; Song & Chang, 1995, p. 66, fig. 1.

**관찰재료:** 1♀, 인천 강화군 길상면 동검리, 동검도선착장, 2012.7.7.

**고찰:** 인천 강화도에서 확인된 암컷 1 개체는 한국에서 기록된 문현들(Song & Chang 1995; Chang 2008, 2009, 2010)과 흉지의 강모식과 제 5 흉지의 형질에서 잘 일치한다. 그러나 동검도 시료는 제 2 촉각의 외지의 강모에서 형태의 차이를 나타냈다. 이전 기록들에서는 제 2 촉각 외지 두 번째 마디의 옆 가장자리에 존재하는 강모가 매우 축소 되어 있지만, 본 연구의 동검도의 시료는 잘 발달되어 있는 우상강모를 가지고 있다. 이러한 동검도 시료의 특징은 중국의 시료(Tai & Song 1979)에서 보고된 것과 비슷하다. 한편, Huys et al. (2005)는 근연 속인 *Neotachidius*의 한국산 2 종을 기록할 때 이 강모의 길이와 종류를 종을 구별할 수 있는 중요한 형질로 사용하였다. Chang (2008, 2009b, 2010)의 문현들에서는 암컷 제 5 흉지 표면에 잔가시열이 없지만, Song & Chang (1995)의 기록에서는 3 개의 잔가시열을 가지고 있다. 그러나 동검도 시료는 2 개의 잔가시열이 존재하였다. 최근, 갈고리노벌레류의 분류에서 이러한 미세형질이 종을 구별하는 형질로 주목 받고 있기 때문에 각 지역별 개체들에 대하여 면밀한 분류학적 검토가 필요하다.

#### Genus *Microarthridion* Lang, 1944 조막마디날래장수노벌레 속

**모식종:** *Microarthridion littorale* (Poppe, 1881)

##### 한국산 조막마디날래장수노벌레 속(*Microarthridion*)의 종에 대한 검색표

1. 제 2 촉각 외지는 모두 4 개의 강모를 갖는다; 제 5 흉지 내지엽은 4 개의 강모를 갖는다 ..... 조막마디날래장수노벌레 *M. littorale*
- 제 2 촉각 외지는 모두 5 개의 강모를 갖는다; 제 5 흉지 내지엽은 3 개의 강모와 1 개의 가시를 갖는다 ..... 가시날래장수노벌레 *M. litospinatus*

#### 83. *Microarthridion littorale* (Poppe, 1881) 조막마디날래장수노벌레(Figs. 100–105)

*Tachidius littoralis* Poppe, 1881, p. 149, pl. 6, figs. 1–12; Canu, 1892, p. 156; Klie, 1913, p. 36, figs. 18–19; Willey, 1929, p. 536, fig. 28; Gurney, 1932, p. 32, figs. 411–428; Pesta, 1932, p. 24, figs. 18–19; Borutsky, 1952, p. 104, fig. 36: 1–12.

*Tachidius crassicornis* T. Scott, 1892, p. 250, pl. 8, figs. 14–27.

*Microarthridion littorale* Lang, 1948, p. 295, fig. 144: 1; Dussart, 1967, p. 177, fig. 63; Apostolov & Marinov, 1988, p. 82, fig 25: 2a–6; Huys et al., 1996, p. 226, fig. 89; Kornev & Chertoprud, 2008, p. 91.

?*Microarthridion littorale*: Tai & Song, 1979, p. 176, fig. 92.

**Material examined.** 4♀♀, 2♂♂, Chosa-ri ( $34^{\circ}24'55.55''N$ ,  $126^{\circ}19'32.59''E$ ), Uisin-myeon, Jindogun, Jeollanam-do, South Korea on 3 May 2015: 1♀ (NIBRIV0000470365) dissected on 14 slides; 1♂ (NIBRIV0000470366) dissected on eight slides; 1♀ (NIBRIV0000470367) dissected on seven slides; 1 ♂ (NIBRIV0000470368) dissected on eight slides; 1♀ (NIBRIV0000470369) dissected on nine slides; 1 ♀ (NIBRIV0000470370) dissected on 13 slides.

**Description. Female:** Body (Fig. 100A, B) fusiform tapering posteriorly, with distinct boundary between prosome and urosome; total length from 660.0 to 716.7  $\mu m$  (mean 690  $\mu m$ , n = 4) including rostrum and caudal rami; surface of each somite armed with rows of minute spinules except for cephalothorax and caudal rami; posterior margin of each somite except for caudal rami armed with spinules; pleuron of each pedigerous prosomite armed with spinules. Rostrum (Fig. 101A) triangular in shape, fused to cephalothorax at its base, with 2 sensilla subapically; anterior tip blunt, with ventral protrusion bearing 2 sensilla. Cephalothorax (Fig. 100A, B) as long as wide in dorsal view, with row of spinules along posterior and anteroventral margins; surface covered with paired sensilla, with 3 nuchal organs posteriorly. P1-bearing somite incorporated into cephalothorax. Each pedigerous prosomite (Fig. 100A, B) with paired nuchal organs on lateral surface; surface with 2 pairs of sensilla except for somite bearing P4; each posterior and anteroventral margins with 10, 8, and 2 pairs of sensilla, respectively. Uosome (Fig. 101B) slender than prosome, tapering posteriorly. P5-bearing somite (Fig. 100A, B) trapezoidal, with 2 pairs of sensilla on surface. Genital double-somite (Figs. 100A, B, 101B) slightly shorter than wide in dorsal view, fused ventrally but separated dorsolaterally by suture; genital somite with 2 pairs of sensilla on posterior margin and well-developed pleuron bearing rows of spinules; urosomite 3 narrower than genital somites, with 2 pairs of sensilla on posterior margin. Genital field (Fig. 101C) having common median genital slit without seta; single copulatory located posterior to genital slit and covered by cuticular process. Urosomite 4 with stout spinules on both posterolateral surfaces; posterior margin with 2 pairs of sensilla dorsally and 1 pair of sensilla ventrally. Urosomite 5 slightly smaller than preceding one, with 2 pairs of sensilla on

posterior margin. Anal somite (Figs. 100A, B, 101B) small; dorsal surface with 1 pair of sensilla; ventral surface with row of spinules and pair of sensilla; posterior margin with row of spinules ventrally; anal operculum weakly developed, semicircular, with row of fine setules along posterior margin; anal opening ornamented with several rows of fine setules.

Caudal rami (Fig. 101D, E) as long as wide in ventral view, with oblique row of setules on dorsomedial surface medially and several minute spinules on dorsal and lateral surfaces, and armed with 7 setae. Seta I small, located on lateral surface proximally. Seta II long, slender, and located on dorsal surface, near seta VII. Seta III spiniform, pinnate, longer than caudal ramus in length. Setae IV and V well-developed, pinnate distally; seta V 1.5 times as long as seta IV. Seta VI slender, small, slightly shorter than seta III and bearing setules. Seta VII articulated, slender, as long as seta III.

Antennule (Fig. 101F) short, blunt, 6-segmented; segment 1 largest, with 1 pinnate seta and 4 oblique rows of spinules; segments 2 with 1 minute bare and 6 pinnate setae; segment 3 with 4 pinnate setae; segment 4 smallest, with 1 pinnate seta and 1 peduncle having aesthetasc and long pinnate seta; segment 5 small, with 1 pinnate seta; segment 6 blunt, as long as two preceding segments combined, and bearing 1 plumose seta, 6 bare setae, 7 pinnate setae and 1 aesthetasc. Each aesthetasc on segments 4 and 6 fused to pinnate seta at its base.

Antenna (Fig. 102A). Coxa without ornamentation. Basis small, shorter than coxa, with 4 rows of spinules. Exopod 2-segmented; proximal segment with 1 plumose seta at distal corner; distal segment slightly shorter than preceding one, with 1 lateral and 2 apical plumose setae. Endopod 2-segmented; proximal segment about 2 times as long as coxa, with row of setules along abexopodal margin; distal segment longer and slender than preceding one, with 1 row of setules on inner margin, 1 row of spinules proximally and 3 pinnate spines on abexopodal margin, and 2 spinule frills on distal margin; distal armature of distal segment composed of 1 small pinnate spine, 4 geniculate setae, and 1 small bare seta.

Labrum (Fig. 102B) well-developed, armed with paired spinular row along lateral margin distally, and 2 spinule rows and 1 paired spinule row near distal margin.

Mandible (Fig. 102C). Gnathobase well-developed, with 1 tricuspid, 1 bicuspis, and 5 unicuspid teeth on cutting edge and 1 pinnate seta at distal corner; surface with 2 rows of setules and patch of small spinules. Palp biramus; basis broad, with 1 plumose seta and 1 row of spinules; exopod 1-segmented, small, with 1 bare and 4 plumose setae and group of setules; endopod 1-segmented, elongate, with 2 uniplumose setae on lateral margin and 3 bare and 2 plumose setae on distal margin.

Maxillule (Fig. 102D). Praecoxal arthrite with 7 spines (3 naked, 3 bearing spinule, 1 pinnate) and 4 setae (2 stout unipinnate, 1 small naked, and 1 small unipinnate); anterior surface with 2 juxtaposed setae. Coxa with 2 row of spinules on anterior surface; endite with 1 stout pinnate and 2 bare setae. Basis with row of spinules on anterior surface, 2 stout pinnate and 3 bare setae. Endopod small, 1-segmented, fused into basis at its base, with 2 apical setae. Exopod absent.

Maxilla (Fig. 102E). Syncoxa with 2 rows of setules along outer margin and 3 endites; proximal endite bilobate, with 1 stout pinnate seta on proximal lobate and 3 setae on distal lobate; both middle and distal endites each with 1 spinulose and 2 bare setae. Allobasis with 2 rows of spinules and bearing 2 spinulose and 2 bare setae. Endopod 1-segmented, small, with 5 elements.

Maxilliped (Fig. 102F) 3-segmented, subchelate. Syncoxa elongate with 6 rows of spinules and 1 group of long setules. Basis as long as coxa, with 1 row of setules near middle of outer margin. Endopod 1-segmented, small, with 1 long and 1 very small setae, and 1 long claw bearing accessory spinules.

P1 (Fig. 103A). Intercoxal plate bilobate distally, with row of spinules on each side. Praecoxal well-developed, with row of setules along distal margin. Coxa small, with 1 rows of small spinules anterior surface and 3 rows of minute or moderate spinules along distal margin; outer margin with 2 row of spinules posteriorly; distal margin with posteriorly 1 row of setules. Basis larger than coxa; inner spines spinulose, with spinules near its base; outer spine spinulose distally, with spinules near its base; inner margin with row of setules; distal margin with 1 row of spinules. Exopod 3-segmented, longer than endopod, armed with several rows of spinules; exp-1 with 1 outer pinnate spine; exp-2 with 1 outer spine and 1 inner plumose seta; exp-3 with 3 outer spines, 2 apical setae, and 1 inner seta. Endopod 3-segmented, armed with several row of spinules; enp-1 small, without inner seta; enp-2 with 1 inner plumose seta, 1 setule row on inner margin; enp-3 elongate, with 1 outer spine, 2 apical and 2 inner setae.

P2–P4 (Figs. 103B, 104A, B). Intercoxal plate armed with 2 spinule rows on anterior surface distally. Praecoxa smaller than that of P1, armed with rows of spinules distally. Coxa larger than that of P1; anterior surface with 1 long setule row and 1 spinule row; posterior surface with 2 or 3 spinular rows and 1 minute setule group; outer margin with 1 row of spinules. Basis with 1 plumose outer seta; anterior surface with 1 or 2 spinules distally and 1 pore; posterior surface with 1 or 3 spinule rows; inner margin with row of long setule; distal margin armed with 2 or 3 spinule rows. Both rami 3-segmented, armed with several rows of spinules; exopod longer than endopod; exp-2 with 1 inner

setule row and 1 anterior pore; exp-3 with anterior pore; enp-1 small, with row of spinules on anterior surface; enp-2 with 1 setule row on inner margin; enp-3 with 1 tube pore on anterior surface except for P4; distal seta on enp-3 serrate distally.

Setal formula of P2–P4 as follows:

	Exopod	Endopod
P2	0.1.222	0.2.221
P3	0.1.222	0.2.321
P4	0.1.122	0.1.221

P5 (Fig. 104C) fused to somite. Outer peduncle located on lateral surface, armed with 2 row of spinules, bearing 1 plumose apical seta. Exopod and baseoendopod fused, forming bilobate sling plate; outer lobe small with 1 plumose seta; inner lobe large, with 3 long plumose setae and 1 group of inner setules (Kim et al. 2016).

**Male:** Body shape and ornamentation similar to female (Fig. 105A); total length from 666.7 to 712.2  $\mu\text{m}$  (mean 689.5,  $n = 2$ ) including rostrum and caudal rami; urosomite 2 and 3 separated each other (Fig. 105B).

Antennule (Fig. 105E, F) 7-segmented, blunt, and subchelate. Segment 1 with 1 plumose seta and 4 rows of spinules. Segment 2 very short, with 1 plumose seta. Segment 3 tapering distally, with 10 plumose or spinulose setae and 1 naked seta. Segment 4 with 5 plumose or spinulose setae, 1 naked seta, and 1 small aesthetasc. Segment 5 small, subtriangular in shape, with 2 plumose and 1 naked setae. Segment 6 large, swollen; palmar margin with 3 naked and 5 unipinnate setae, 3 small produces and 1 bub-like process; inner surface having 2 slender setae and 1 aesthetasc; distal corner with 1 spinulose seta; aesthetasc on inner surface fused to seta at its base; distal margin of bub-like process serrate in ventral view (Fig. 6F). Segment 7 hook-shaped, slender, with 9 bare setae and 1 aesthetasc.

P1 as female except for distal inner seta on enp-3, which plumose, not pinnate distally (Fig. 103C).

P2 as female except for exp-3 and enp-3. Two apical setae on exp-3 modified; outer margin of apical setae armed with very small spinules; inner seta on smaller than of female (Fig. 103D). Enp-3 with modified apical setae; outer seta very reduced, slightly curved outwardly; inner seta shorter than that of female, slightly swollen at its base (Fig. 103E).

P3 and P4 with modified apical seta on exp-3; outer margin of apical setae armed with very small spinules; inner apical seta on exp-3 smaller than of female (Fig. 104D, E).

P5 (Fig. 105C) incorporated into P5-bearing somite. Endopodal lobe weakly developed, small plate-like, and with 4 setae; second inner seta shortest. Outer peduncle separate from endopodal lobe, located on lateral surface, with long plumose apical seta.

P6 (Fig. 105D) symmetrical, represented by plate; each with 2 pinnate spines and 1 long plumose seta (Kim et al. 2016).

**Remarks.** The Korean specimens examined in the present study are herein attributed to *M. littorale* (Poppe, 1881) in the following diagnostic features for females: 6-segmented antennule, antennary exopod with four setae totally, P1 enp-3 with five setae, P2–P3 enp-2 with two setae, respectively, and P5 represented by a single plate bearing four plumose setae (Boxshall & Halsey 2004; Kihara & Rocha 2007; Tran & Chang 2012). However, our specimens differ from the representative records of *M. littorale* (Poppe 1881; T. Scott 1892; Gurney 1932; Borutsky 1952; Tai & Song 1979; Huys et al. 1996) by the following: (1) the maxillipedal syncoxa is armed with six groups of spinules and one group of long setules, while it is ornamented with only two rows of spinules in the records of Poppe (1881) and Gurney (1932); (2) the maxillipedal endopod has one long and one very small accessory setae, whereas it is armed with only one long seta in the materials of previous records; (3) both anterior and posterior surfaces of the swimming legs are armed with several rows of setules or spinules, while these ornateations are absent or simple in previous records; (4) the distal inner setae on enp-3 of the swimming legs are distally serrate, whereas it is plumose in previous records; (5) the inner apical seta of P2 enp-3 in males is slightly swollen at its proximal, while it is not expanded in the records of Gurney (1932) or Huys et al. (1996). These morphological details hitherto have not been considered as key characters to identify Microarthridion species, although detailed features such as body ornamentation pattern, pores and sensilla pattern, and the feature of the setae on swimming legs have been noticed as characteristic features in modern harpacticoid taxonomy (Huys et al. 2005; Kihara & Huys 2009; Karanovic & Cho 2012; Fiers & Kotwicki 2013).

For male *M. littorale*, the Korean materials typically display well known sexual dimorphism of the genus with the outer apical seta of P2 enp-3 remarkably reduced (Fig. 4E). In addition, for the first time, sexual dimorphisms in swimming legs were observed from these Korean materials of *M. littorale*. The distal inner seta on P1 enp-3 is distally serrate in females, while it is plumose in males (Fig. 4C). The two apical setae (Figs. 4D, 5D, E) on exp-3 of P2–P4, inner one of which is decreasing in length, are modified with size reduction of the outer spinules in the males. Such modification of the apical setae is not present in the females.

*Microarthridion littorale* Poppe (1881) is euryhaline with a wide distribution, ranging from estuarine to shallow subtidal localities (Huys et al. 1996). It has been found in Europe, North America, and East Asia (Chang, 2008). However, taxonomical records (Poppe 1881; T. Scott 1892; Gurney 1932; Borutsky 1952; Tai & Song 1979; Huys et al. 1996) of this species are ambiguous in details. They represent some discords from each other in the following characters:

(1) The female *M. littorale* from Norway was about 750 µm long in the original description of Poppe (1881). However, the females from British and Chinese waters were smaller in sizes (Gurney 1932; Tai & Song 1979). The sizes of Gurney's (1932) materials ranged from 450 to 570 µm in the females and from 400 to 460 µm in the males. The sizes of Tai & Song's (1979) specimens ranged from 420 to 620 µm in the females. On the other hand, the males of larger size (about 680 µm in body length) were described from British waters by Huys et al. (1996).

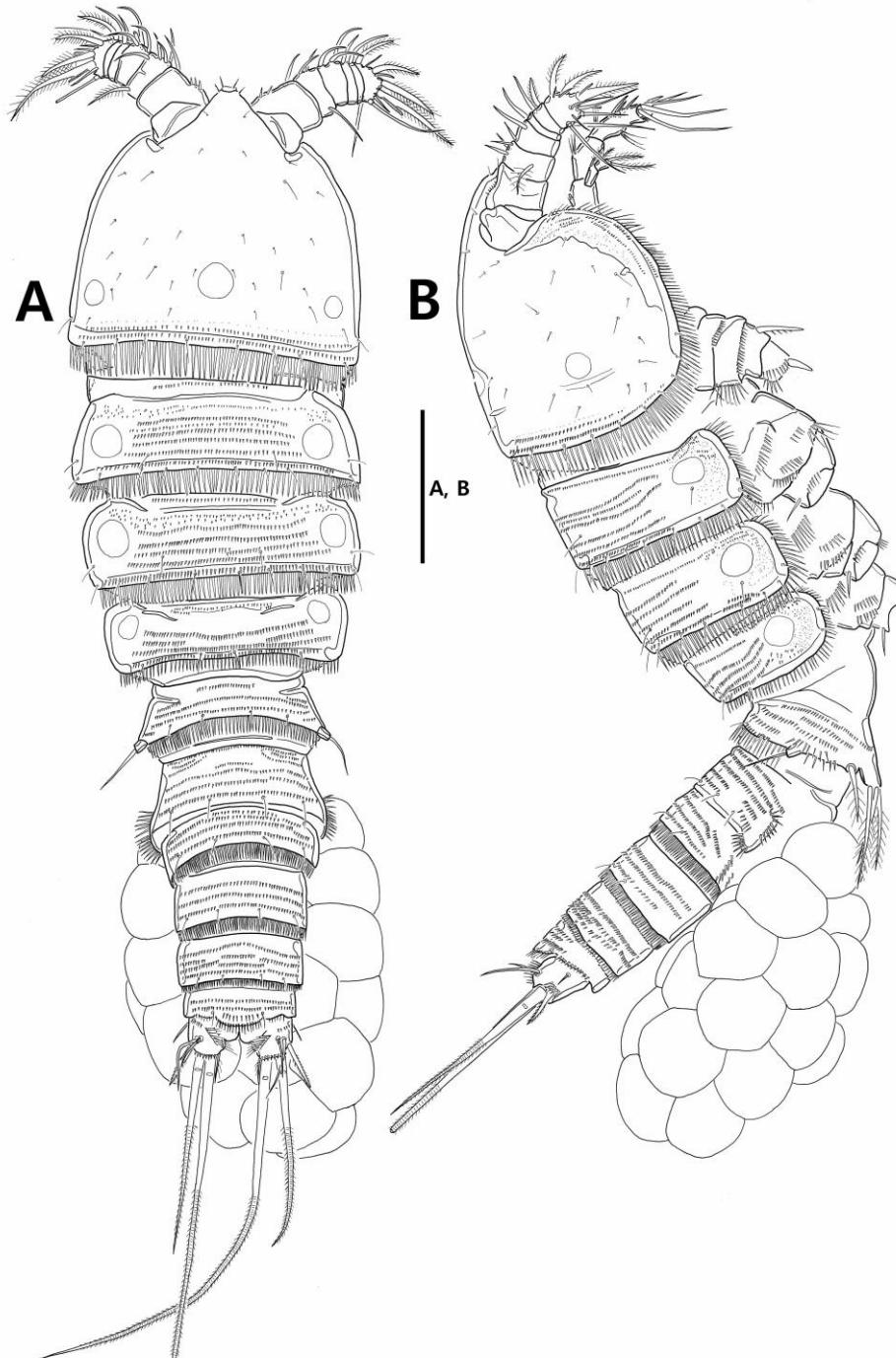
(2) *Microarthridion littorale* has 6-segmented antennule. Such segmentation of the antennule in the females is considered as an important identification key for *Microarthridion* species (Boxshall & Halsey 2004; Kihara & Rocha 2007; Tran & Chang 2012). However, discrepancy of antennular segmentation is known among species reported as *M. littorale*. Borutsky (1952) has described that the antennule was composed of seven segments for his Russian materials of *M. littorale*, although he presented 6-segmented antennule in his figure (see the position of the first antennular segment in Borutsky 1952, Fig. 36:1). On the other hand, Chinese specimens of Tai & Song (1979) appear to have 5-segmented antennule (see the position of the segment with one seta in Tai & Song 1979, Fig. 92B). It has been reported that harpacticoid species commonly bear only one seta on the first antennular segment (Huys & Boxshall 1991). However, the Chinese materials were described to have an antennule bearing a seta on the second segment among six antennular segments (Tai & Song 1979). They might have mistakenly considered the base of the antennule as the first antennular segment. It is highly possible that they have mislabeled the position of the first segment among six antennular segments in their illustration.

(3) It is generally known that the second innermost seta on the female P5 is as long as the neighboring setae in *M. littorale* (Poppe 1881; T. Scott 1892; Gurney 1932). The Korean materials of the present study also have the same feature. However, the seta in the materials of *M. littorale* from China and Russia was smaller in length (about half) compared to other neighboring setae (Borutsky 1952; Tai & Song 1979).

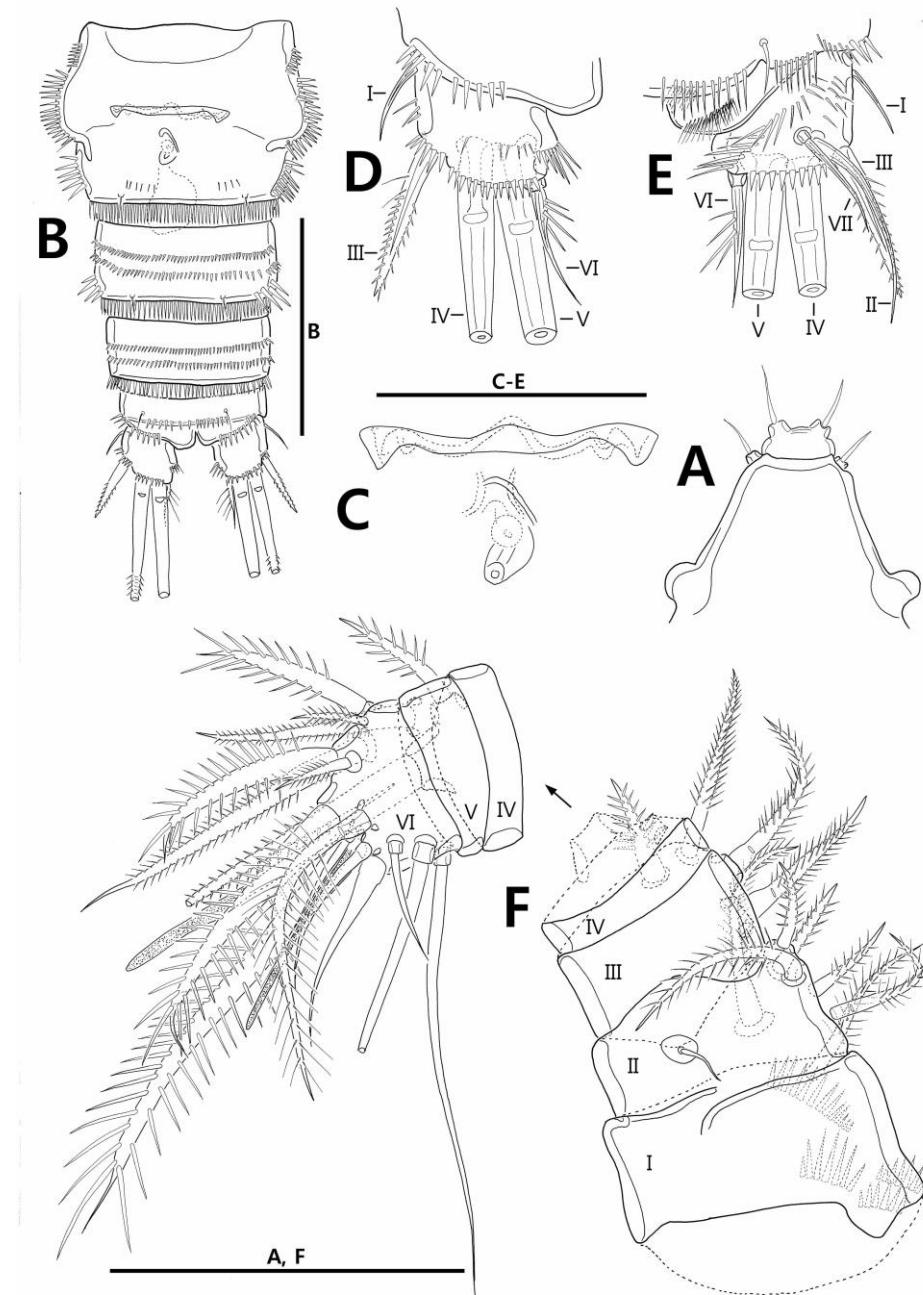
(4) Morphological differences between the previous records of *M. littorale* are also found in the armatures of the antennule, antenna, and mouth appendages and in the ornamentation of the swimming legs. However, these discrepancies might be due to observational errors or poor descriptions by the previous authors. It is well known that such incomplete descriptions from the oldest records can increase taxonomic confusion on most harpacticoid taxa, including Ectinosomatidae Sars, 1903 (Kihara & Huys 2009).

These discrepancies in detailed morphological features might be mainly caused by poor and brief descriptions as mentioned above. Among so-called *M. littorale*, nevertheless, *M. littorale sensu* Tai & Song (1979) from China is probably a species distinct from *Microarthridion littorale* (Poppe, 1881) based on its small body size, the segmentation of antennule, and the length of the second inner seta on female P5 endopodal lobe. If those Chinese specimens indeed have 5-segmented antennule, they should not be coincided as *M. littorale* (Poppe, 1881) because the segmentation of the antennule is presently considered as an important identification key in the taxonomy of the genus (Kihara & Rocha 2007; Tran & Chang 2012). However, the real meaning of these morphological discrepancies merit further study with materials from China, Europe, and other regions.

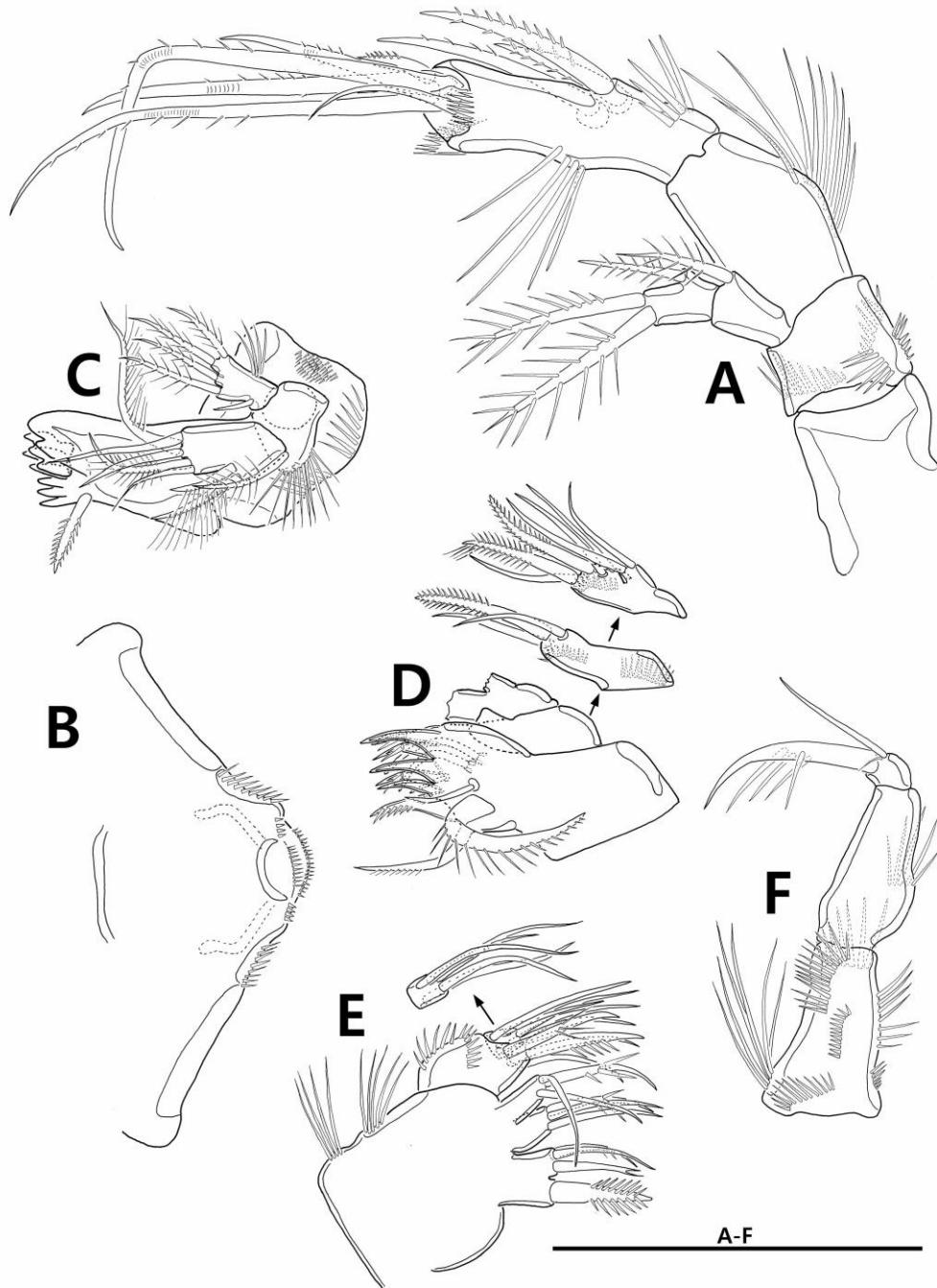
*Microarthridion littorale* reported from north-west Europe, North America, and East Asia (Huys et al. 1996; Chang 2008). Schizas et al. (1999) have reported that *M. littorale* populations along the southeastern Atlantic and Gulf of Mexico coasts of the U.S.A are structured over large geographic scales (hundreds of kilometers) based on molecular data. Considering the existence of morphological discrepancies among regional populations as mentioned above, these results suggest that many new species are probably situated under the name of *M. littorale*. Recently, Fiers & Kotwicki (2013) have revealed that there are differences among specimens from several regions on Europe attributed to *Nannopus palustris* Brady, 1880 which is known to have a worldwide distribution. As a result, they have introduced four new species and one new combination by detailed morphological study. Therefore, a revision for so-called *M. littorale* is urgently needed. The present study could provide basic information for such study (Kim et al. 2016).



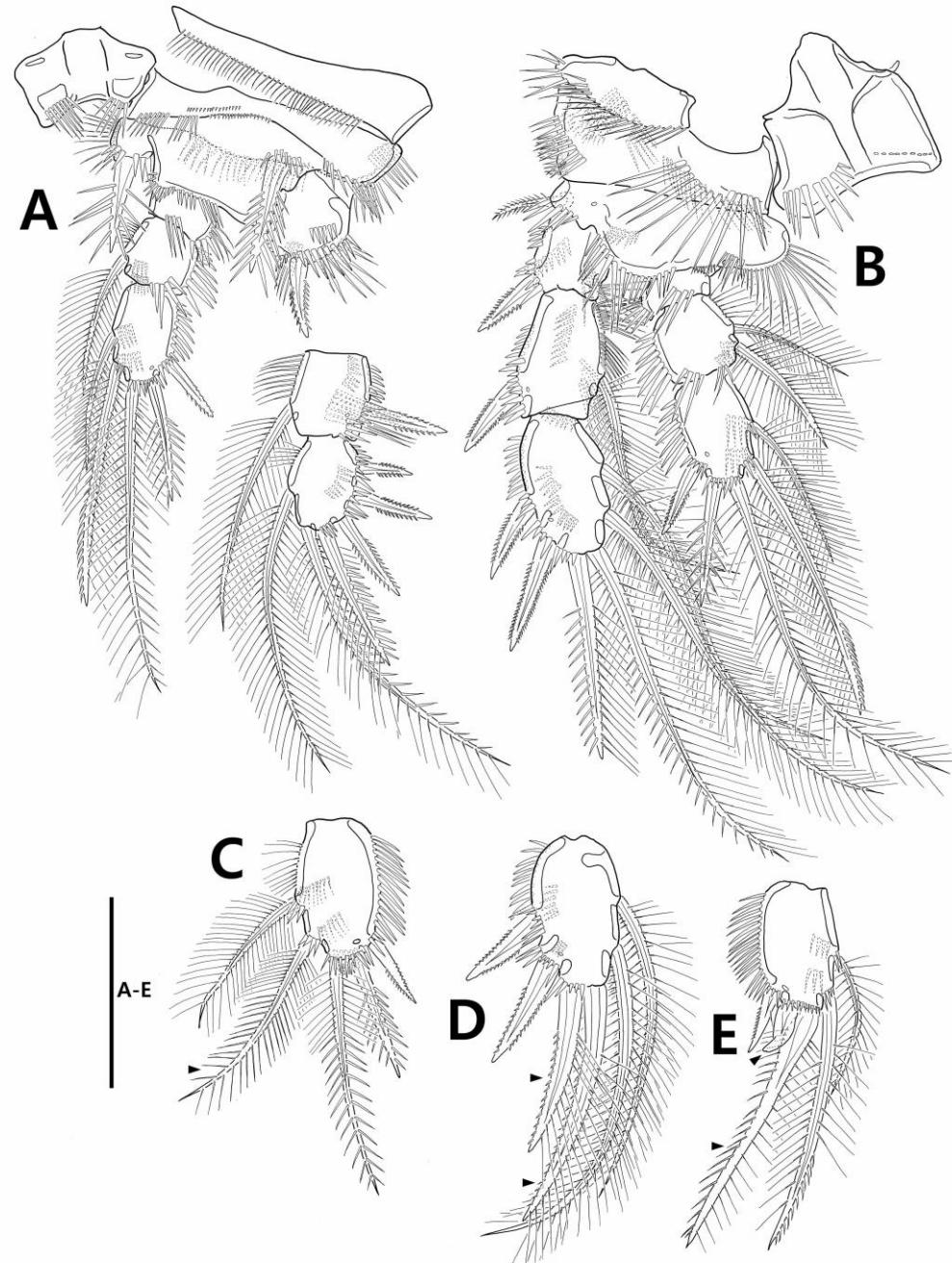
**Fig. 100.** *Microarthridion littorale* (Poppe, 1881), female. A, habitus, dorsal; B, habitus, lateral.  
Scale bar: 100  $\mu\text{m}$  (cited from Kim et al. 2016).



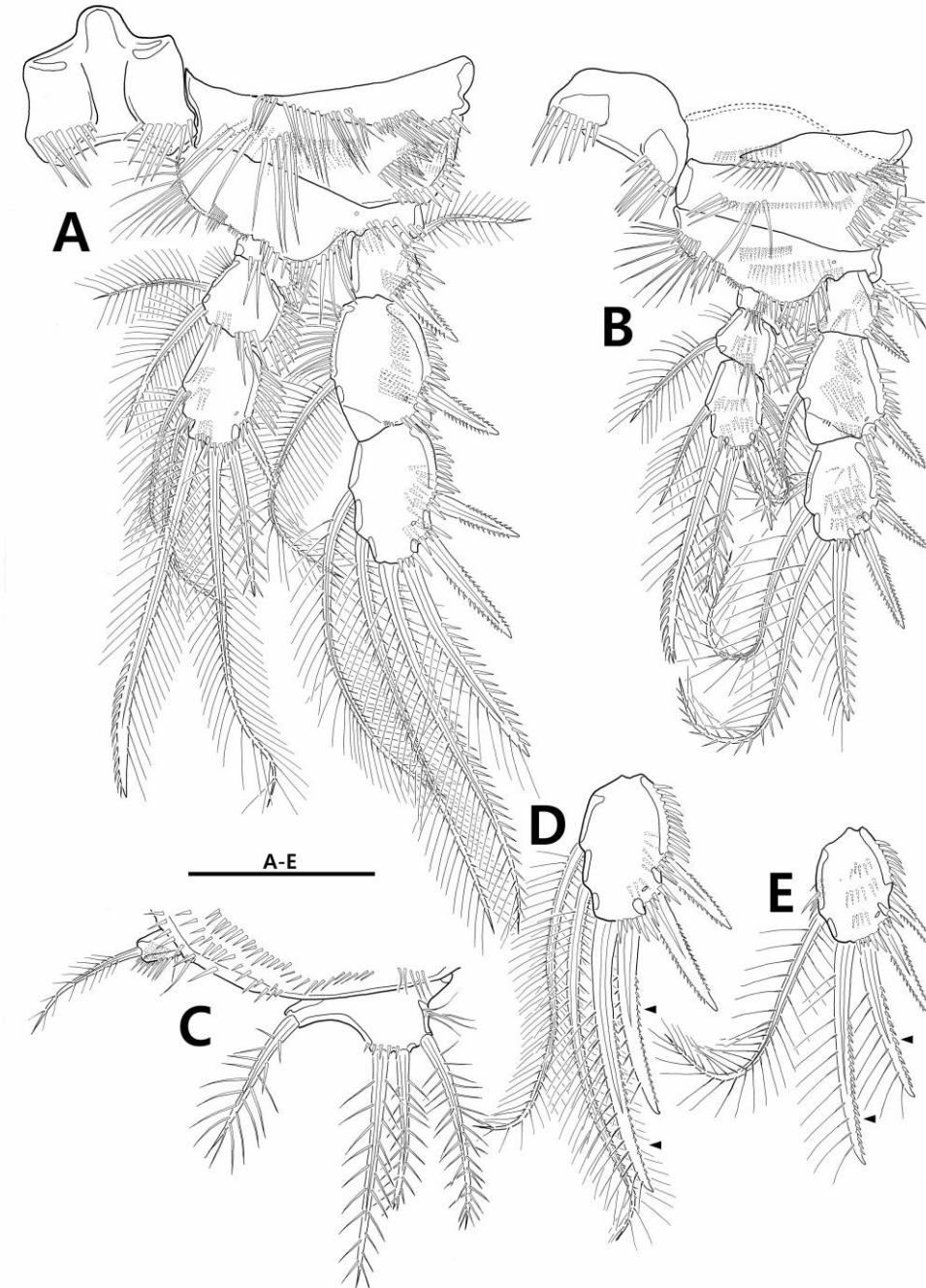
**Fig. 101.** *Microarthridion littorale* (Poppe, 1881), female. A, rostrum; B, urosome, ventral; C, genital field; D, caudal ramus, ventral; E, caudal ramus, dorsal; F, antennule. Scale bars: 50 µm (A, C–F); 100 µm (B) (cited from Kim et al. 2016).



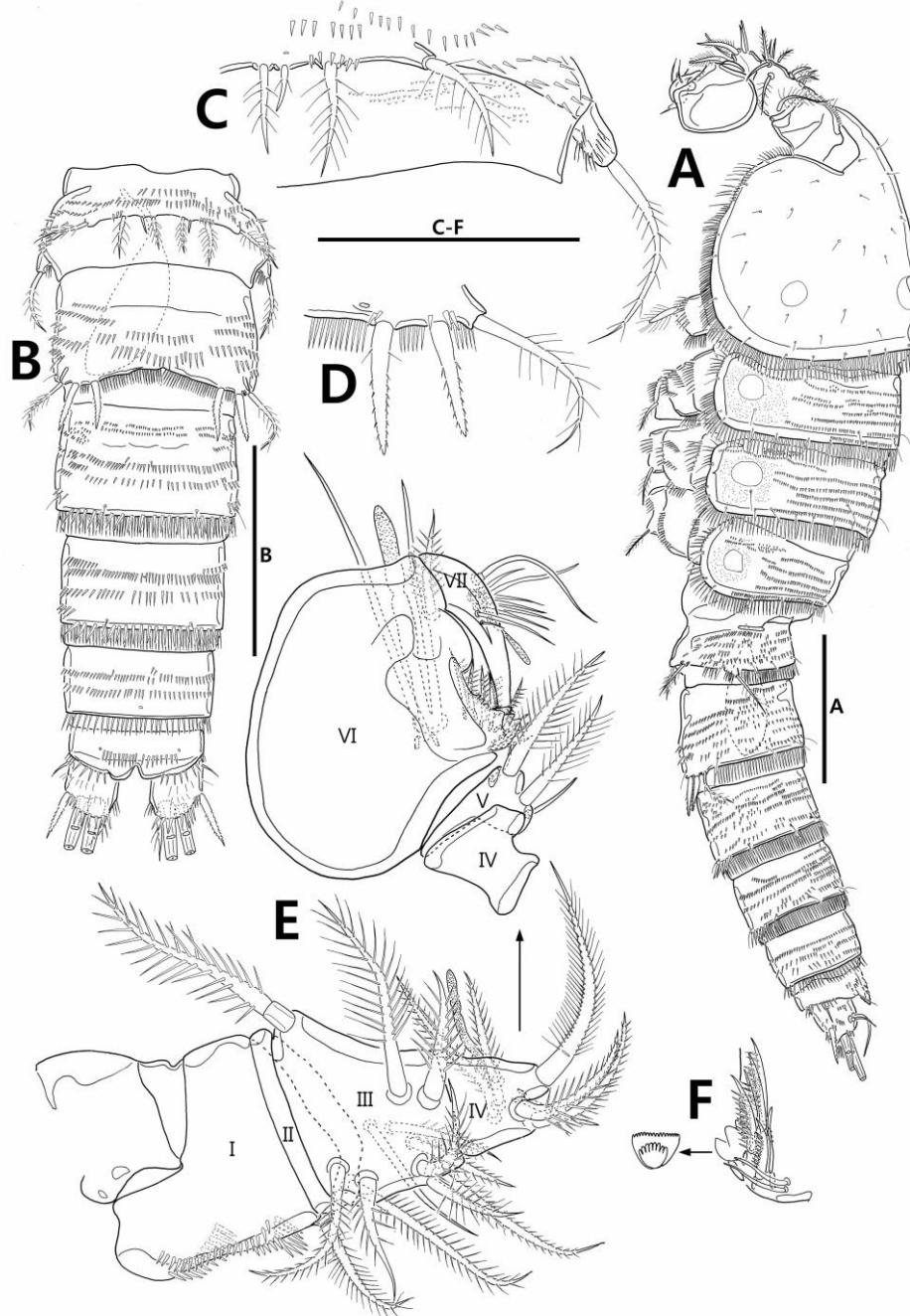
**Fig. 102.** *Microarthridion littorale* (Poppe, 1881), female. A, antenna; B, labrum; C, mandible; D, maxillule; E, maxilla; F, maxilliped. Scale bar: 50  $\mu\text{m}$  (cited from Kim et al. 2016).



**Fig. 103.** *Microarthridion littorale* (Poppe, 1881), female (A, B): A, P1; B, P2. Male (C–E): C, P1 enp-3; D, P2 exp-3; E, P2 enp-3. Arrows indicate sexual dimorphism in male. Scale bar: 50 µm (cited from Kim et al. 2016).



**Fig.104.** *Microarthridion littorale* (Poppe, 1881), female (A–C): A, P3; B, P4; C, P5. Male (D, E): D, P3 exp-3; E, P4 exp-3. Arrows indicate sexual dimorphism in male. Scale bar: 50  $\mu$ m. (cited from Kim et al. 2016)



**Fig. 105.** *Microarthridion littorale* (Poppe, 1881), male (A–D). A, habitus, lateral; B, urosome, ventral; C, P5; D, P6; E, antennule; F, proximal of palmar margin on sixth antennular segment, ventral. Scale bars: 50 µm (C–F); 100 µm (A, B) (cited from Kim et al. 2016).

**84. *Microarthridion litospinatus* Shen & Tai, 1973 가시날래장수노벌레**

*Microarthridion litospinatus* Shen & Tai, 1973, p. 369, figs. 1–11; Tai & Song, 1979, p. 178, fig. 93; Chang, 2008, p. 233, figs. 3–5; Chang, 2009b, p. 168, figs. 61, 62; Chang, 2010, p. 37, figs. 14–16.

**관찰재료:** 4♀♀, 전남 광양시 광양읍 도월리, 2016.4.26; 2♀♀, 경남 사천시 사천읍 구호리, 중선포천 하구역, 2016.04.26.

**분포:** 한국, 중국.

**고찰:** 우리나라에 조막마디날래장수노벌레 속은 조막마디날래장수노벌레(*M. littorale*)와 가시날래장수노벌레(*M. litospinatus*)의 2 종이 보고 되어 있다. 이 두 종은 형태적으로 암컷의 제 5 흉지 기내지에 존재하는 강모의 종류에서 차이를 나타낸다. 한편 본 연구에서 조막마디날래장수노벌레는 주로 기수지역의 갯벌 조간대에서 채집되었지만, 가시날래장수노벌레 담수의 영향이 비교적 크게 미치는 하구역에서만 확인되었다. 이 점으로 보아 영분이 이 두 종의 서식처를 결정하는 인자로 판단된다.

**Genus *Neotachidius* Shen & Tai, 1963 세모날래장수노벌레 속**

**모식종:** *Neotachidius triangularis* (Shen & Tai, 1963)

**한국산 세모날래장수노벌레 속의 종에 대한 검색표**

1. 제 1 흉지 내지의 세 번째 마디 끝 가장자리에 존재하는 바깥 강모는 안쪽 강모보다 훨씬 짧으며 가시 모양이다; 제 5 흉지의 길이는 너비의 1.4 배정도 이다 ..... 고려세모날래장수노벌레 *N. coreanus*
- 제 1 흉지 내지의 세 번째 마디 끝 가장자리에 존재하는 바깥 강모는 안쪽 강모와 비슷한 길이이며, 강모 모양이다; 제 5 흉지의 길이는 너비 정도이다 ..... 작은세모날래장수노벌레 *N. parvus*

**85. *Neotachidius coreanus* Huys, Ohtsuka, Conroy-Dalton & Kikuchi, 2005****고려세모날래장수노벌레**

*Neotachidius coreanus* Huys et al., 2005, p. 135, figs. 1–10, 16A, C; Chang, 2009b, p. 164, fig. 57; Chang, 2010, p. 31, fig. 11.

**관찰재료:** 5♀♀, 1♂, 전남 신안군 신용리, 압해도(갯벌), 2012.4.6; 2♀♀, 충남 태안군 원북면 방갈리, 민어도(플랑크톤네트), 2012.6.23; 3♀♀, 전남 완도군 신지면 대평리(갯벌), 2012.7.19; 1♀, 경기 용진군 영흥면 선재리, 영흥도, 음포해변(갯벌) 2012.7.22; 15♀♀, 6♂♂, 전남 순천시 해룡면 상내리, 2013.3.26; 15♀♀, 7♂♂, 전남 진도군 고군면 내산리, 2013.4.9; 5♀♀, 전남 진도군 임회면 남동리(갯벌), 2013.4.9; 3♀♀, 경남 거제시 사등면 사곡리, 사곡해수욕장(해조류), 2013.7.2; 3♀♀, 전남 해남군 화산면 가좌리, 2015.5.3; 1♀, 다박포선착장, 전남 해남군 화산면 평호리, 2015.5.1; 1♀, 전남 진도군 의신면 초사리(갯벌), 2015.5.3; 3♀♀, 전남 진도군 고군면 지막리, 2015.5.3; 1♀, 전남 해남군 문내면 예락리, 2015.5.3.

**분포:** 한국.

**고찰:** 이 종은 제 1 흉지와 제 5 흉지의 형질에서 작은세모날래장수노벌레(*Neotachidius parvus*)와 뚜렷한 차이를 나타낸다.

**86. *Neotachidius parvus* Huys, Ohtsuka, Conroy-Dalton & Kikuchi, 2005****작은세모날래장수노벌레**

*Tachidius (Neotachidius) triangularis*: Song & Chang, 1995, p. 66, fig. 2 (part.).

*Neotachidius parvus* Huys et al., 2005, p. 147, figs. 11–15, 16B; Chang, 2008, p. 230, fig. 2; Chang, 2009b, pl. 21C, D, fig. 56; Chang, 2010, p. 29, fig. 10.

**관찰재료:** 1♀, 전남 섬진강 하류, 섬진강교(기수역), 2015.4.18; 1♂ 전남 진도군 고군면 지막리, 2015.5.3.

분포: 한국.

**고찰:** Song & Chang (1995)은 진도의 기수역에서 *Tachidius (Neotachidius) triangularis* 를 보고하였다. 그러나, Huys et al. (2005)는 이들의 시료들이 작은세모날래장수노벌레(*N. parvus*)와 몸 길이, 제 2 촉각의 외지의 마디수와 강모의 종류, 제 1 흉지 내지의 마지막 마디에 존재하는 강모의 종류, 미차의 장식 등에서 서로 잘 일치하는 것을 확인하여, 부분적으로 동종이명처리하였다.

본 연구에서는 우리나라의 갯벌 서식지에서 세모날래장수노벌레 속(*Neotachidius*)의 종들은 흔히 관찰할 수 있었으나, 소수의 개체들만이 Huys et al. (2005)가 제시한 형질들과 정확히 일치하였다. Huys et al. (2005)은 중국과 한국의 해안선을 따라 이 속의 종들이 종 분화가 빠르게 진행되고 있으며, *Neotachidius* species complex 가 존재할 가능성도 언급하였다. 이 점을 고려할 때, 이 속의 종들에 대하여 면밀한 분류학적 재검토를 할 필요가 있으며, 그 결과에 따라 많은 종들이 추가로 밝혀질 것으로 판단된다.

### Family Peltidiidae Claus, 1860 갑옷장수노벌레 과

#### 한국산 갑옷장수노벌레 과(Peltidiidae)의 속에 대한 검색표(Huys et al. 1996)

1. 제 1 흉지의 내지는 2 마디로 이루어져 있다 ..... 갑옷장수노벌레 속 *Peltidium*
  - 제 1 흉지의 내지는 3 마디로 이루어져 있다 ..... 2
2. 제 5 흉지의 내지와 외지는 융합되어 있다 ..... *Alteuthella*
  - 제 5 흉지의 내지와 외지는 융합되어 있지 않다 ..... 3
3. 제 1 흉지 외지의 세 번째 마디는 4 개의 발톱모양 가시를 갖는다 .....
  - ..... 고갑옷장수노벌레 속 *Alteutha*
  - 제 1 흉지 외지의 세 번째 마디는 매우 잘 발달된 1 개의 발톱모양 가시를 갖는다 ..... 비고갑옷장수노벌레 속 *Alteuthoides*

**Genus *Peltidium* Philippi, 1839 갑옷장수노벌레 속**

모식종: *Peltidium purpureum* Philippi, 1839

**87. *Peltidium quinquesetosum* Song & Yun, 1999 오가시갑옷장수노벌레**

*Peltidium quinquesetosum* Song & Yun, 1999, p. 68, figs. 1–3; Lee et al., 2012, p. 174, figs. 116–118.

**관찰재료:** 27♀♀, 3♂♂, 경북 포항시 남구 호미곶면 강사리(해조류), 2015.5.19; 2♀♀, 대포항, 제주 서귀포시 대포동(light trap), 2015.5.22; 10♀♀, 3♂♂, 강원 동해시 봉호동, 봉호항, 2016.7.20; 3♀♀, 2♂♂, 강원 삼척시 원덕읍 노곡리, 비화항, 2016.7.20.

**분포:** 한국.

**고찰:** 이 종은 동해안과 제주도의 해안에서 light trap에 의하여 손쉽게 채집되었다. 오가시갑옷장수노벌레(*Peltidium quinquesetosum*)는 제 1 흉지 내지 두 번째 마디에 5개의 강모를 가진 다른 종들과 쉽게 구분할 수 있다.

**Genus *Alteutha* Baird, 1846 고갑옷장수노벌레 속**

모식종: *Alteutha depressa* (Baird, 1837)

**한국산 고갑옷장수노벌레 속의 종에 대한 검색표**

1. 제 1 측지는 9 마디로 이루어져 있다; 악각 기절의 길이는 너비 정도이다 ..... 납작고갑옷장수노벌레 *A. depressa*
- 제 1 측지는 7 마디로 이루어져 있다; 악각 기절의 길이는 너비의 약 2.3 배 정도이다 ..... *Alteutha* sp. nov.

**88. *Alteutha depressa* (Baird, 1837) 납작고갑옷장수노벌레**

*Cyclops depressa* Baird, 1837, p. 331, pl. 10, figs. 9-12 (cited from Lang 1948).

*Peltidium crenulatum* Brady, 1880, p. 163, pl. 72, figs. 6-15.

*Alteutha depressa*: Lang, 1948, p. 444, fig. 168; Hicks, 1982, p. 71, figs 46-47; Song & Chang, 1995, p. 69, fig. 4; Huys et al., 1996, p. 316, figs. 124A-D, 125D, 126C, E; Lee et al., 2012, p. 166, fig. 111.

**관찰재료:** 2♀♀, 1♂, 울산시 을주군 서생면 진하리, 솔개해수욕장(해조류), 2012.5.18; 5♀♀, 서빈백사, 제주 제주시 우도면 연평리(해조류), 2014.6.24; 1♀, 삼척시 근덕면 궁촌리, 궁촌항(해조류), 2014.9.16; 2♀♀, 부산시 기장군 일광면 학리(해조류), 2015.7.28.

**분포:** 범세계적.

**고찰:** 이 종은 전세계적으로 보고되어 있으나, 각 지역의 개체들 사이에서 형태학적 변이를 보이고 있다(Song & Chang 1995). Lee et al. (2012)는 이 종을 다형종으로 여겼으며, 많은 종들이 납작고갑옷장수노벌레(*Alteutha depressa*)아래에 숨겨져 있을 것으로 보았다.

**89. *Alteutha* sp. nov. (Figs. 106-113)**

**Type locality.** Off Gageodo Island (34°3'45.17"N, 125°5'41.51"E), Gageodo-ri, Heuksan-myeon, Sinan-gun, Jeollanam-do, South Korea.

**Materials examined.** Holotype: ♀, dissected and mounted in lactophenol solution on 13 slides. Allotype: ♂, was dissected and mounted in lactophenol solution on 13 slides. Paratypes: 2♀♀, 3♂♂, dissected on several slides, respectively; 3♀♀, 2♂♂, preserved in 99 % ethanol solution together. For the SEM photograph, 2♀♀, 1♂, examined under the SEM. All materials examined was collected from macroalgal assemblages in the type locality on 30 July, 2013.

**Description. Female.** Habitus (Figs. 106A, 113A) broad, dorsoventrally flatten, arched along longitudinal axis; total length including tip of rostrum and end of caudal rami in dorsal view about 1,084 µm; greatest width measured at posterior end of cephalothorax, about 550 µm; surface covered with sensilla and foveate patterns (Fig. 113A, B). Rostrum small, broad, downwardly directed, with

several sensilla on surface and distinct border between its base and end of cephalothorax. Cephalothorax, length/width ratio in dorsal view about 0.83, slightly tapering towards anterior end. P1-bearing somite incorporated into cephalothorax. Prosomites bearing P2–P4 armed with minute setules along lateral margins; epimera of P4-bearing somite more developed than preceding somites. P5-bearing somite shorter and narrower than preceding somite. Genital double-somite (Fig. 106B) wider than its length, tapering towards posterior end; genital field with circular copulatory pore; P6 represented by 2 setae and 1 spinule-like process. Anal somite with semicircular operculum; dorsal surface with 1 pair of sensilla.

Caudal rami (Fig. 106B, C) slightly longer than width, tapering towards posterior end, with 7 setae; dorsolateral seta I slender, longer than length of caudal ramus; ventrolateral seta II stout, as long as seta I, armed with minute spinules; caudal seta III inserted at distolateral corner dorsally, slightly smaller than seta II; outer terminal seta IV slender and smaller than principal terminal seta V, armed with minute spinules; seta IV and V fused at base; innermost terminal seta VI small, slender, armed with minute spinules; dorsal seta VII slender, as long as caudal ramus, tri-articulated at base.

Antennule (Fig. 107A) 7-segmented, elongate; length ratio of each segment, from proximal to distal, about 1.0 : 1.3 : 0.8 : 0.6 : 0.2 : 0.3 : 0.4; first segment with 1 row of spinules along outer margin and 1 group of minute spinules on surface; second segment with 2 groups of minute spinules and 1 tube pore on surface. Setal formula as follows: 1-[1]; 2-[12]; 3-[10]; 4-[6 + ae]; 5-[4]; 6-[4]; 7-[7 + ae]. Each aesthetasc fused basally to seta.

Antenna (Fig. 107B). Coxa small, with 1 group of spinules near distal margin. Basis elongate, with 1 group of stout spinules and 1 long pinnate seta at outer corner distally. Exopod 2-segmented; proximal segment elongate with 2 pinnate setae and 1 spinular row; distal segment small, about 1/3 of preceding one, with 3 pinnate apical setae and 1 spinular row. Endopod 2-segmented; proximal segment elongate, longer than basis, with 1 pinnae seta on abexopodal margin; distal segment longer and slender than preceding one, with 4 setae on surface subdistally and 3 hyaline frills; distal armature composed of 1 stout spine, 4 geniculate setae, 1 long pinnate seta, and 1 bare seta.

Mandible (Fig. 108A). Coxal gnathobase with 2 stout bicuspid teeth, 4 pinnate spines, 1 pointed spine, and 1 stout pinnate seta. Palp composed of basis, exopod, and endopod; basis broad, with 3 groups of spinules and 3 naked setae; exopod small with 3 apical setae; endopod elongate, bilobate, with 1 apical seta on small lobe and 5 apical setae on large lobe.

Maxillule (Fig. 108B). Praecoxal arthrite well-developed, with 2 groups of spinules on inner surface and 2 juxtapose setae on anterior surface; distal armature composed of 8 spines and 1 seta. Coxal endite with 1 group of spinules along lateral margin and 5 elements apically. Basis with 3 rows of spinules on surface; lateral margin with 3 pinnate setae; distal armature composed of 1 stout pinnate spine, 1 geniculate seta, and 2 pinnate setae. Exopod 1-segmented, elongate, with 4 apical setae. Endopod 1-segmented, with 3 pinnate setae.

Maxilla (Fig. 108C). Syncoxa elongate, with 2 rows of spinules along outer margin and 3 endites; proximal endite elongate, armed with spinules, with 3 long pinnate and 1 small bare setae; middle endite small, elongate, with 2 apical setae; distal endite largest, elongate, with 3 pinnate apical setae and 1 group of spinules. Basis with 1 seta near base of endopod; distal armature composed of 1 claw-like spine apically and 4 setae subapically. Endopod 1-segmented, small, with 2 long apical setae.

Maxilliped (Fig. 108D). Preacoxa small. Coxa elongate, with 1 pinnate and 1 bare setae near distal margin, and 1 row of spinules on surface proximally. Basis oval, longer than coxa, with 1 group of spinules on outer margin proximally; palmar margin with 3 rows of spinules and 1 tongue-like process armed with small papilla. Endopod 1-segmented, claw-like, with 1 long and 3 small accessory setae.

P1 (Fig. 109A). Praecoxa small, triangular in shape. Coxa elongate, ornamented with 1 row of spinules along outer margin and 1 row of setules along inner margin, with 1 pore on anterior surface. Basis transversally elongate, with 1 outer and 1 inner setae, and ornamented with 2 rows of setules along lateral margins. Exopod 3-segmented, slightly bent towards outside; exp-1 elongate, armed with spinules along outer and inner margins, with 1 outer spine; exp-2 as long as exp-1, armed with spinules along outer margin, with 1 outer spine and 1 pinnate inner seta; exp-3 very small, with 1 small spinulose spine, 3 curved spinulose spines, and 1 geniculate spine. Endopod 3-segmented, ornamented with spinules on anterior surface and setules along outer margin; enp-1 with 1 long plumose seta on inner margin; enp-2 with 1 pinnate seta on inner margin; enp-3 with 1 pinnate outer seta, 2 plumose apical setae, and 2 plumose inner setae.

P2 (Fig. 109B). Coxa small, with 2 groups of spinules along outer margin, and 1 row of spinules and 1 pore on anterior surface. Basis transversally elongate, with 1 row of spinules, 1 pore, and 1 pinnate seta along outer margin. Exopod 3-segmented; each segment armed with spinules on outer margin and anterior surface partially; exp-1 elongate, with 1 pinnate outer spine and 1 plumose inner seta; exp-2 shortest, with 1 pinnate outer spine and 1 plumose inner seta; exp-3 as long as exp-1, with

3 pinnate spines on outer margin, 2 plumose setae (outer one of them ornamented with outer spinules) on apical margin, and 2 plumose setae on inner margin; outer margin of exp-3 with 1 pore subdistally. Endopod 3-segmented; each segment armed with setules along outer margin; enp-1 elongate, with 1 plumose inner seta; enp-2 shortest, with 2 plumose setae on inner margin and several spinules on posterior surface; enp-3 with 1 pinnate seta on outer margin, 2 plumose setae on apical margin, 1 plumose and 1 pinnate setae on inner margin, and several setules on posterior surface; anterior surface of enp-3 with 1 pore subdistally.

P3 (Fig. 110A). Coxa small, with 2 rows of spinules on outer margin and 1 pore on anterior surface. Basis transversally elongate, with 1 row of spinules, 1 pore, and 1 bare seta along outer margin. Exopod 3-segmented; each segment armed with spinules on outer margin and surface partially; exp-1 elongate, with 1 pinnate outer spine and 1 plumose inner seta; exp-2 shortest, with 1 pinnate outer spine and 1 plumose inner seta; exp-3 with 3 pinnate outer spines, 2 plumose apical setae (outer one of them ornamented with outer spinules), and 3 plumose inner setae (proximal one of them ornamented with small spinules along inner margin); posterior margin of exp-3 with 1 row of spinules on surface; anterior surface of exp-2 and exp-3 with pore subdistally, respectively. Endopod 3-segmented; each segment armed with spinules along outer margin; enp-1 with 1 plumose inner seta; enp-2 with 2 plumose setae on inner margin and several spinules on posterior surface; enp-3 with 1 pinnate outer seta, 2 pinnate apical setae (plumose proximally), and 3 plumose inner setae; anterior and posterior surfaces of exp-3 with 1 pore and several spinules, respectively.

P4 (Fig. 111A). Coxa small, with 1 row of spinules at outer distal corner, and 1 pore and 1 row of spinules on anterior surface. Basis transversally elongate, with 1 bare seta, 1 row of spinules, and 1 pore along outer margin. Exopod 3-segmented; each segment armed with spinules on outer margin and anterior surface partially; exp-1 shorter than that of P2 and P3, as long as exp-2, with 1 pinnate outer spine and 1 plumose inner seta; exp-2 with 1 pinnate spine on outer margin, 1 plumose seta on inner margin, and 1 pore on anterior surface subdistally; exp-3 longest, with 3 pinnate spines on outer margin, 1 pinnate and 1 plumose (outer margin armed with spinules) on apical margin, 2 plumose (distal and proximal) and 1 pinnate (middle) setae, 1 pore on anterior surface, and several spinules on posterior surface. Endopod 3-segmented; each segments armed with spinules along outer margin, with several spinules on posterior surface; enp-1 and enp-2 with 1 and 2 plumose inner setae, respectively; enp-3 with 1 pinnate seta on outer margin, 2 pinnate apical setae (plumose proximally),

2 plumose setae (outer margin pinnate distally) on inner margin, and 1 pore on anterior surface subdistally.

P5 (Figs. 109D, 113C). Baseoendopod small, covered with spinules, with 1 outer seta; endopodal lobe weakly developed, with 1 long and 1 small setae. Exopod elongate, about 3.3 times as long as width; outer margin armed with minute spinules, with 1 bare seta and 1 pore; apical margin with 3 stout pinnate setae; inner margin with 2 slender pinnate setae subdistally.

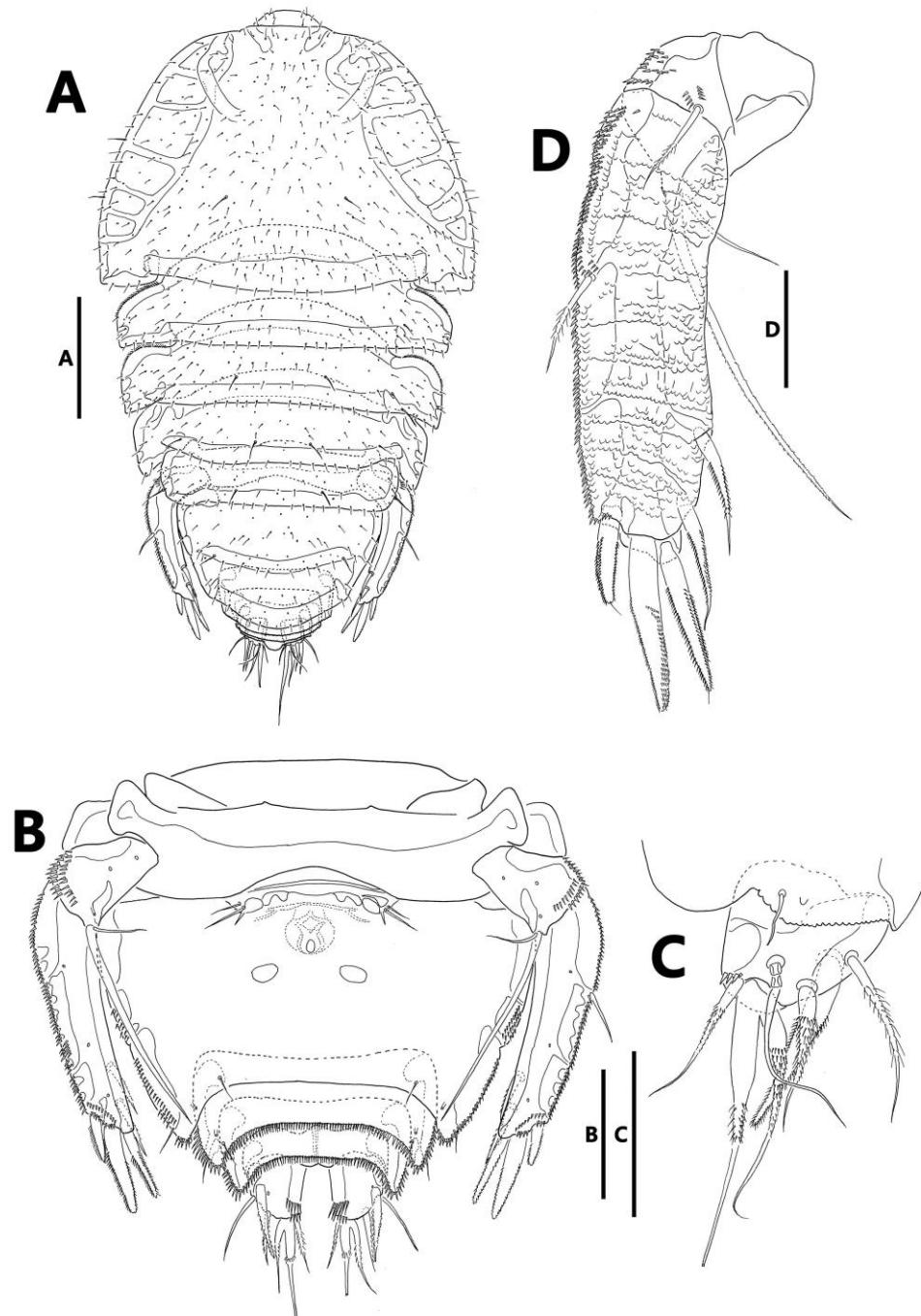
**Male:** Habitus (Fig. 112A) as in female, except for urosomites 2 and 3; total length including anterior end of cephalothorax and posterior end of caudal rami about 876.9  $\mu\text{m}$  in dorsal view.

Urosomite 2 (Fig. 112B) separated from urosomite 3; posterior corner produced, with 1 stout spine and 1 slender seta on apical margin, and 1 seta on dorsal surface (representing P6).

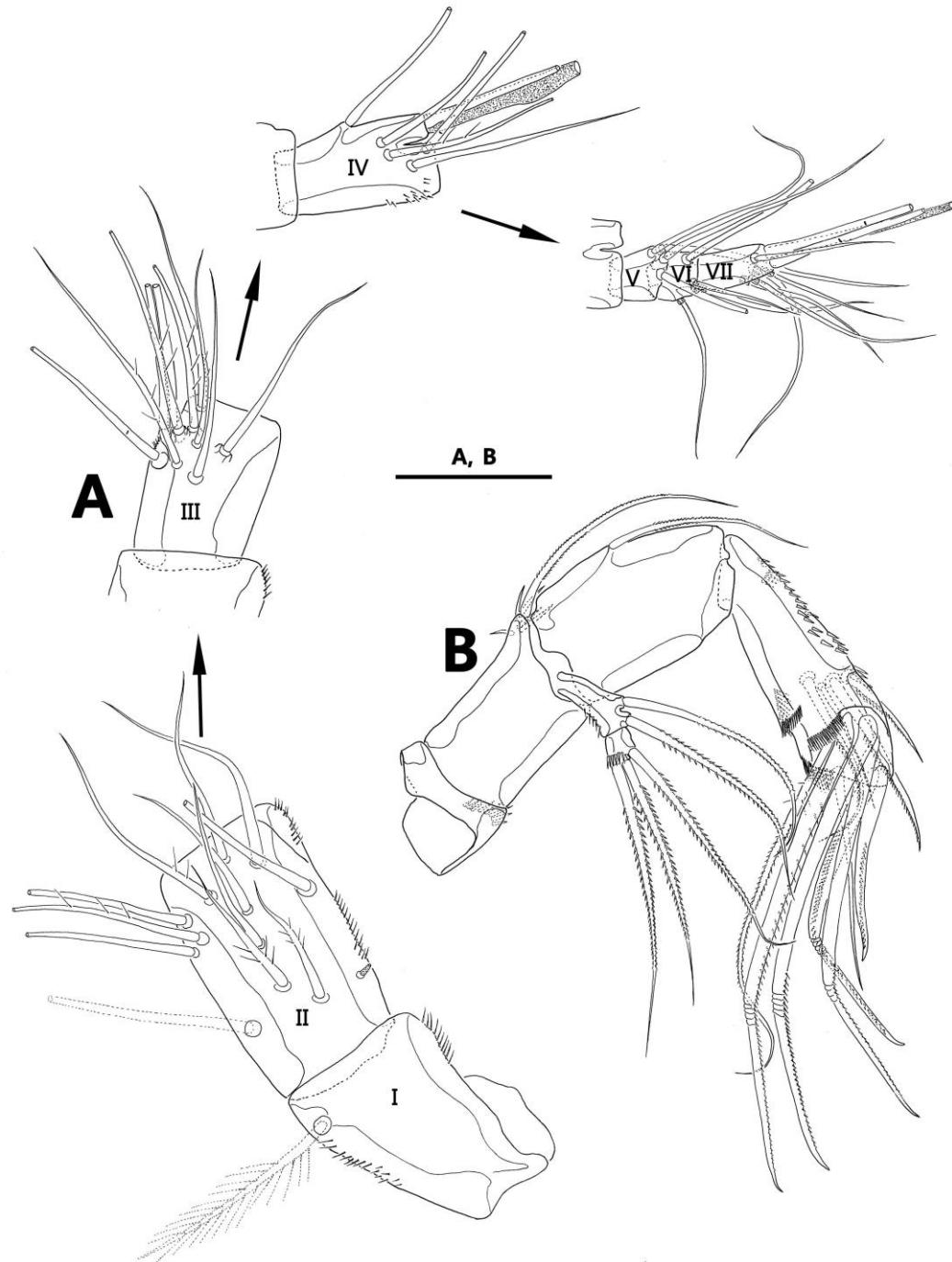
Antennule (Figs. 112C, 113D) 8-segmented, haplocer; fourth segment smallest, triangular in shape; seventh segment with groups of papilla on inner margin proximally; eighth segment conical in shape. Setal formula of each segment as follows: 1-[1], 2-[12]; 3-[7 + ae]; 4-[2]; 5-[8 + ae]; 6-[2]; 7-[3]; 8-[11 + ae].

P5 (Fig. 111B). Baseoendopod small, with 1 outer seta and 1 group of small spinules; endopodal lobe weakly developed, with 1 long and 1 small setae. Exopod elongate, about 3.0 times as long as width, tapering distally; outer margin armed with spinules, with 1 slender and 2 pinnate setae; apical margin with 3 stout pinnate spines.

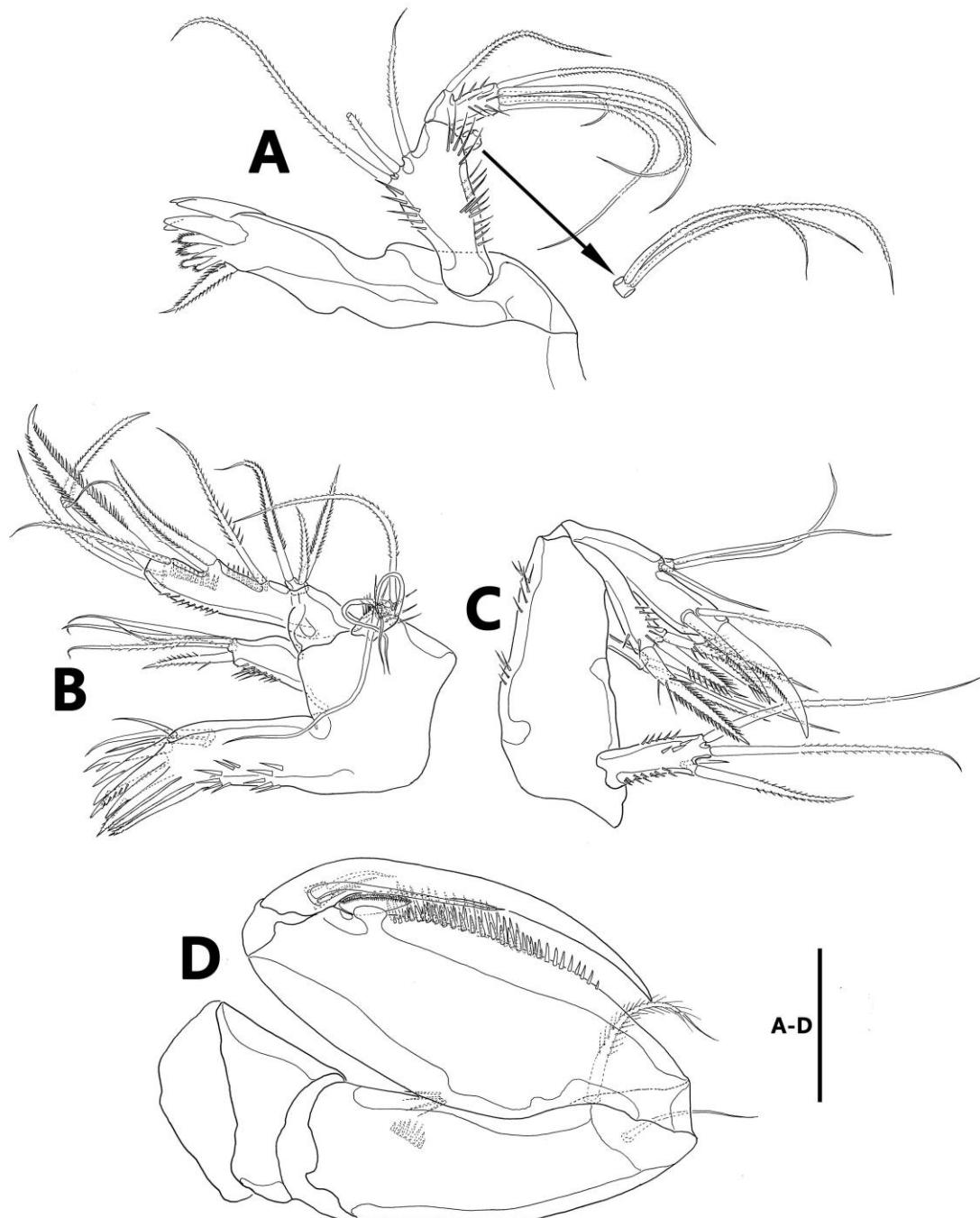
**Remarks.** Among *Alteutha* species, the new species is mostly closed to *A. spinicauda* Nicholls, 1941 described from South Australia in the morphology of the 7-segmented antennule, antennary exopod with 5 setae, maxilliped with elongate palm, and armature of P2–P4. However, *Alteutha* sp. nov. differs from *A. spinicauda* by the body size (about 1,000  $\mu\text{m}$  in *Alteutha* sp. nov. vs. about 700  $\mu\text{m}$  in *A. spinicauda*), relative length of female P1 exp-2 (as long as P1 enp-2 and enp-3 combined in *Alteutha* sp. nov. vs. as long as P1 endopod in *A. spinicauda*), length:width ratio of female P5 exopod (about 3.6:1 in *Alteutha* sp. nov. vs. about 4.5:1 in *A. spinicauda*), antennule of male (8-segmented in *Alteutha* sp. nov. vs. 7-segmented in *A. spinicauda*), P3 exp-3 (with 3 stout outer spines in *Alteutha* sp. nov. vs. with 3 slender setae in *A. spinicauda*), and male P4 exp-3 (with 3 outer spines as in female *Alteutha* sp. nov. vs. with 3 slender outer setae in *A. spinicauda*).



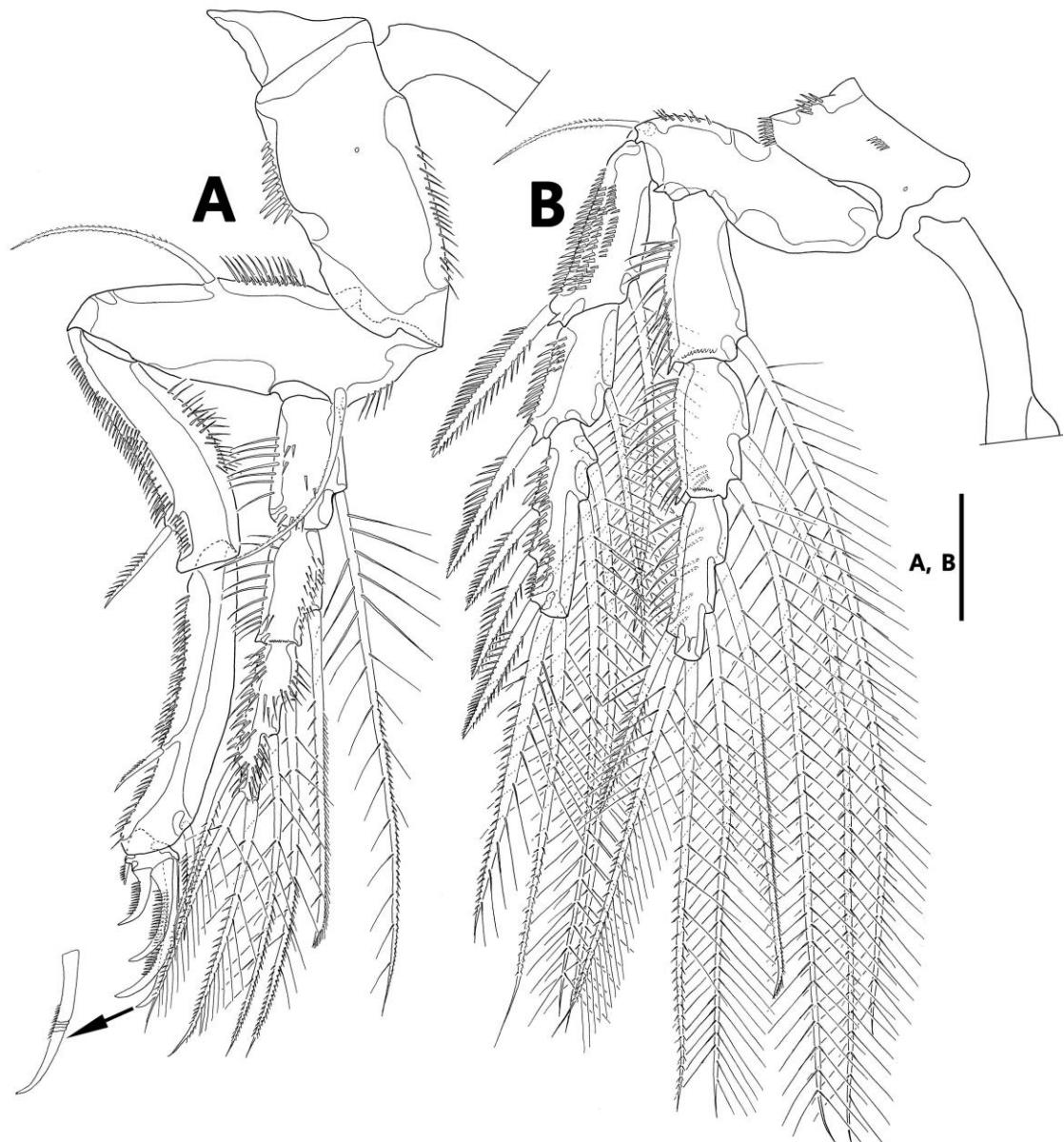
**Fig. 106.** *Alteutha* sp. nov., female. A, habitus, dorsal; B, urosome, ventral; C, caudal ramus, dorsal; D, P5. Scale bars: 50 µm (C, D); 100 µm (B); 200 µm (A).



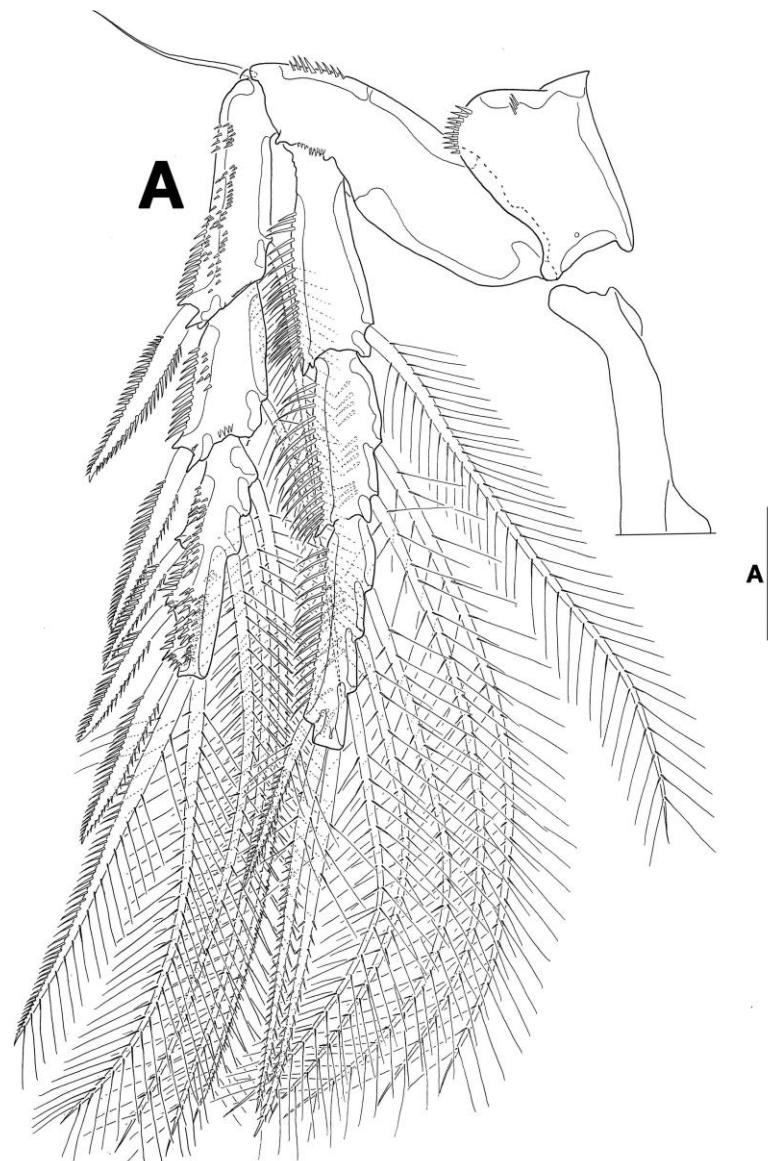
**Fig. 107.** *Alteutha* sp. nov., female. A, antennule; B, antenna. Scale bar: 50  $\mu\text{m}$ .



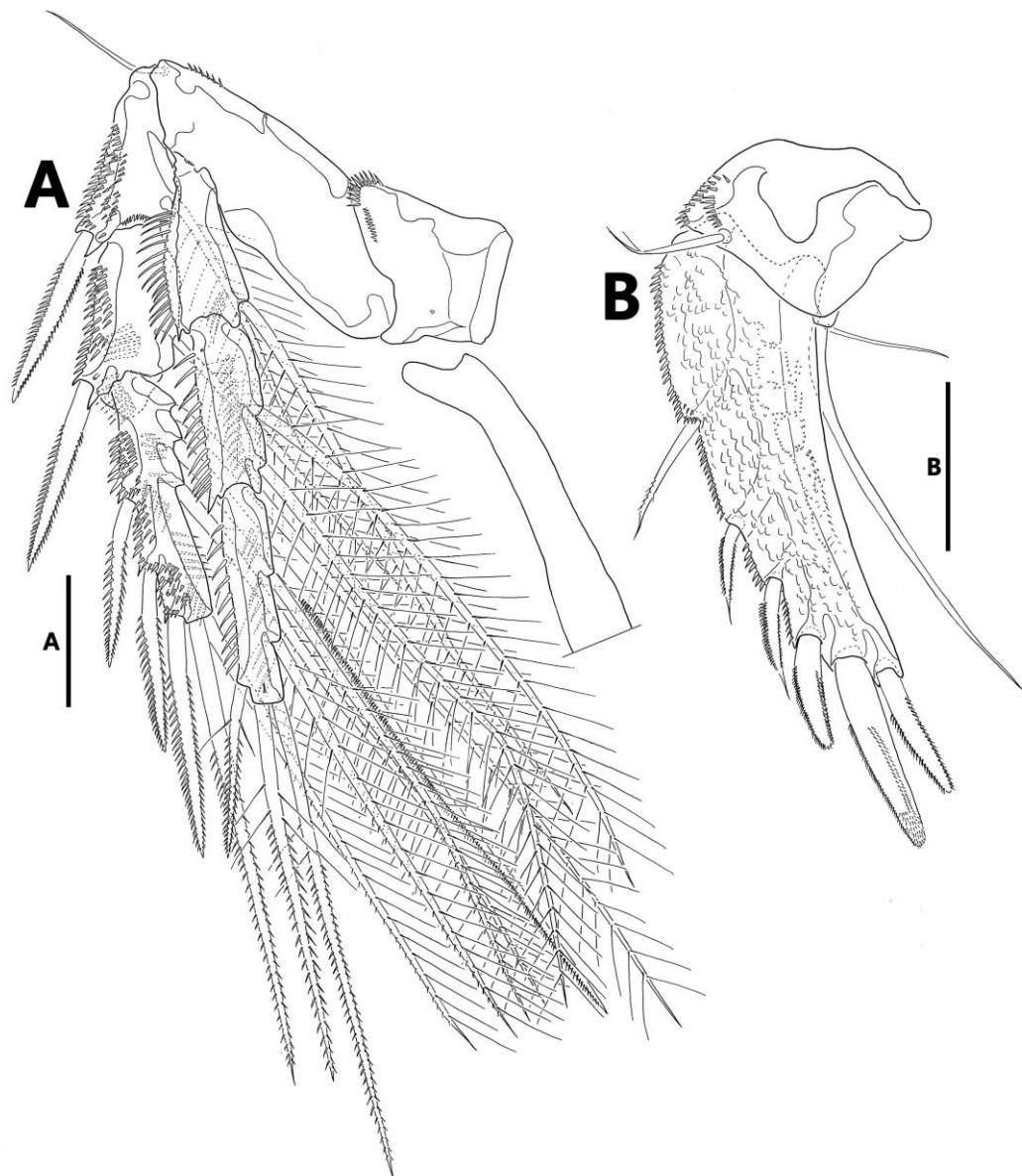
**Fig. 108.** *Alteutha* sp. nov., female. A, mandible; B, maxillule; C, maxilla; D, maxilliped. Scale bar: 50  $\mu\text{m}$ .



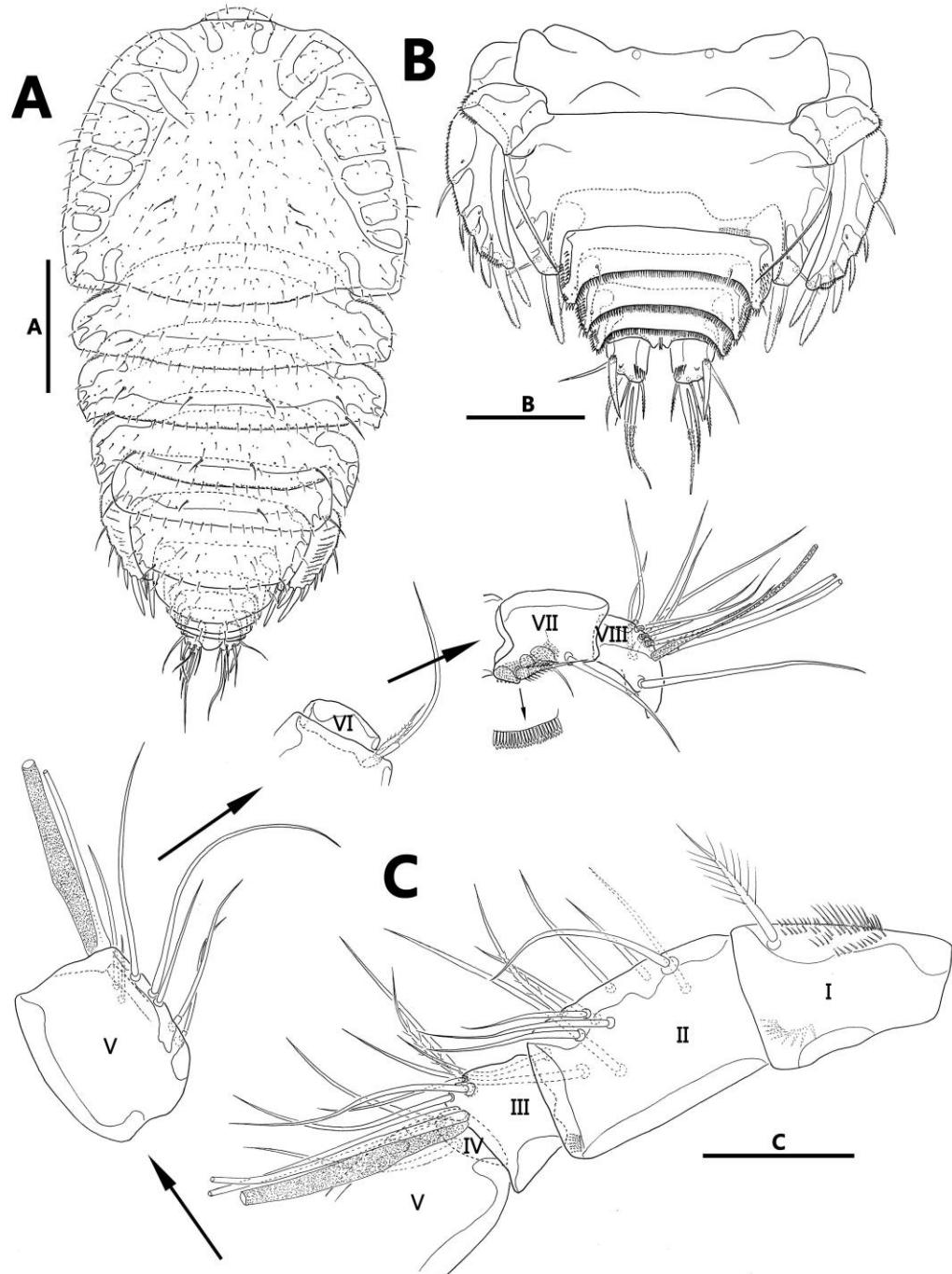
**Fig. 109.** *Alteutha* sp. nov., female. A, P1; B, P2. Scale bar: 50  $\mu\text{m}$ .



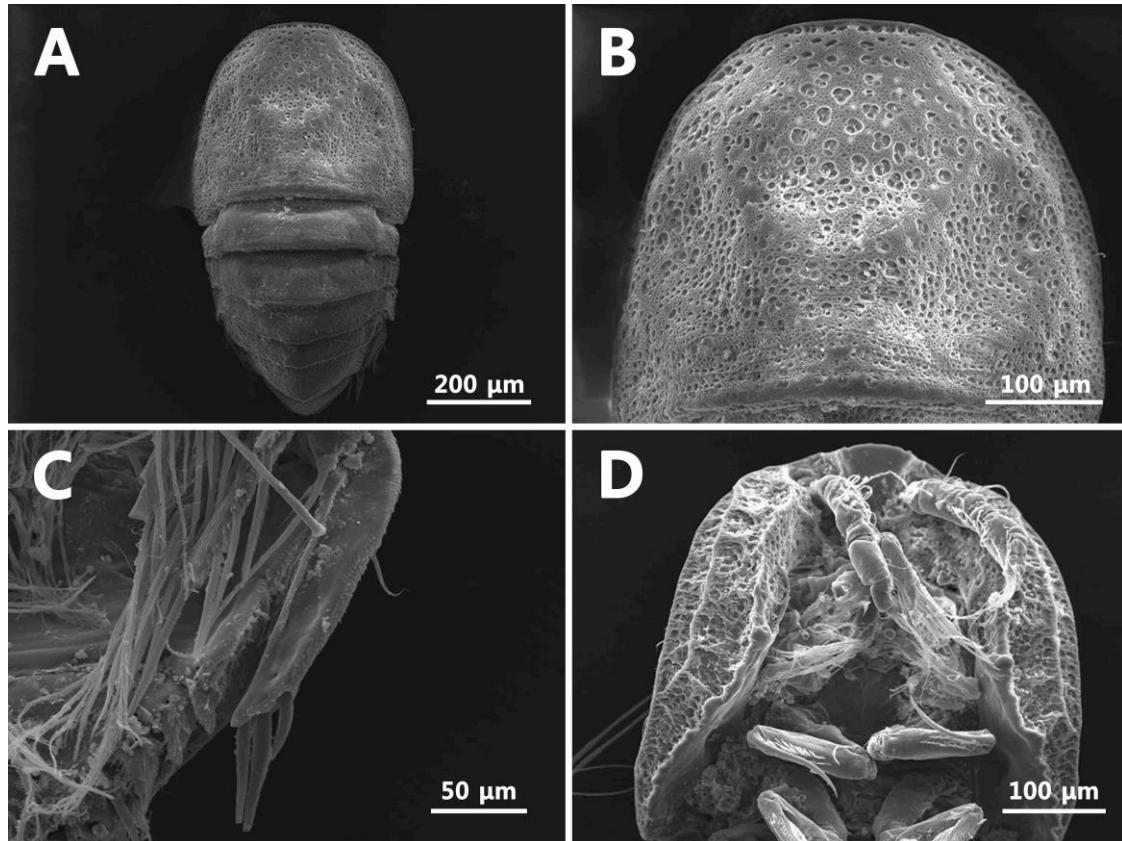
**Fig. 110.** *Alteutha* sp. nov., female. A, P3. Scale bar: 50  $\mu\text{m}$ .



**Fig. 111.** *Alteutha* sp. nov., female: A, P4. Male: B, P5. Scale bars: 50  $\mu\text{m}$ .



**Fig. 112.** *Alteutha* sp. nov., male. A, habitus, dorsal; B, urosome, ventral; C, antennule. Scale bars: 50 µm (C); 100 µm (B); 200 µm (A).



**Fig. 113.** Scanning electron microscope photographs of *Alteutha* sp. nov. Female (A–C): A, habitus, dorsal; B, cephalothorax, dorsal; C, P5, ventral. Male (D): D, cephalothorax, ventral.

#### Genus *Alteuthella* A. Scott, 1909

모식종: *Alteuthella pellucida* A. Scott, 1909

#### 90. *Alteuthella* sp. nov. (Figs. 114–120)

**Type locality.** Off Gageodo Island (34°3'45.17"N, 125°5'41.51"E), Gageodo-ri, Heuksan-myeon, Sinan-gun, Jeollanam-do, South Korea.

**Materials examined.** Holotype: ♀, dissected and mounted in lactophenol solution on 13 slides. Allotype: ♂, dissected and mounted in lactophenol solution on 13 slides. Paratypes: 1♀, 1♂, each

was dissected on several slides, respectively; 1♀, 1♂, preserved in 99 % ethanol solution together. All materials examined was collected from macroalgal assemblages in the type locality on 30 July, 2013.

**Description. Female.** Habitus (Fig. 114A) broad, dorsoventrally depressed; total body length measured from tip of rostrum to end of caudal rami in dorsal view about 861.5 µm; greatest width measured at posterior end of cephalothorax, about 538.5 µm; body surface covered with sensilla, small pores, and foveate patterns. Rostrum (Fig. 114B) prominent, fused basally to cephalothorax, downwardly directed; ventral surface with 3 pairs of sensilla and 1 pore. Cephalothorax about 0.47 times of total body length, about 0.76 times as long as width, slightly tapering towards anterior end; posterior margin dentate; posterior part with 1 pair of circular subcuticular ridge on both side. P1-bearing somite incorporated into cephalothorax. Prosomites bearing P2–P4 each with well-developed epimeral plates; each posterior margin dentate; epimera of P4-bearing somite more developed than preceding somites. P5-bearing somite narrower than preceding somite, with dentate posterior margin. Genital double-somite (Fig. 114C) wider than its length, tapering towards posterior end; dorsal surface with vestigial border, but ventral surface completely fused; genital field with circular copulatory pore. Anal somite with semicircular operculum and 1 pair of sensilla on dorsal surface.

Caudal rami (Fig. 114D, E) as long as width; distal margin oblique (inner part distinctly produced), with U-shaped notch on dorsal surface and 2 produces on ventral surface; seta I slender, inserted on dorsal surface, smallest, shorter than length of caudal ramus; seta II stout, twice as long as caudal ramus, inserted at inner distal corner; seta III plumose, inserted on dorsal surface distally, slightly longer than length of caudal ramus; outer terminal seta IV slightly longer than length of seta II, armed with spinules along outer margin; inner terminal seta V pinnate, longest, 2 times as long as seta IV; terminal setae fused basally; seta VI pinnate, inserted at inner distal corner, slightly shorter than length of seta II; seta VII slender, bare, bi-articulated, as long as seta II, inserted at dorsal surface.

Antennule (Fig. 115A) 7-segmented, elongate; length ratio of each segment, from proximal to distal, about 1.0:1.7:1.0:0.7:0.3:0.3:0.5; first segment armed with several rows of setules along outer margin, with 1 group of spinules on surface; peduncle on fourth segment with 1 aesthetasc and 1 long seta. Setal formula as follows: 1-[1]; 2-[12]; 3-[10]; 4-[4 + ae]; 5-[2]; 6-[8]; 7-[7 + ae].

Antenna (Fig. 115B). Coxa small, without ornamentation. Basis elongate, with 1 pinnate seta and 2 rows of spinules along outer margin. Exopod 1-segmented elongate, with 3 lateral and 2 apical setae. Endopod 2-segmented; proximal segment elongate, 1.7 times as long as greatest width, with 1

pinnate seta on abexopodal margin, armed with spinules along abexopodal margin; distal segment longer and slender than preceding one, with 2 long and 2 small setae on surface, 3 hyaline frills on inner margin; distal armature composed of 1 stout pinnate spine, 5 pinnate and 1 bare setae; bare seta on distal segment fused basally to one of 5 pinnate setae.

Mandible (Fig. 115C). Coxal gnathobase slender, with 2 stout and 3 slender multicuspid teeth, and 1 pinnate seta. Palp composed of basis, exopod, and endopod; basis broad, armed with several rows of spinules, with 2 long pinnate and 1 small bare setae; exopod 1-segmented, small, with 3 long pinnate setae apically; endopod elongate, bilobate, with 1 long pinnate seta on small lobe apically, and 4 long pinnate and 1 small bare setae on large lobe apically.

Maxillule (Fig. 116A). Praecoxal arthrite well-developed, with 2 juxtapose setae on anterior surface, and 7 seta-like elements along distal margin. Coxal endite with 1 plumose and 3 pinnate setae on distal margin. Basis armed with spinules on anterior surface, with 3 pinnate setae subdistally and 4 pinnate setae apically. Exopod 1-segmented, elongate, with 3 apical setae. Endopod 1-segmented, small, with 2 long pinnate and 1 small bare setae apically.

Maxilla (Fig. 116B). Syncoxa elongate, about 1.7 times as long as width, with several spinular rows along outer margin and 3 endites; proximal endite armed with spinules on surface, with 2 pinnate and 1 serrate setae on apical margin and 1 small bare seta on surface; middle endite small, with 2 pinnate setae apically; distal endite, elongate, with 2 pinnate and 1 serrate setae apically. Basis with 1 stout claw-like spine, 1 stout pinnate spine, 1 plumose seta, and 2 long and 1 small setae. Endopod 1-segmented, small, with 2 bare setae apically.

Maxilliped (Fig. 116C). Preacoxa small, with oblique distal margin. Coxa elongate, tapering towards distal end, with 1 pinnate seta subdistally and 1 group of spinules proximally on outer margin. Basis elongate, about 3 times as long as wide, with 1 group of spinules on outer margin proximally; palmar margin linear, with 2 small spines subdistally. Endopod 1-segmented, claw-like, reaching to mid of palmar margin, with 5 accessory setae.

P1 (Fig. 117A). Coxa elongate, about 1.8 times as long as greatest width, ornamented with 1 row of spinules along outer margin. Basis transversally elongate, with 1 outer and 1 inner setae. Exopod 3-segmented; exp-1 about twice as long as width, with 1 outer; exp-2 as long as preceding segment, with 1 outer and 1 inner setae subdistally; exp-3 very small, with 1 stout claw-like spine and 4 setae. Endopod 3-segmented; emp-1 elongate, about 2.9 times as long as width, with 1 plumose seta on inner margin and 1 tube pore on anterior surface; emp-2 about 0.4 times as long as preceding one,

with 1 serrate seta on inner margin and 1 tube pore on anterior surface; enp-3 as long as enp-2, with 3 plumose setae.

P2 (Fig. 117B). Coxa small, with 1 spinular row at outer corner distally, and 1 spinular row and 1 tube pore on anterior surface. Basis transversally elongate, with 1 spinular row and 1 seta on outer margin. Exopod 3-segmented; outer margin of each segment armed with spinules; exp-1 and exp-2 each with 1 plumose outer seta and 1 plumose inner seta; exp-3 longest, with 3 pinnate outer, 2 plumose apical (outer one of them ornamented with outer spinules), and 2 plumose inner setae; anterior surface of exp-3 with 1 tube pore. Endopod 3-segmented; outer margin of each segment armed with spinules; enp-1 longest, with 1 pinnate inner seta; enp-2 with 1 plumose and 1 pinnate inner setae; enp-3 smallest, with 1 pinnate seta on outer margin, 2 plumose setae on apical margin, and 1 plumose and 1 serrate setae on inner margin.

P3 (Fig. 118A). Coxa quadrate, with 1 spinular row at outer corner distally, and 1 spinular row and 1 tube pore on anterior surface. Basis transversally elongate, with 1 spinular row and 1 pinnate seta on outer margin. Exopod 3-segmented; each outer margin of segments armed with spinules; exp-1 and exp-2 elongate, each with 1 pinnate outer spine and 1 plumose inner seta; exp-3 longest, with 3 pinnate outer, 2 plumose apical (outer one of them ornamented with outer spinules), and 3 plumose inner setae; anterior surface of exp-3 with 1 tube pore distally and 1 pore proximally. Endopod 3-segmented; each outer margin of segments armed with spinules; enp-1 longest, with 1 plumose inner seta; enp-2 with 2 plumose inner setae; enp-3 with 1 pinnate outer, 2 pinnate apical, and 3 plumose inner setae.

P4 (Fig. 118B). Coxa with 1 spinular row at outer distal corner and 1 pore on anterior surface. Basis transversally elongate, with 1 pinnate seta and 1 spinular row on outer margin. Exopod 3-segmented; each outer margin of segments armed with spinules; exp-1 with 1 serrate spine on outer margin and 1 conical shaped protrusion at outer distal corner; exp-2 about 1.5 times as long as preceding one, with 1 pinnate outer spine and 1 plumose inner seta; outer distal corner of exp-2 produced hook-like; exp-3 slightly longer than preceding one, with 3 pinnate spines on outer margin, 2 plumose setae (outer one of them ornamented with outer spinules) on apical margin, and 2 plumose and 1 stout serrate setae on inner margin. Endopod 3-segmented; each outer margin of segments armed with spinules; enp-1 with 1 plumose inner seta; enp-2 with 2 plumose inner setae; enp-3 with 1 pinnate outer, 2 pinnate apical, and 2 plumose inner setae.

P5 (Fig. 117C). Baseoendopod and exopod fused partially; dorsal surface with 1 plumose seta proximally; outer surface armed with spinules proximally; ventral surface with 4 pores; outer margin with 3 pinnate setae; apical margin with 3 pinnate setae; endopodal lobe small, with 1 long pinnate and 1 small bare setae.

**Male:** Habitus (Fig. 119A) as in female, except for urosomites 2 and 3; total length measured from anterior end of rostrum to posterior end of caudal rami about 776.9  $\mu\text{m}$  in dorsal view.

Urosomite 2 (Fig. 120A) separated from urosomite 3; posterior corner produced, reaching to end of anal somite, with 1 spine (representing P6) apically.

Antennule (Fig. 119B) 8-segmented, haplocer; first segment with 1 row of spinules near distal margin, 1 group of spinule along anterior margin; fourth segment smallest; seventh segment with patch of small papilla on inner margin proximally; eighth segment conical in shape. Setal formula of each segment as follows: 1-[1]; 2-[12]; 3-[7]; 4-[2]; 5-[11 + ae]; 6-[2]; 7-[3]; 8-[12 + ae].

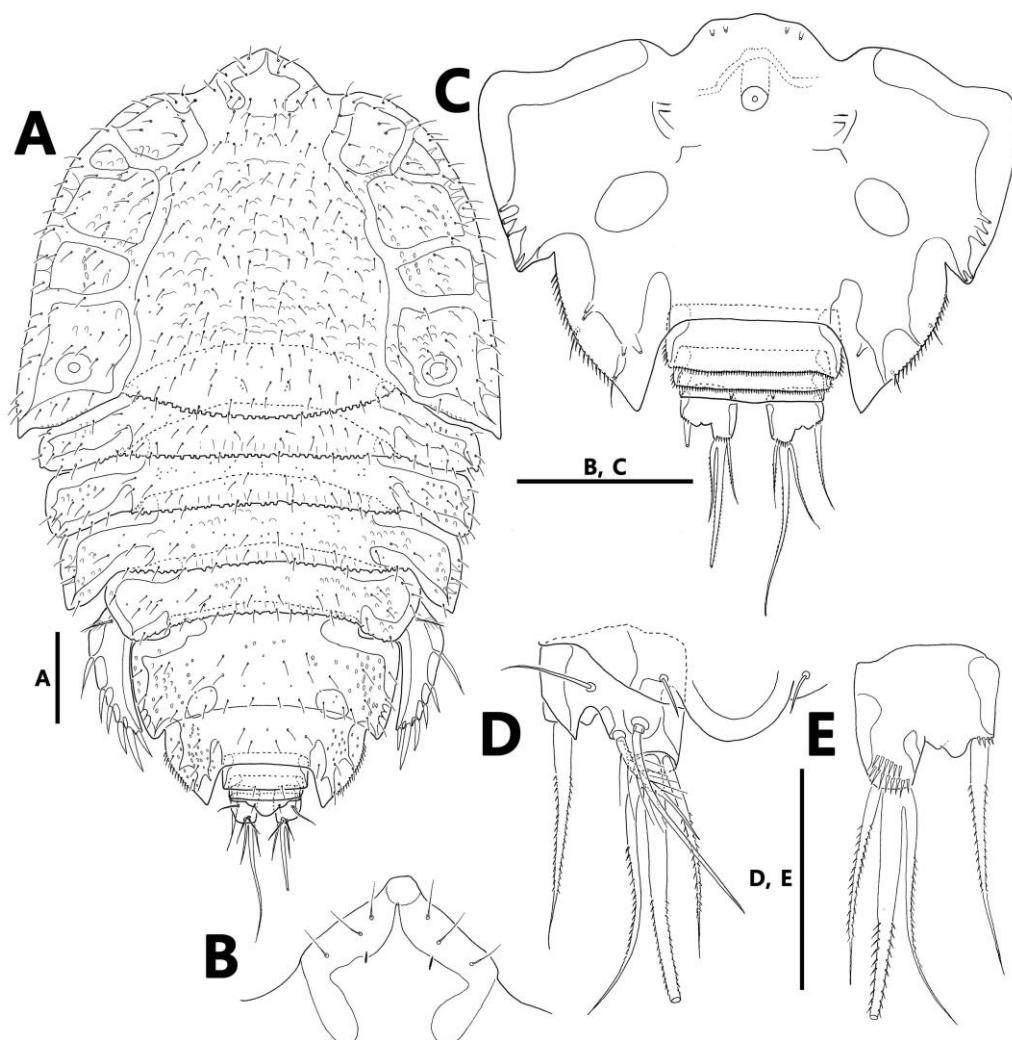
P5 (Figs. 119C, 120A). Baseoendopod and exopod fused, but with vestigial border on ventral surface proximally; dorsal surface with 1 plumose seta; outer margin with 3 pinnate setae; apical margin width 3 stout pinnate setae; ventral surface with 3 pores on baseoendopod and 5 pores on exopod; endopodal lobe on ventral surface weakly developed, with 2 subequal (1 pinnate and 1 bare) setae.

Caudal rami (Fig. 120B, C) as in female, but seta II much smaller than female.

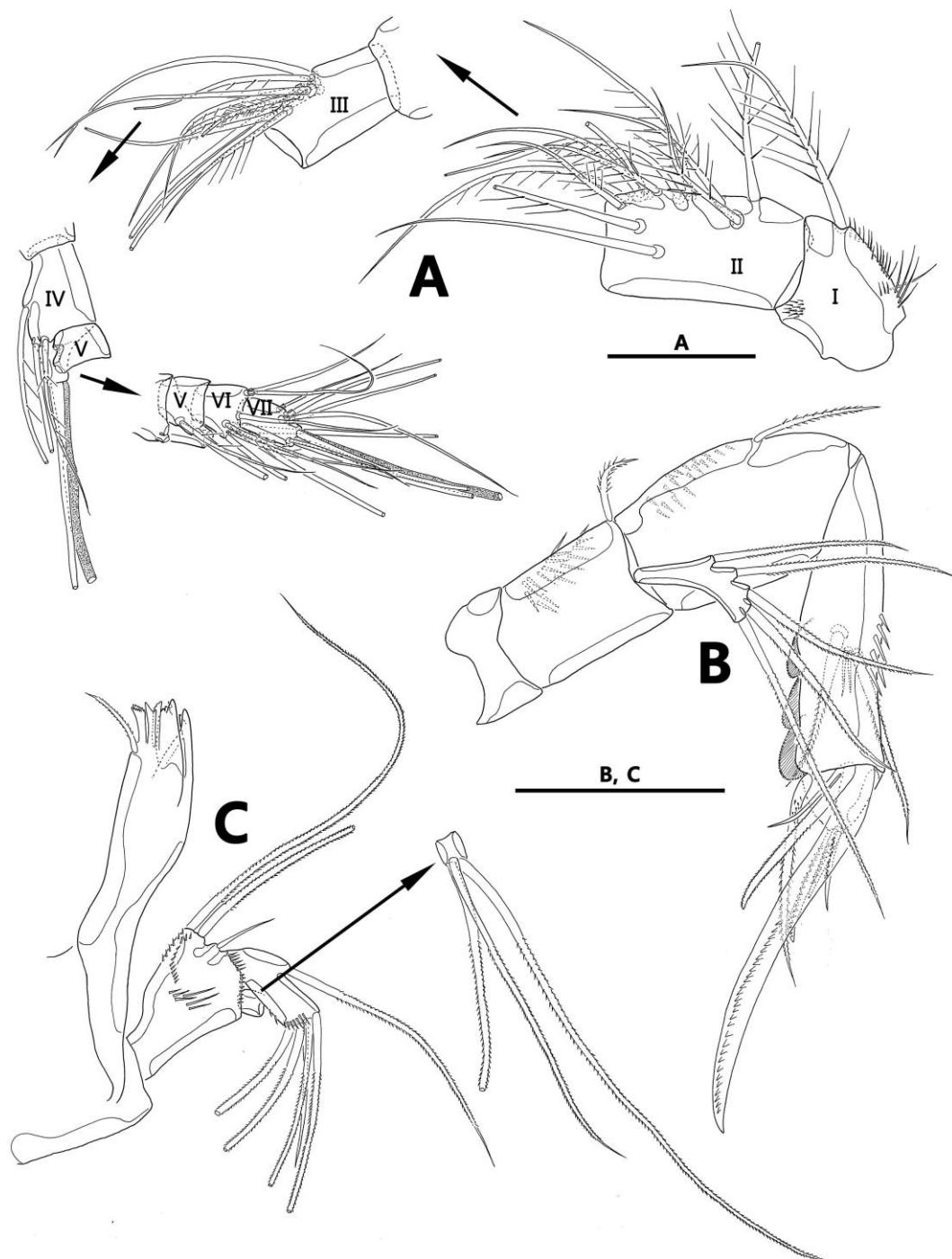
**Remarks.** So far, only three *Alteuthella* species, *A. pellucida* A. Scott, 1909, *A. pygmaea* A. Scott, 1909, and *A. spinicauda* A. Scott, 1909, have been recorded from the deep-sea in the northern west coast of New Guinea and the Banda Sea. Although peltidiid copepods are usually known to inhabit macroalgal assemblages and sandy beaches of marine habitats (Suárez-Morales & Jarquín-González, 2013), but all known *Alteuthella* species were collected by washings from subtidal samples dredged by A. Scott (1909). Unlike these three species, *Alteuthella* sp. nov. was collected from macroalgae bed. There have been no records of *Alteuthella* from other regions except for Gurney's (1927) report of *A. spinicauda* from the Gulf of Suez, while this records is doubtful due to the geological distance from the type locality (Song et al. 2015).

*Alteuthella* sp. nov. is mostly closed to *A. pellucida* by the relatively wide body shape in female, about 1.6 times as long as width (1.5 times in *A. pellucida*, 1.9 times in *A. spinicauda*, and 1.8 times in *A. pygmaea*). However, the new species clearly differs from the latter by the presence of dentate ornamentation on the posterior margins of prosome (vs. bare in *A. spinicauda*). According to Lang's

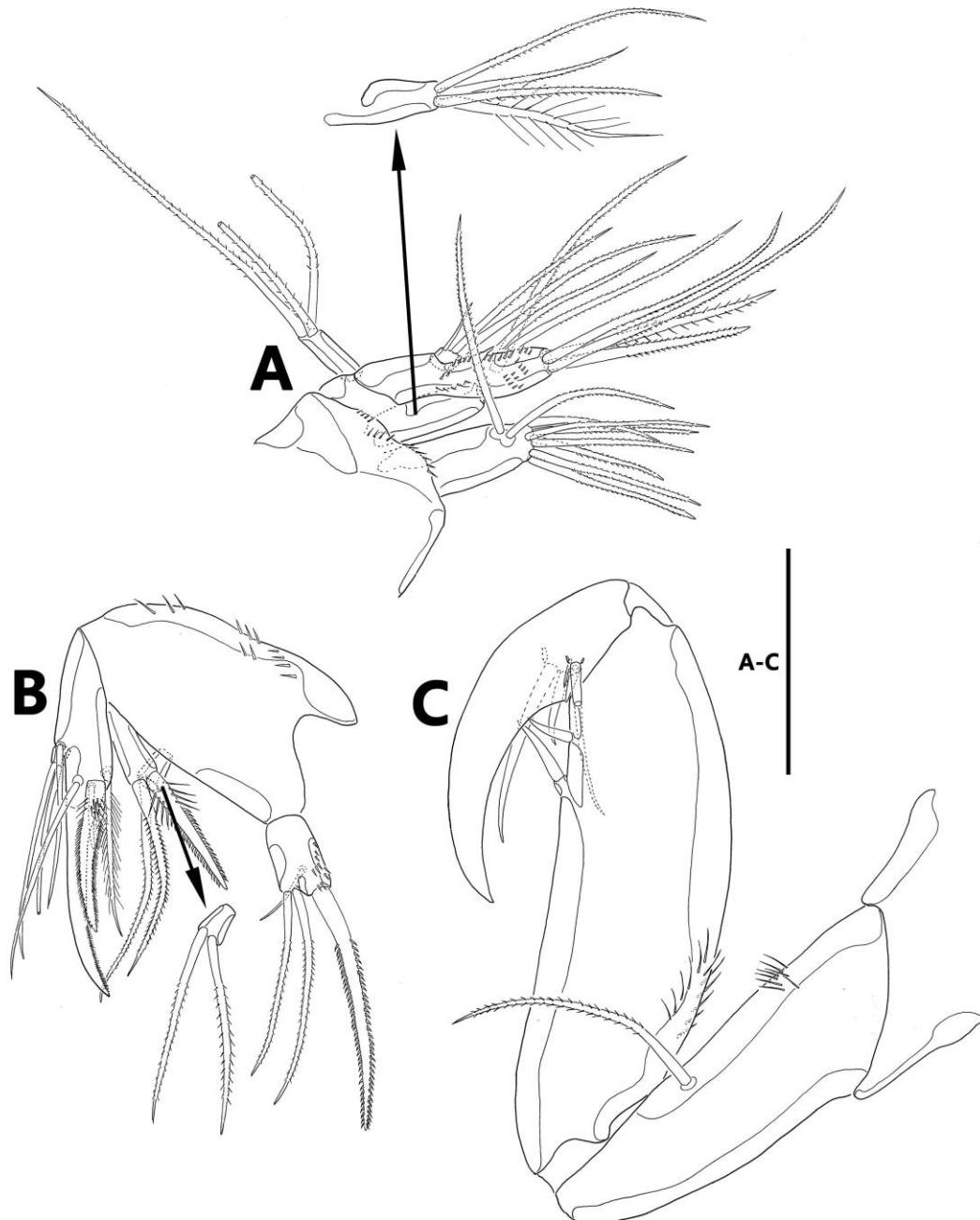
(1948) key to species of the genus, whether these margins are dentate or bare was considered as an identification key. Male of *Alteuthella* sp. nov. also can be discriminated from *A. pellucida* by the structures of P5 and caudal rami. Comparing the relative length of setae on P5 exopod, the middle and distal setae on P5 exopod in *A. pellucida* are distinctly shorter than those of *Alteuthella* sp. nov. *Alteuthella* sp. nov. uniquely displays a sexual dimorphism in the length of caudal seta II.



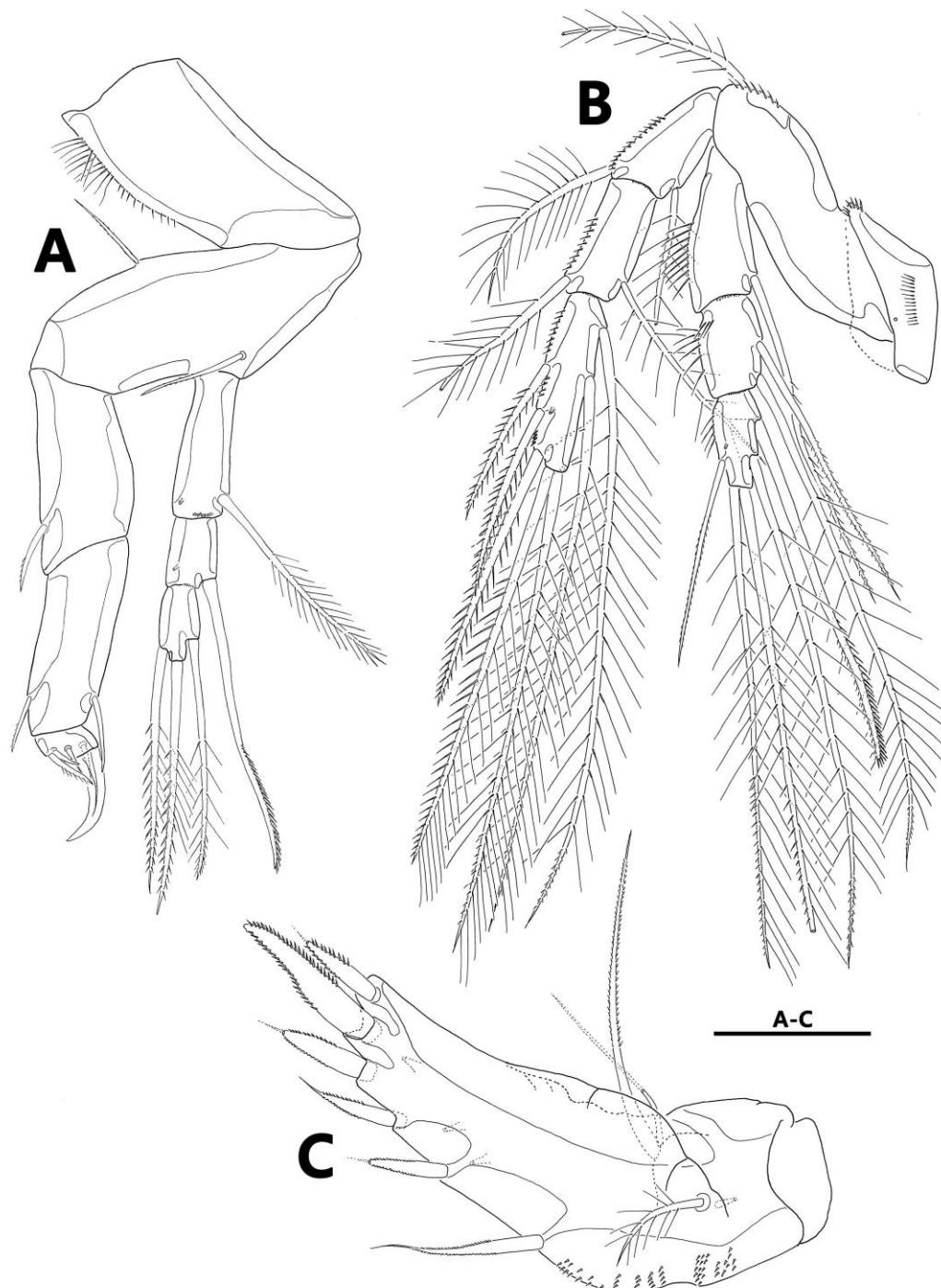
**Fig. 114.** *Alteuthella* sp. nov., female. A, habitus, dorsal; B, rostrum, ventral; C, urosome, ventral; D, E, caudal rami, dorsal (D), ventral (E). Scale bars: 50 µm (D, E); 100 µm (B, C); 200 µm (A).



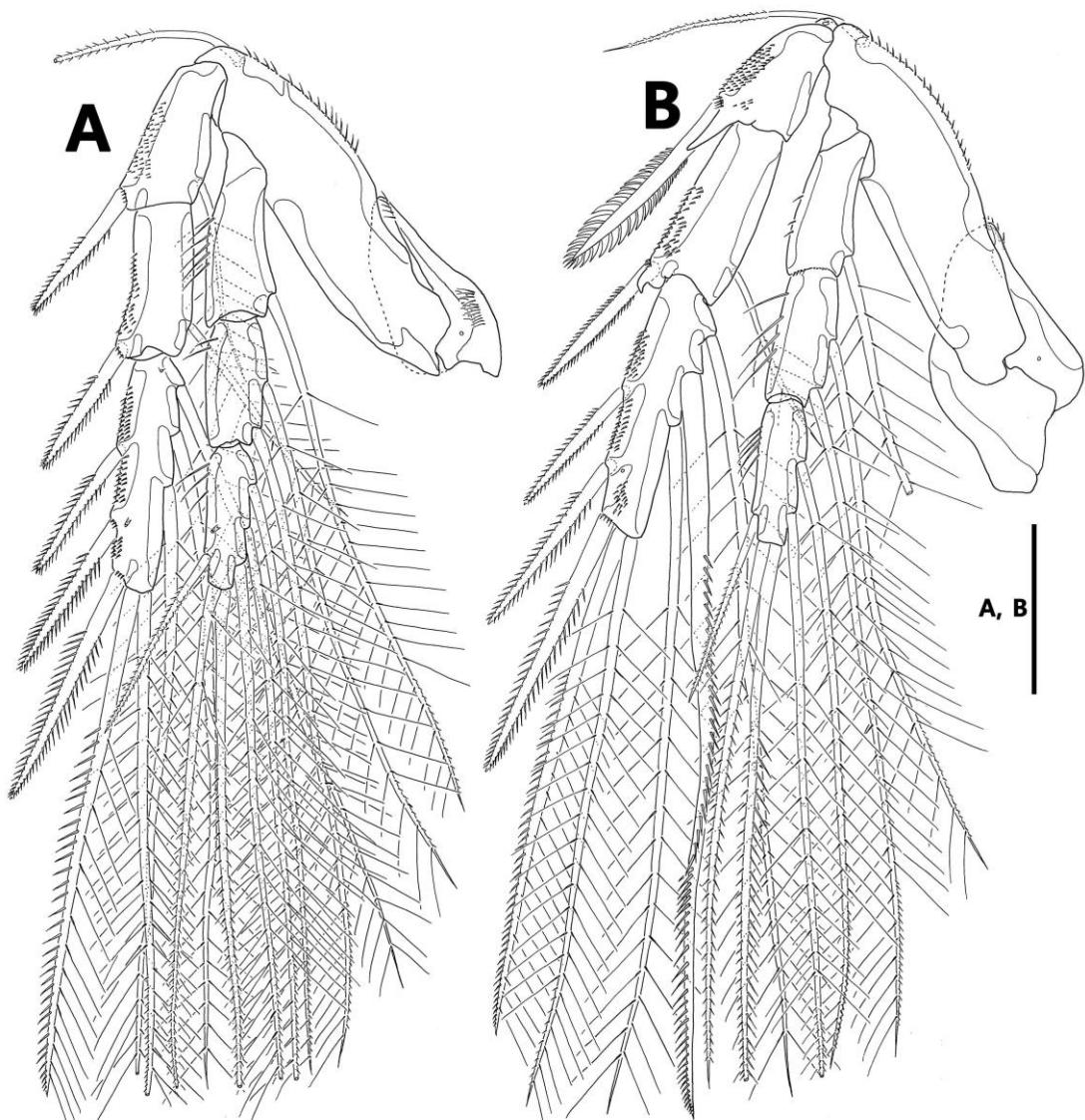
**Fig. 115.** *Alteuthella* sp. nov., female. A, antennule; B, antenna; C, mandible. Scale bar: 50  $\mu\text{m}$ .



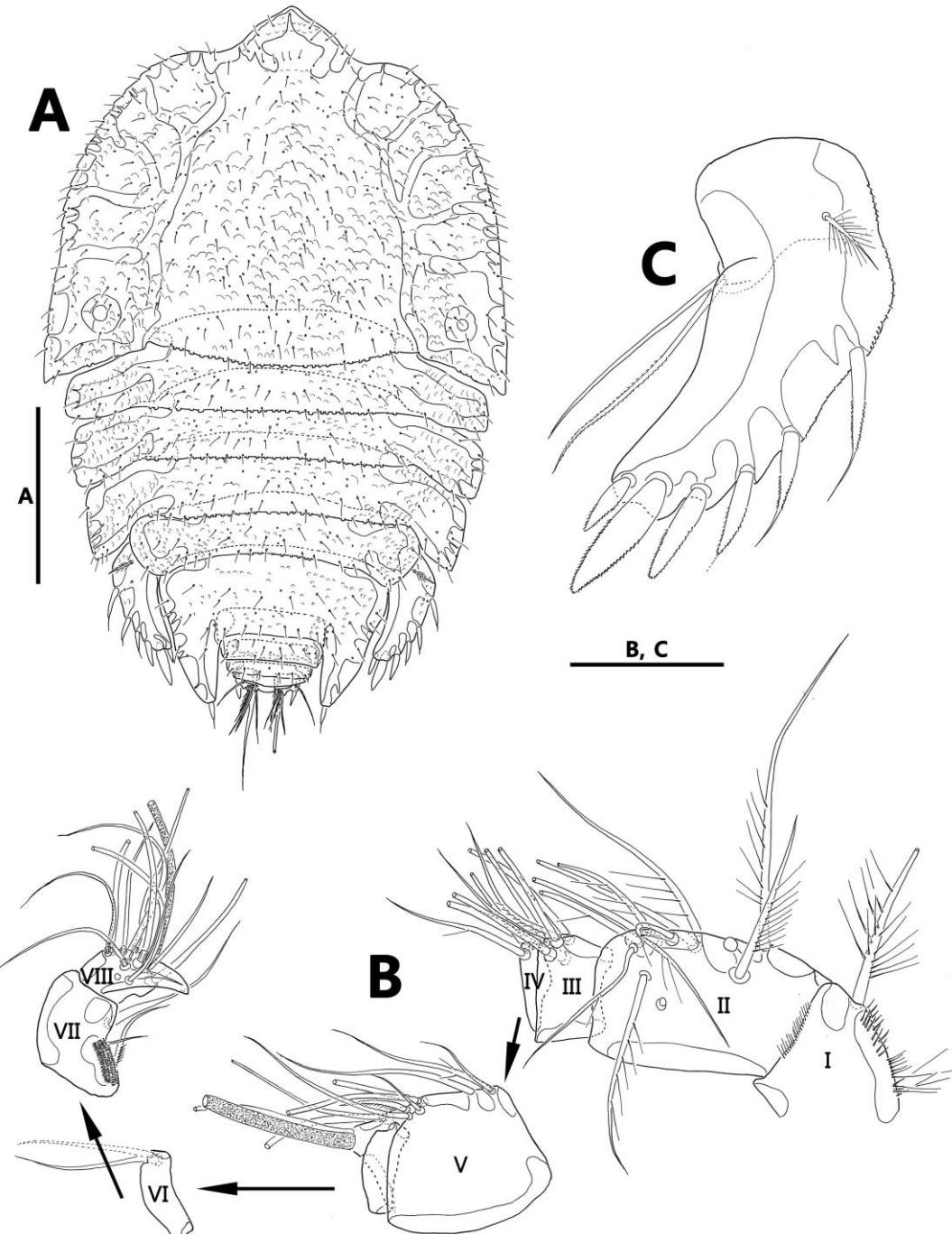
**Fig. 116.** *Alteuthella* sp. nov., female. A, maxillule; B, maxilla; C, maxilliped. Scale bar: 50  $\mu\text{m}$ .



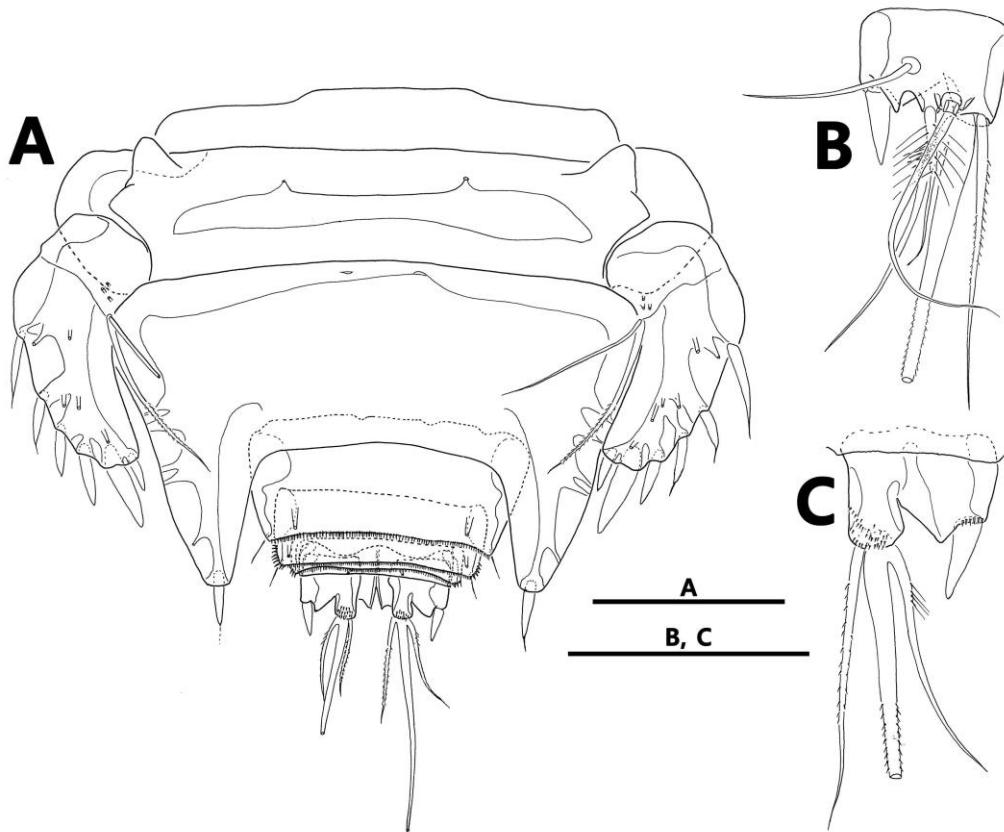
**Fig. 117.** *Alteuthella* sp. nov., female. A, P1; B, P2; C, P5. Scale bar: 50  $\mu\text{m}$ .



**Fig. 118.** *Alteuthella* sp. nov., female. A, P3; B, P4. Scale bar: 50  $\mu\text{m}$ .



**Fig. 119.** *Alteuthella* sp. nov., male. A, habitus, dorsal; B, antennule; C, P5. Scale bars: 50  $\mu\text{m}$  (B, C); 200  $\mu\text{m}$  (A).



**Fig. 120.** *Alteuthella* sp. nov., male. A, urosome, ventral; B, C, caudal rami, dorsal (B), ventral (C). Scale bars: 50 µm (B, C); 100 µm (A).

#### Genus *Alteuthoides* Hicks, 1986 비고갑옷장수노벌레 속

모식종: *Alteuthoides kootare* Hicks, 1986

#### 91. *Alteuthoides affinis* Kim and Kim, 1998 우리비고노벌레

*Alteuthoides affinis* Kim & Kim, 1998, p. 203, figs. 1–4; Lee et al., 2012, p. 162, figs. 112–115.

관찰재료: 15♀♀, 2♂♂, 전남 신안군 흑산면 가거도리, 가거도(해조류, 수심 5m), 2013.7.30.

분포: 한국.

**고찰:** 이 종은 제주도 연안에 서식하고 있는 해면동물인 *Callyspongia elegans* 와 연관, 또는 공생하는 것으로 알려져 있지만(Kim & Kim 1998), 본 연구에서는 자유생활을 하는 개체들을 가거도에서 채집, 확인하였다.

### Family Tegastidae Sars, 1904

#### Genus *Syngastes* Monard, 1928

**모식종:** *Syngastes clausii* (Thomson, 1883)

#### 한국산 넓은배장수노벌레 속(*Syngastes*)의 종에 대한 검색표

1. 암컷의 제 1 촉각은 5 마디로 이루어져 있다 .....  
..... 구멍넓은배장수노벌레 *S. multicavus*
- 암컷의 제 1 촉각은 7 마디로 이루어져 있다 .....  
..... 나도구멍넓은배장수노벌레 *S. pseudofoveatus*

#### 92. *Syngastes multicavus* Kim, Jung & Yoon, 2016 구멍넓은배장수노벌레(Figs. 121–128)

*Syngastes multicavus* Kim et al., 2016c, p. 433, figs. 1–8.

**Type locality.** Gageodo Island (34°05'12.5"N, 125°05'22.0"E), Gageodo-ri, Heuksan-myeon, Sinan-gun, Jeollanam-do, Korea.

**Material examined.** Holotype ♀ (NIBRIV0000326514) and allotype ♂ (NIBRIV0000326515) dissected and mounted, each on a slide. Paratypes: 2♀♀ (NIBRIV0000326516, NIBRIV0000326525), each dissected and mounted on one and 10 slides, respectively. 2♀♀, 1♂ were examined under SEM. All material was collected from the type locality by SCUBA diving at depth 5 m on 30 July 2013.

**Description. Female.** Body (Figs. 121A, 125A, 126D) laterally compressed, covered with small hollows and sensilla; total body length 730 µm from rostrum to caudal rami in lateral view; dorsal outline less rounded in lateral view. Rostrum indiscernible, fused with cephalothorax.

Prosome (Figs. 121A, 125B, C, D, 126E) 4-segmented, composed of cephalothorax and 3 free pedigerous somites. Cephalothorax as long as 4 succeeding somites combined; cephalic shield (Figs. 1A, 5B, D) expanded ventrally; posteroventral corner slightly produced and pointed. Length ratio of thoracic somite 2-4 1.0:2.7:3.0.

Urosome (Figs. 121A, B, 126A, B, C, F, 127A, B) composed of P5-bearing, genital double-somite, and 3 postgenital somites. P5-bearing somite 0.66 times as long as preceding one. Genital double-somite well-developed and scoop-like; posteroventral margin with pointed posteroventral corn, forming angle at midway in lateral view; posterior surface forming T-shaped ridge in posterior view (Fig. 126F); ventromedian and lateral cones developed; ventral margin very short. Postgenital somites short and shrouded in genital double-somite.

Caudal rami (Figs. 121C, 127C) small, as long as width, with 1 large and 1 small pores, and 1 protrusion, and armed with 1 geniculate and 6 bare setae.

Antennule (Figs. 121 D, 125E) 5-segmented, with aesthetasc on segments 4 and 5, respectively; length ratio of each segment 3.3:2.5:1.7:1.0:1.5; setal formula as follows: 1-[1], 2-[10], 3-[10], 4-[4 + ae], 5-[17 + ae].

Antenna (Fig. 122A). Coxa small. Basis longest and naked. Exopod 2-segmented; proximal segment with unipinnate seta distally; distal segment about 1/3 of preceding one in length, with 1 unipinnate, 1 plumose and 1 bare setae. Endopod 2-segmented; proximal segment 0.8 times as long as basis, with row of setae on inner surface and small seta on abexopodal margin; distal segment with row of setae along inner margin, armed with 3 spines, 2 plumose, and 1 bare setae along distal margin, 2 setae on abexopodal margin.

Labrum (Fig. 122B) subrectangular; inner surface with H-shaped ridge bearing row of spinules gradually increasing, 2 rows of papilla; distal margin armed with rows of spinules.

Mandible (Fig. 122C, D). Coxal gnathobase well-developed, with stout protrusion basally; cutting edge armed with 4 multicuspids, 1 unicuspids teeth, and 1 long pinnate seta. Basis 1-segmented, with 2 rows of setules along lateral margins and 2 long plumose setae. Exopod fused to basis, represented by 2 elements. Endopod 1-segmented and bearing 3 plumose setae on distal margin.

Maxillule (Fig. 122E). Praecoxal arthrite well-developed, armed with 7 toothed spines and 2 setae. Coxal endite small, with stout unipinnate seta. Basal endite armed with 4 bipinnate distally. Exopod 1-segmented, with 2 apical plumose and 1 lateral pinnate setae. Endopod incorporated into basis, represented by 2 naked setae.

Maxilla (Fig. 122F). Syncoxa elongate, with rows of spinules and setule along outer margin, bearing 3 endites; proximal endite small, bearing 2 apical and 2 lateral plumose setae; middle endite small, with 2 naked setae apically; distal endite well-developed, drawn out into strong claw bearing row of spinules along lateral margin, with 2 setae. Allobasis forming stout claw distally, with 1 stout pinnate seta on inner margin, 2 naked and 2 plumose setae on outer margin, armed with set of spinules on outer margin proximally. Both rami incorporated into basis.

Maxilliped (Figs. 122G, 127D). Coxa elongate, with seta at inner distal corner; proximal part slightly swollen; outer margin ornamented with fovea. Basis as long as preceding coxa; palmar margin swollen proximally, armed with 1 row of stout median spinules, 1 row of medial spinules, 2 lateral spinule and 1 group of small denticles, bearing 1 button-shaped process and 1 tongue-like process. Endopod drawn out into strong claw, with 3 accessory setae proximally; inner margin serrate.

P1 (Fig. 123A). Coxa subrectangular. Basis elongate, with 2 rows of setules, 1 outer and 1 inner setae. Exopod 1-segmented, half of basis in length, with 1 row of inner setules, 2 apical and 3 outer setae, 1 tube pore; inner margin swollen proximally. Endopod longer and wider than exopod, with 1 long plumose and 1 naked setae on inner margin, 2 pinnate setae on apical margin, 1 pinnate seta and 1 row of setules on outer margin.

P2–P3 (Fig. 123B, C). Coxa small; distal outer margin expanded outwardly and triangular in shape. Basis elongate, with rows of spinules along outer margin and outer seta; proximal and outer margins linear. Exopod 2-segmented; outer margin of each segment armed with row of spinules; proximal segment longer than distal one. Endopod 3-segmented; each segment subequal in length, armed with row of setules along outer margin.

P4 (Fig. 123D). Coxa small; outer and distal margins expanded outwardly, with row of setules along outer margin distally. Basis elongate, with row of setules and seta on outer margin; surface with foveate ornamentations. Exopod 3-segmented; each segment armed with row of outer spinules; length ratio of each segment 1.0:3.5:3.0; middle inner seta on distal segment stout, serrate, bearing curved protrusion subdistally. Endopod 2-segmented; enp-1 swollen, drastically narrow in distal part, ornamented with small foveate on surface and 2 groups of spinules along outer margin; enp-2 slender, rod-like, shorter than proximal one, with 2 rows of bumps on surface.

Setal formula of P2-P4 as follows:

	Exopod	Endopod
P2	2.222	1.2.221
P3	2.322	1.2.321
P4	0.1.322	1.021

P5 (Figs. 123E, F, 125F). Baseoendopod well-developed, wide, flattened, with longitudinal ridge; surface subdivided by subrectangular or linear ridges, covered with small bumps; anterior margin with 3 slender and 1 stout setae; posterior margin with 3 setae; ventral edge with small seta. Exopod very small, conical in shape, shrouded in baseoendopod, with 2 apical and 1 lateral setae; proximal part with several setules (Kim et al. 2016c).

**Male.** Sexual dimorphism in body size, cephalothorax, urosome, antennule, and P5.

Body (Figs. 124A, 128A) smaller than female, about 596  $\mu\text{m}$  in length.

Cephalic shield (Figs. 124A) forming right angle at posteroventral corner.

Urosome (Figs. 124A, B, 128B, C). P5-bearing and genital somites fused; posterior margin concave, V-shaped between 2 protrusions, with 2 protrusions (ventromedian and posteroventral cones); ventral margin rounded, with large recurved valve. Postgenital somites occasionally within body inwardly.

Antennule (Figs. 124C, 128D) 7-segmented, modified for grasping, with aesthetasc on segments 3, 4 and 7, respectively, having small wedge-like process bearing seta between segments 3 and 4. Setal formula as follows: 1-[1], 2-[10], 3-[6 + ae], 4-[9 + ae], 5-[1], 6-[2], 7-[12 + ae].

Maxilliped (Fig. 128E) similar to female.

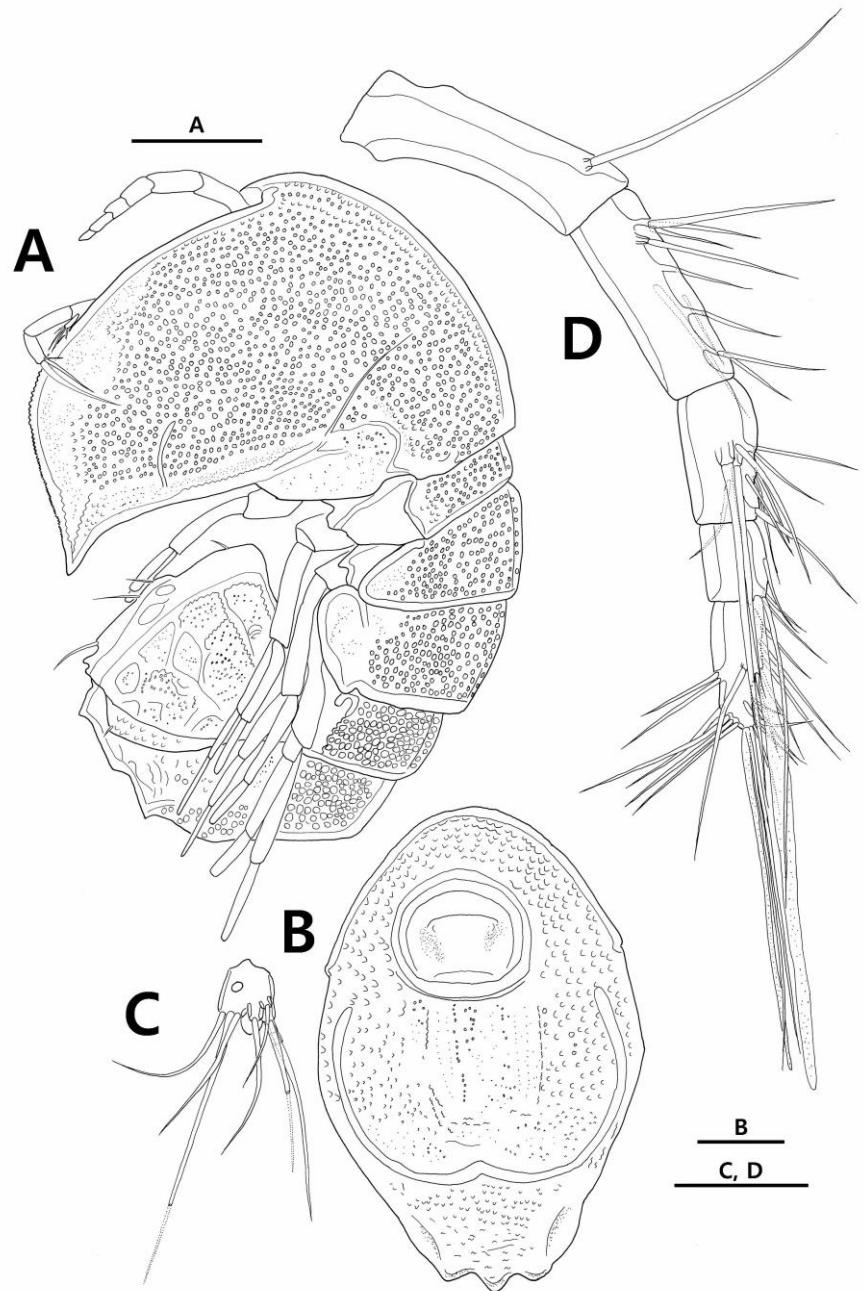
P4 middle inner seta (Figs. 124D, 128F) of distal segment serrated distally.

P5 (Fig. 124E) 1-segmented, small, baseoendopod and exopod fused, with 3 apical and 2 lateral setae (Kim et al. 2016c).

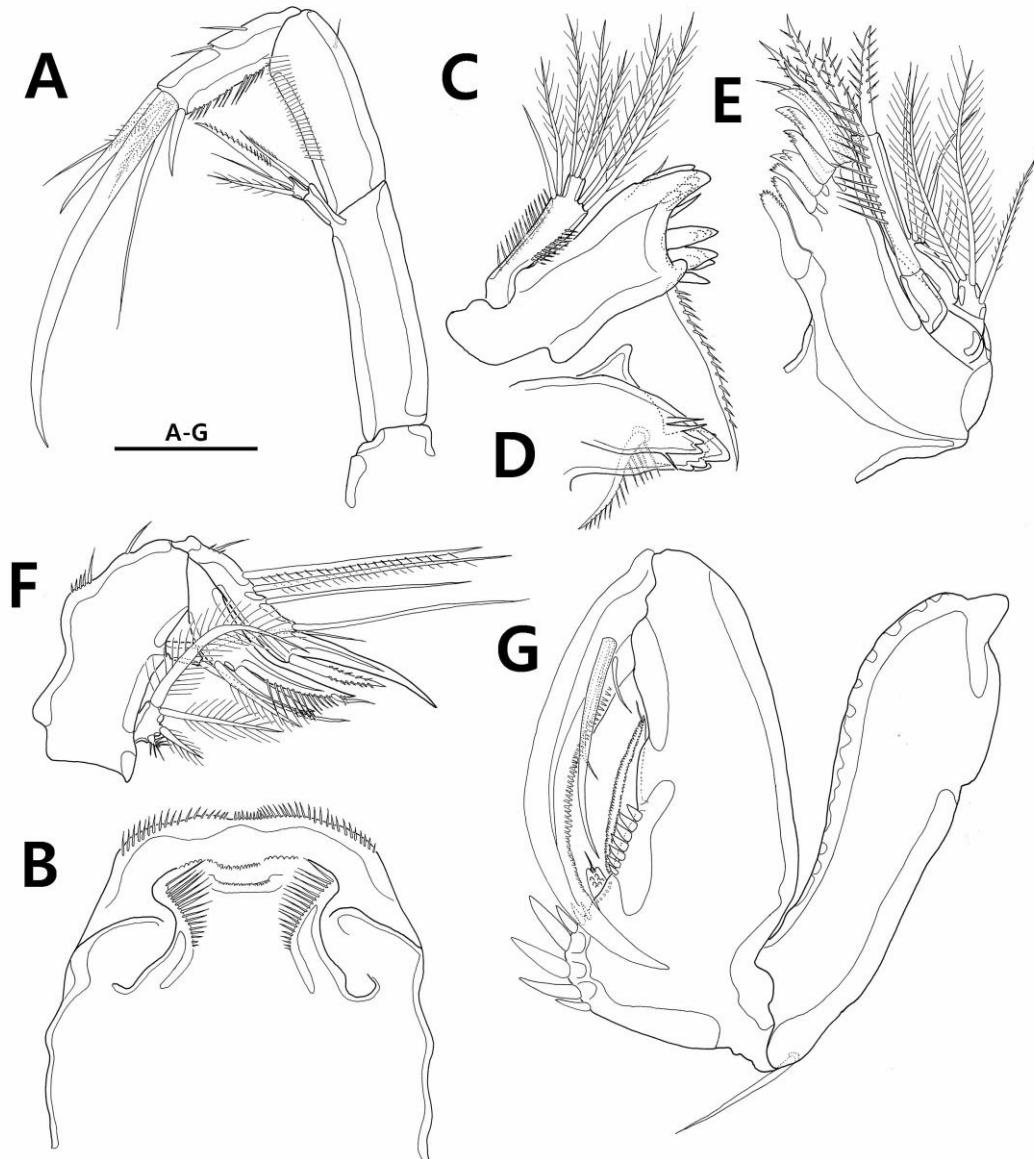
**Habitat.** This species was collected from macroalgal assemblages at depth of 5 m on rocky shore (Kim et al. 2016c).

**Remarks.** Among six genera of the family Tegastidae Sars, 1904, the present species is assigned into the genus *Syngastes* based on the segmentation of P2–P4 and the shape of P5 baseoendopod which is largely extended to encase egg mass (Boxshall & Halsey 2004; Wells 2007).

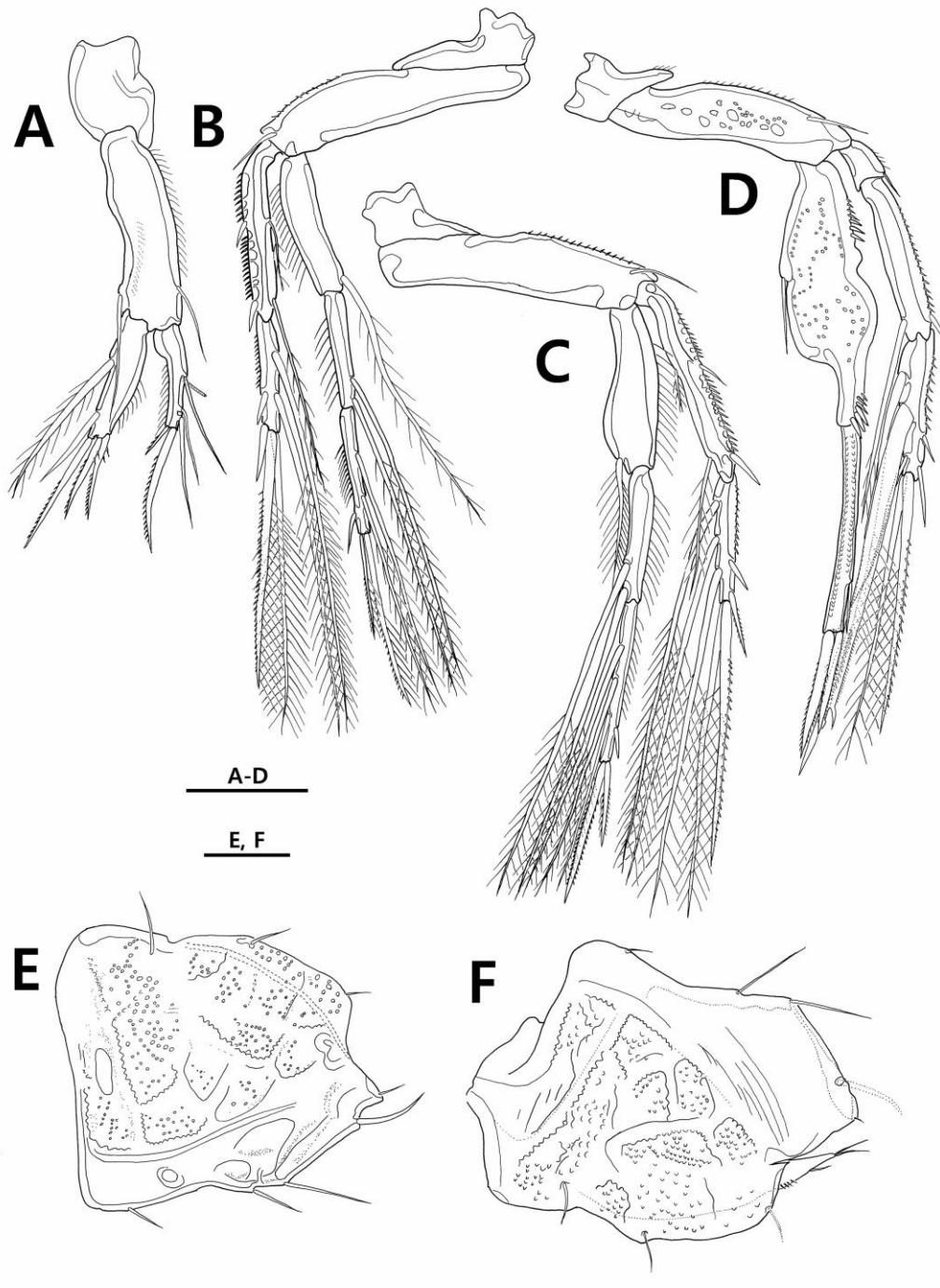
*Syngastes multicavus* Kim, Jung & Yoon, 2016 shares the characteristic of having two setae on the first exopodal segment of P2 and P3 with its congeners similar to *S. clausii* (Thomson, 1883), *S. gibbus* Geddes, 1968, *S. langi* Geddes, 1968, *S. spinifer* Fiers, 1983, *S. australiensis* Bartsch, 1999, and *S. gibbosus* Bartsch, 1999 (Thomson 1883; Geddes 1968; Fiers 1983; Bartsch 1999). The new species closely resembles *S. gibbosus* in having the five-, seven-segmented antennules in female and male, respectively, and the two-segmented antennary exopod. They can be easily distinguished from each other by the body outline in lateral view. Bartsch (1999) has considered that the gibbosus body outline is an important morphological characteristic which is represented in *S. donnani* (Thompson & A. Scott, 1903), *S. gibbosus* Bartsch, 1999, and *S. subgibbus* Bartsch, 1999. *Syngastes multicavus* has a weakly rounded dorsal outline in lateral view. However, *S. gibbosus* has the gibbosus dorsal outline because the fourth thoracic somite is much higher than the fifth. The present new species is also different from the latter by having the following characteristic features: (1) It has the foveate ornamentation on the basis and enp-1 of P4, which is absent in *S. gibbosus*; (2) It has an unguiform posterior valve on the urosome of male in lateral view, while *S. gibbosus* has one unguiform valve and two sharp prongs; (3) It has a V-shaped posterior margin between ventromedian and posteroventral cones in male, while it is slightly concave in *S. gibbosus*; (4) It has a tube pore on P1 exopod, which is the first time notified within this genus in the present study; (5) *Syngastes multicavus* has an accessory seta on mandibular gnathobase. This seta was not described in the original description of *S. gibbosus* (Bartsch 1999) (Kim et al. 2016c).



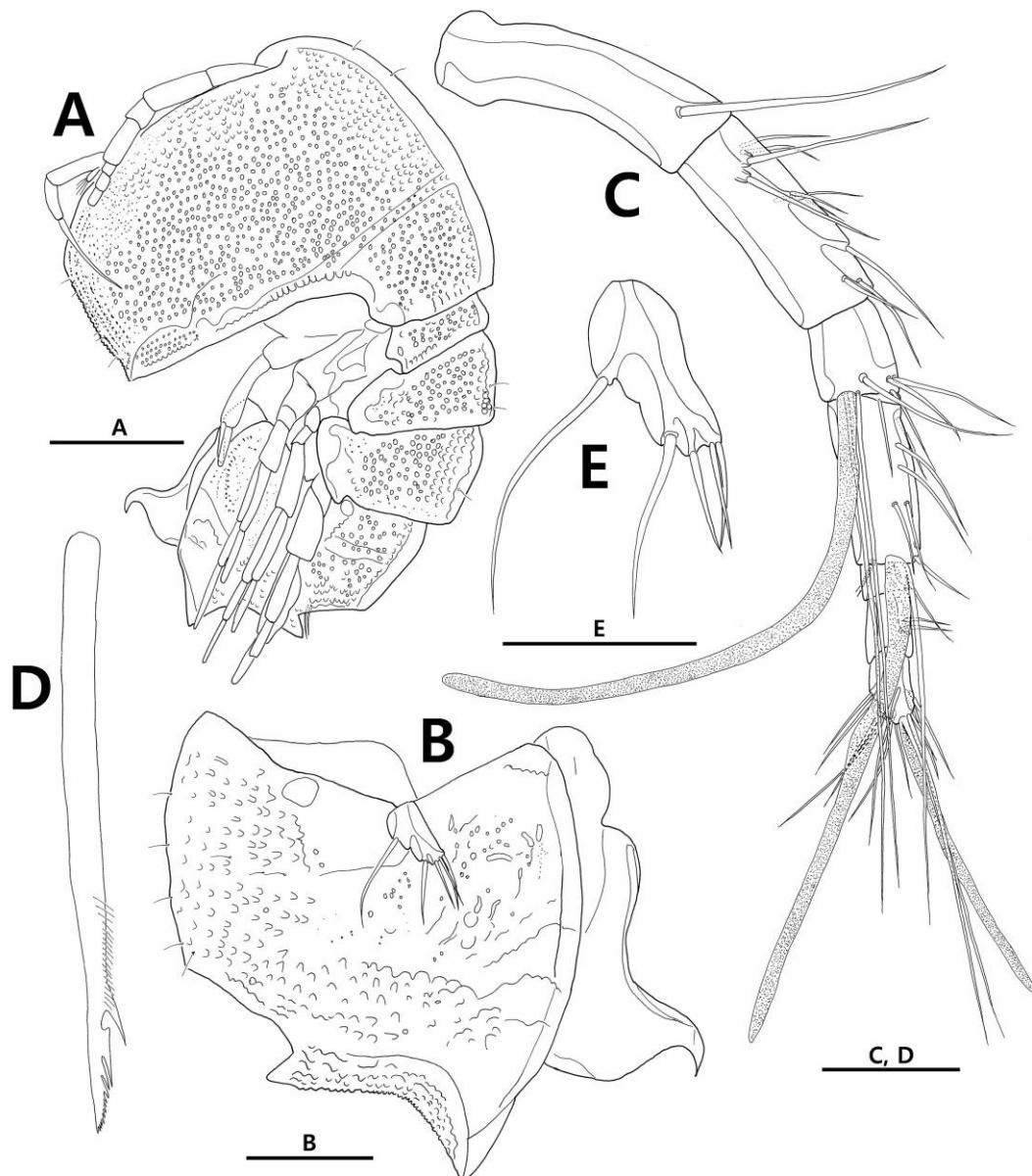
**Fig. 121.** *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A, habitus, lateral; B, urosome, posterior; C, caudal ramus; D, antennule. Scale bars: 30  $\mu\text{m}$  (C, D); 50  $\mu\text{m}$  (B); 100  $\mu\text{m}$  (A) (cited from Kim et al. 2016c).



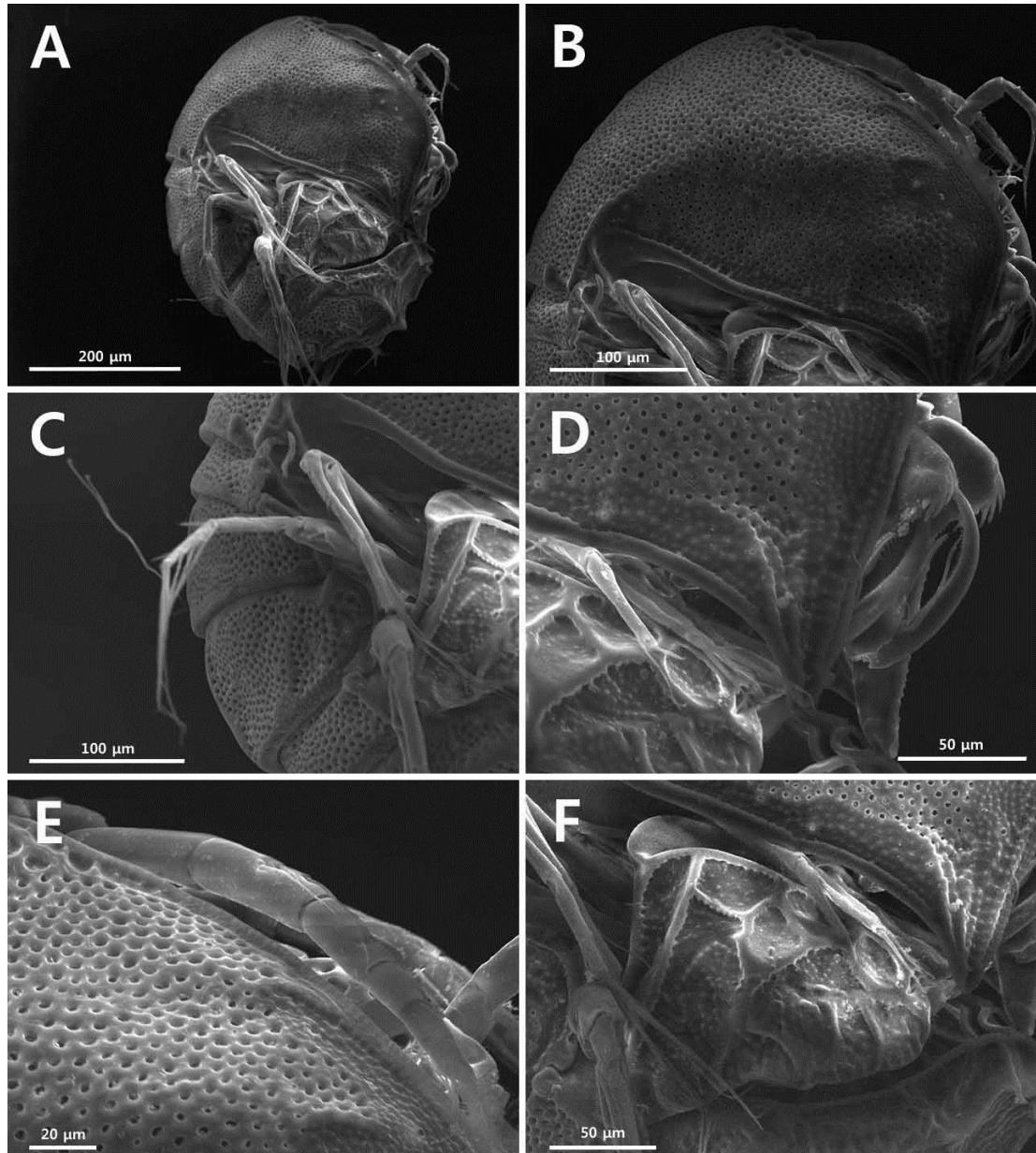
**Fig. 122.** *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A, antenna; B, labrum; C, mandible; D, mandibular gnathobase; E, maxillule; F, maxilla; G, maxilliped. Scale bar: 30  $\mu\text{m}$  (cited from Kim et al. 2016c).



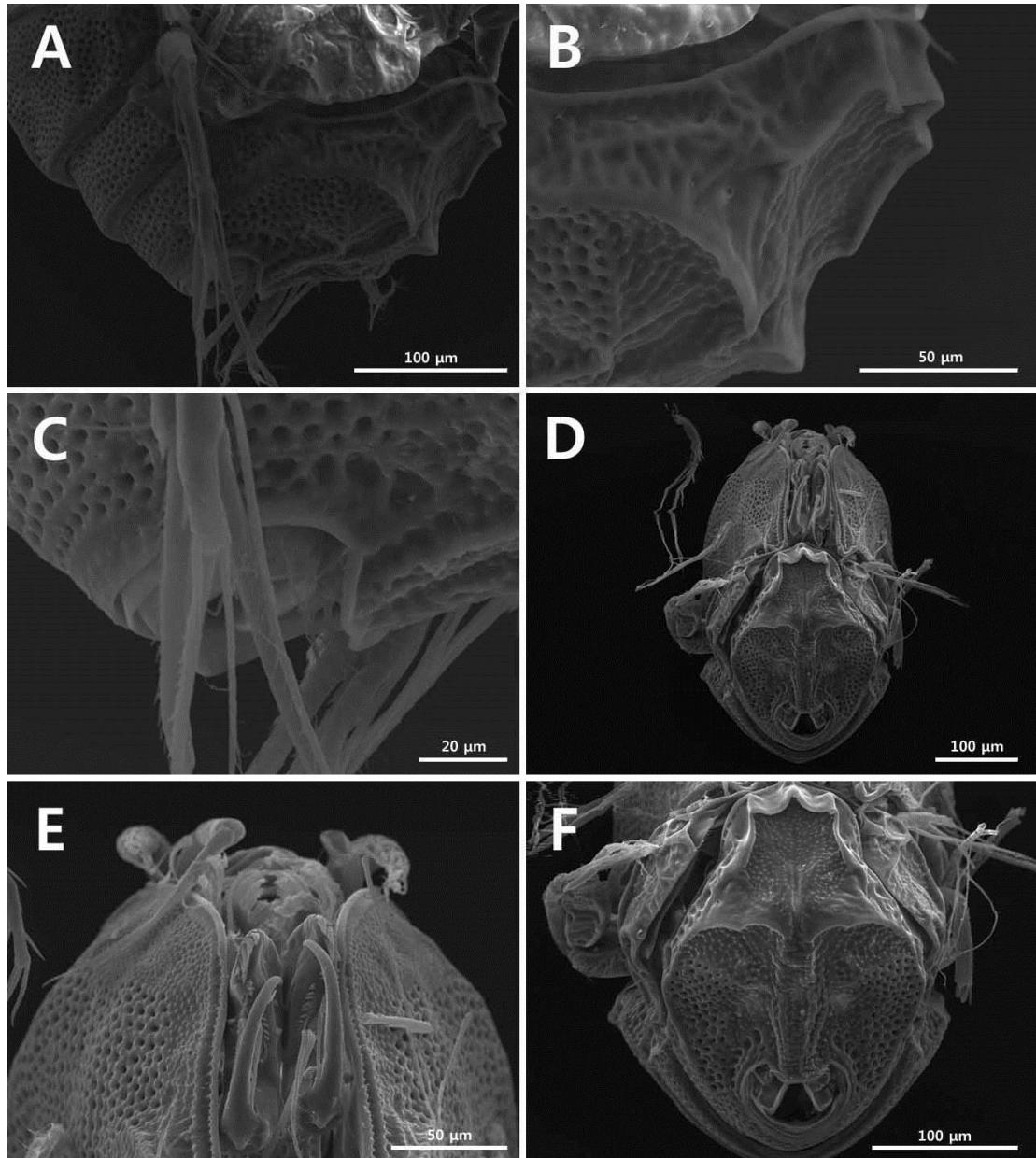
**Fig. 123.** *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A–E, P1–P5; F, P5 depressed by cover slip. Scale bars: 50 µm (cited from Kim et al. 2016c).



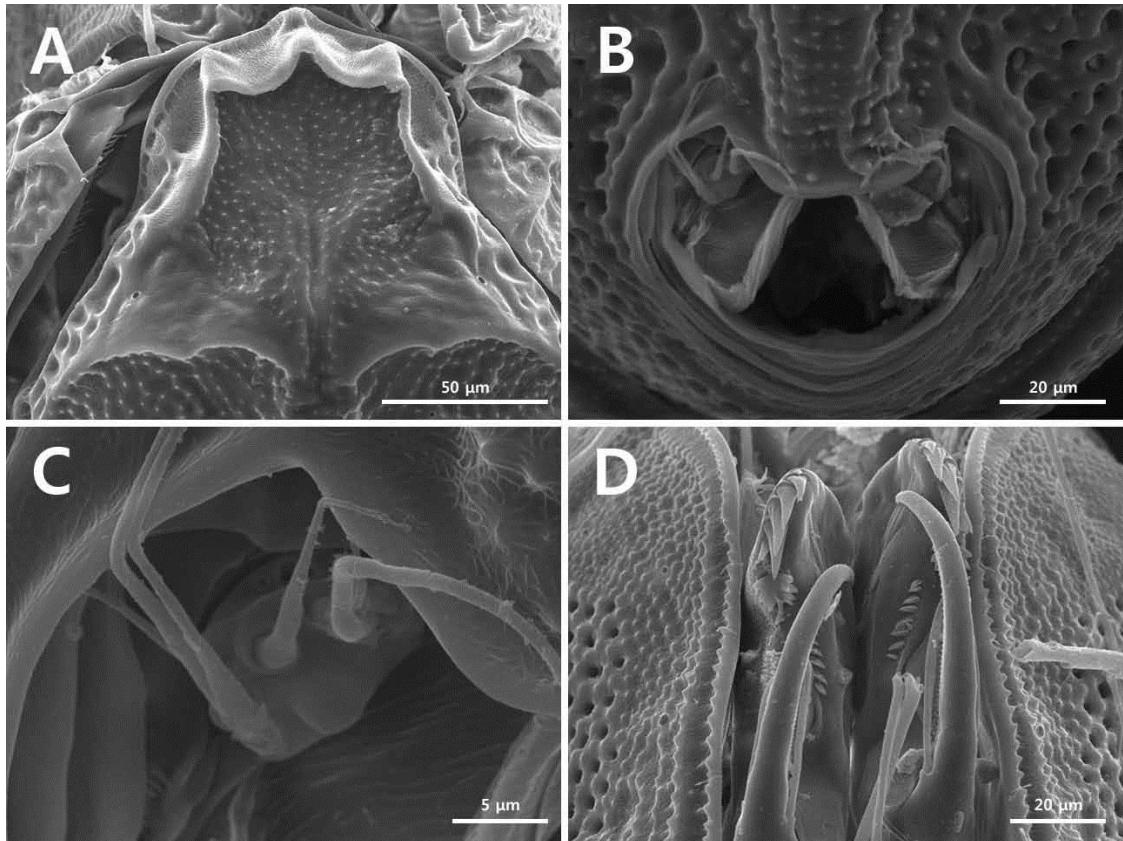
**Fig. 124.** *Syngastes multicavus* Kim, Jung & Yoon, 2016, male. A, habitus, lateral; B, urosome, lateral; C, antennule; D, middle inner seta on P4 exp-3; E, P5. Scale bars: 30  $\mu\text{m}$  (C–E); 50  $\mu\text{m}$  (B); 100  $\mu\text{m}$  (A) (cited from Kim et al. 2016c).



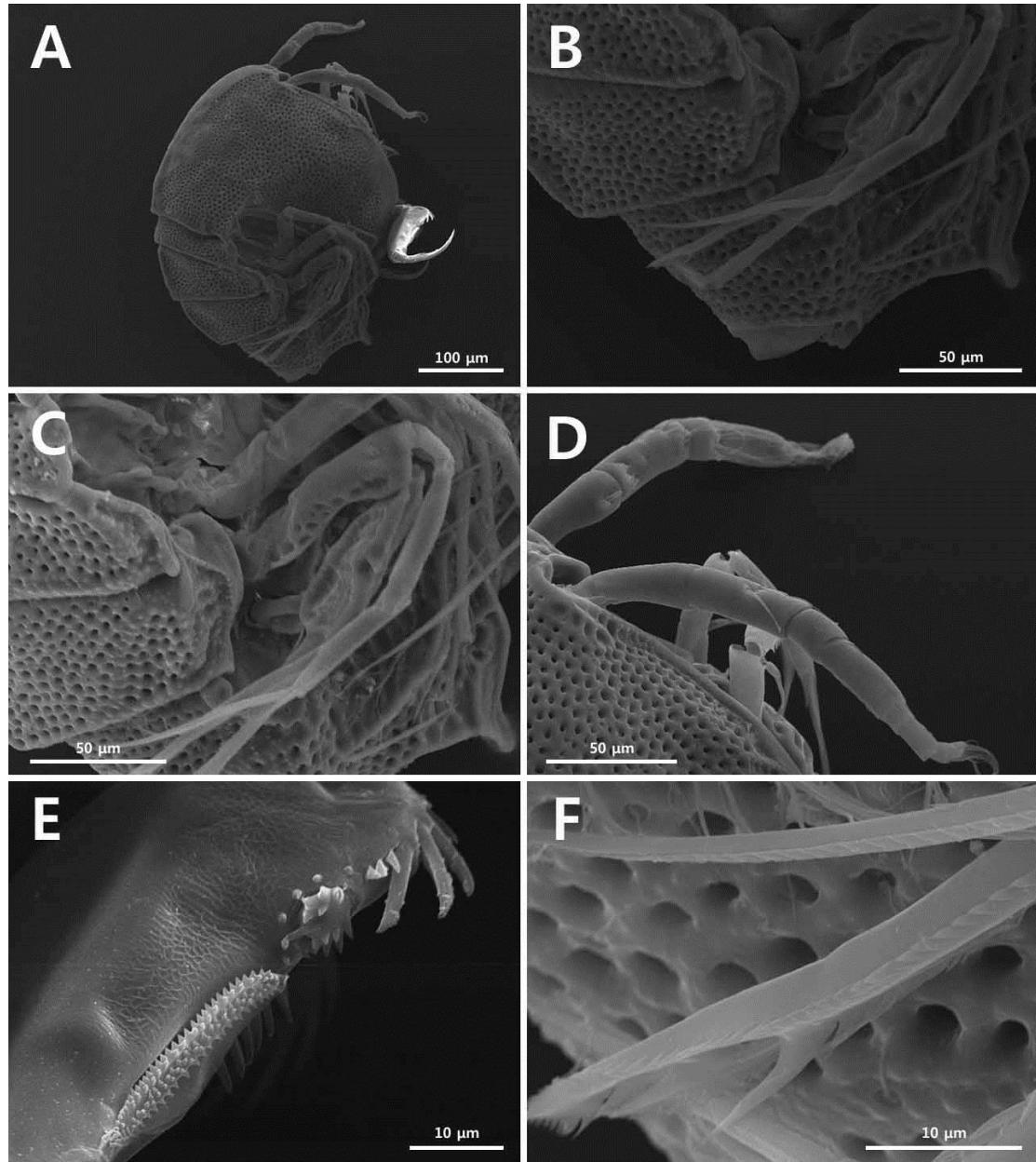
**Fig. 125.** Scanning electron micrographs of *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A, habitus, lateral; B, cephalothorax, lateral; C, outer margin of thoracic somites; D, ventroposterior corner of cephalic shield; E, antennule; F, P5 (cited from Kim et al. 2016c).



**Fig. 126.** Scanning electron micrographs of *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A, urosome; B, posteror margin of genital complex; C, posterior portion of urosome, lateral; D, habitus, ventral; E, anterior portion of cephalosome, ventral; F, urosome, posterior (cited from Kim et al. 2016c).



**Fig. 127.** Scanning electron micrographs of *Syngastes multicavus* Kim, Jung & Yoon, 2016, female. A, ventral portion of genital complex, ventral; B, posterior portion of urosome, posterior, C, caudal ramus, posterior; D, portion of maxilliped, ventral (cited from Kim et al. 2016c).



**Fig. 128.** Scanning electron micrographs of *Syngastes multicavus* Kim, Jung & Yoon, 2016, male. A, habitus, lateral; B, C, urosomite, lateral; D, antennule, lateral; E, palmar margin of maxilliped, lateral; F, distal portion of middle inner seta on P4 exp-3 (cited from Kim et al. 2016c).

**93. *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016 나도구멍넓은배장수노벌레**

(Figs. 129–134)

*Syngastes pseudofoveatus* Kim et al., 2016c, p. 444, figs. 9–14.

**Type locality.** Geumildo Island ( $34^{\circ}21'29.4''\text{N}$ ,  $127^{\circ}00'22.6''\text{E}$ ), Yeonji-ri, Geumil-eup, Wando-gun, Jeollanam-do, Korea.

**Materials examined.** Holotype ♀ (NIBRIV0000326517) and allotype ♂ (NIBRIV0000326518) were dissected and mounted, each on a slide. Paratypes: 2♀♀ (NIBRIV0000326519, NIBRIV0000326520) and 1♂ (NIBRIV0000326526) were dissected and mounted on each slide. 2♀♀, 2♂♂ were examined with SEM. All material was collected from type locality using a hand net on 24 June 2013.

**Description. Female.** Body (Figs. 129A, 132A, 133A) laterally compressed, with foveate ornamentation on surface; total length 520  $\mu\text{m}$  measured from rostrum to caudal rami, greatest height 270  $\mu\text{m}$  at cephalic shield; dorsal outline rounded in lateral view. Rostrum like small protrusion, fused with cephalothorax.

Prosome (Figs. 129A, 132B, 133B, C) 4-segmented, composed of cephalothorax and 3 free thoracic somites. Cephalothorax as long as 3 succeeding somites combined, with large cephalic shield. Length ratio of thoracic somites 2–4 1.0:1.7:2.1.

Urosome (Figs. 129A, B, 132C, D) composed of P5-bearing, genital double-, and 3 postgenital somites. P5-bearing somite 0.46 times as long as preceding one. Genital double-somite (Fig. 4B, C) well-developed and scoop-like; posterior margin straight, with weak posteroventral cone; ventral margin about 0.5 times as long as posterior margin, with rounded protrusion. Each postgenital somite small.

Caudal rami (Fig. 129D) small, bearing 1 articulated and 6 naked setae.

Antennule (Fig. 129E) 7-segmented, with aesthetasc on segments 4 and 7, respectively; segment 1 longest while segment 5 shortest; relative length ratio of each segment: 4.6:4.5:2.9:1.8:1.0:1.5:1.2; setal formula as follows: 1-[1], 2-[9], 3-[9], 4-[4 + ae], 5-[2], 6-[6], 7-[6 + ae].

Antenna (Fig. 129F). Basis longest. Exopod 2-segmented; proximal segment with naked seta distally; distal segment slightly shorter than preceding one, with 2 apical and 1 subapical setae. Endopod 2-segmented; proximal segment shorter than preceding one, with seta on abexopodal

margin; distal segment with several spinules along inner margin, 2 setae on abexopodal margin, 3 spines and 2 setae on distal margin.

Mandible (Fig. 129G). Coxal gnathobase well-developed, with large protrusion; cutting edge armed with 3 multicuspид and 2 unicuspид teeth, 1 unipinnate seta. Palp composed of basis and endopod; basis with 2 long plumose setae; exopod inserted into basis, represented by naked seta; endopod 1-segment, elongate, with 3 apical and 1 lateral bare setae.

Maxillule (Fig. 130A). Praecoxal arthrite armed with 1 naked seta and 7 spines. Coxal endite small, with unipinnate seta. Basal endite, with 2 pinnate, 1 plumose, and 1 bare setae on distal margin, set of setules on surface distally. Exopod 1-segmented, with 1 bare and 2 plumose setae. Endopod inserted into basis, represented by 2 plumose setae.

Maxilla (Fig. 130B). Syncoxa elongate, armed with row of setules on outer margin, with 3 endites; proximal endite small, with 2 apical and 1 lateral plumose setae; middle endite elongate, conical, with 1 apical and 1 lateral plumose setae; distal endite with 2 unipinnate and 1 plumose setae on distal margin. Allobasis drawn out into strong claw, ornamented with spinules, with 1 stout unipinnate seta on inner margin, 3 plumose and 1 naked setae along outer margin. Both rami incorporated into allobasis.

Maxilliped (Fig. 130C). Praecoxa small, with oblique distal margin. Coxa longest, ornamented with fovea and proximal group of setules along outer margin, bearing naked seta at inner distal corner. Basis 0.7 times as long as coxa, swollen proximally; palmar margin, armed with 1 rows of lateral spinules, 1 row of medial spinules, 1 row of median spines gradually increasing, bearing tongue-like and tubercle-like projections; tongue-like and tubercle-like projections on palmar margin ornamented with set of papillae and delicate setule.

P1 (Fig. 130D). Basis elongate, covered with short outer and long inner setules, with 1 outer and 1 inner setae. Exopod slender and elongate; outer margin armed with minute setules and 3 naked setae; apical margin with 1 stout pinnate and 1 small plumose setae; inner margin armed with row of setules. Endopod shorter and wider than exopod, with row of spinules along outer margin, bearing 1 outer, 2 apical, and 2 inner setae.

P2 and P3 (Fig. 130E, F). Coxa small, extended outwardly, with several setules at distal outer corner. Basis elongate, with 1 outer seta; proximal margin oblique; outer margin of P2 with spinular patch distally. Exopod 2-segmented, with row of spinules along each outer margin. Endopod 3-segmented; each outer margin except for enp-3 armed with spinules.

P4 (Fig. 131A). Coxa small, with oblique distal margin and 3 rows of setules. Basis elongate, with 1 row of spinules and 1 seta, ornamented with fovea on surface. Exopod 3-segmented; exp-1 very small, without inner seta, with group of spinules distally; exp-2 and exp-3 elongate, armed with small spinules along outer margin; middle inner seta on exp-3 well-developed and serrated laterally. Endopod 2-segmented; enp-1 swollen medially, with 3 rows of spinules along outer margin, 1 moderate and 1 small inner spines on inner margin, ornamented with fovea on surface; enp-2 slightly shorter than preceding one, rod-like, and with 2 rows of parallel bumps.

Setal formula of P2-P4 as follows:

	Exopod	Endopod
P2	2.222	1.2.221
P3	2.322	1.2.321
P4	0.1.322	2.021

P5 (Figs. 131B, 132F). Baseoendopod large and expanded; surface ornamented with longitudinal ridge, fovea on surface; anterior margin with 3 setae, posterior margin with 3 setae, ventral margin with 1 seta; Exopod small, distinguished from baseoendopod by fissure, with 2 lateral and 1 apical setae; fissure about 1/3 of baseoendopodal lobe in length (Kim et al. 2016c).

**Male.** Body (Figs. 131C, 134A, E) smaller (416  $\mu\text{m}$ ) than female.

Urosome (Figs. 131C, 134B, F). P5 bearing somite fused to genital complex. Genital complex, ventral margin straight with 3 projections, posterior margin rounded.

Caudal rami (Fig. 131E) small, with 1 geniculate and 6 bare setae.

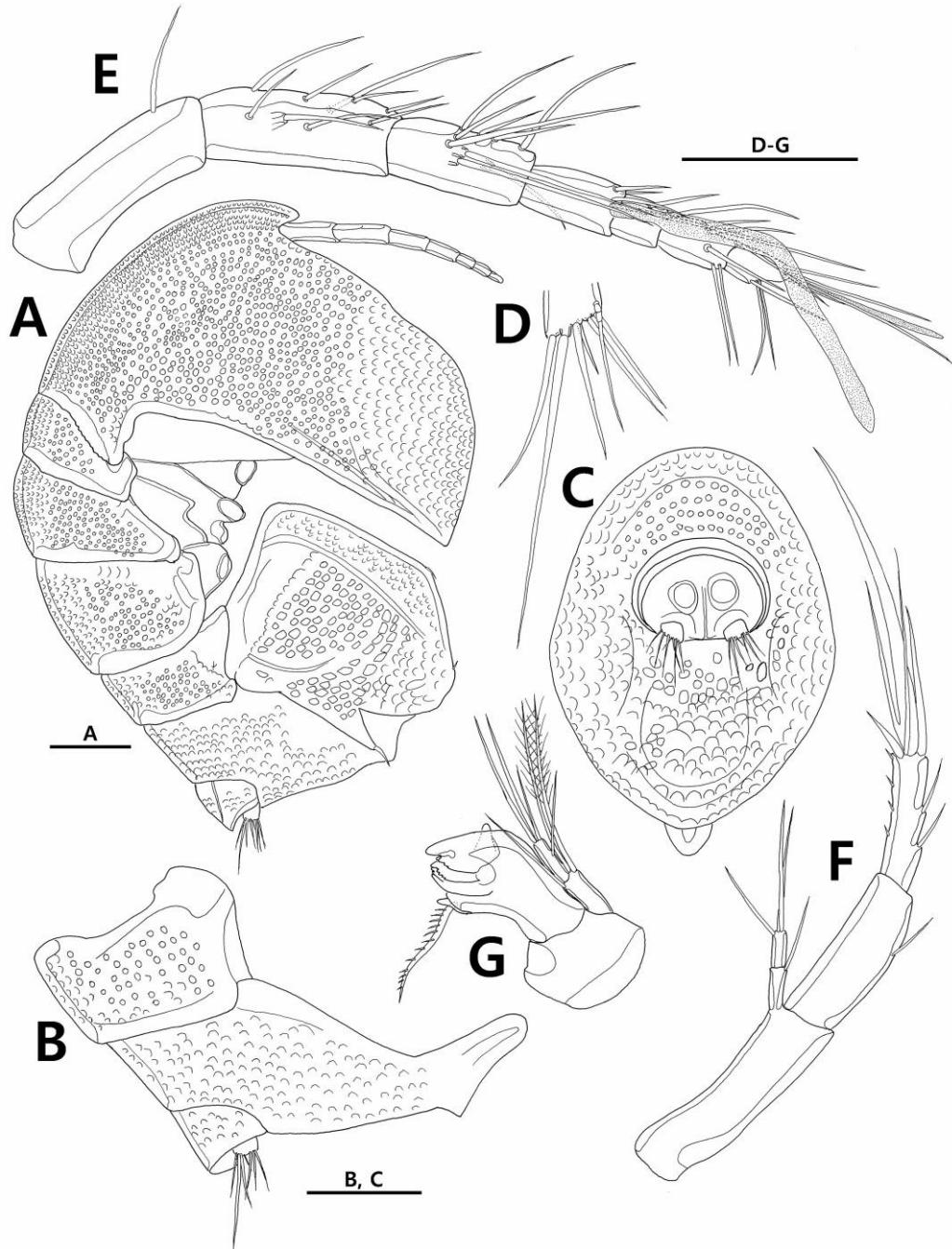
Antennule (Figs. 131D, 134C) 7-segmented, modified for grasping, with 1 small wedge-like process bearing seta between segments 3 and 4. Setal formula as follows: 1-[1], 2-[10], 3-[8 + ae], 4-[8 + ae], 5-[1], 6-[2], 7-[11 + ae].

P5 (Fig. 131F) small, elongate, 1-segmented, with 5 setae (Kim et al. 2016c).

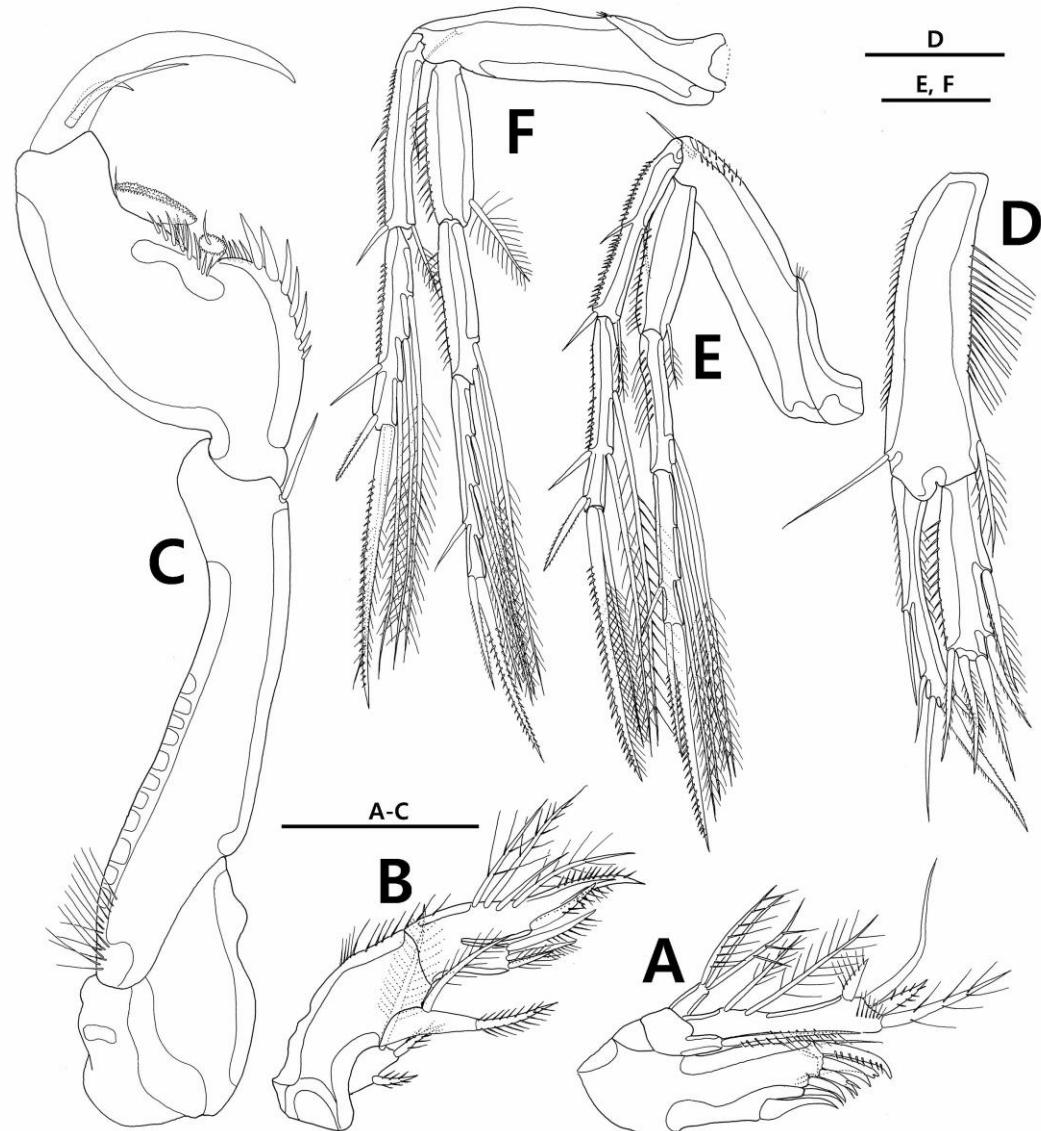
**Habitat.** This species was collected from a seagrass bed (*Zostera* sp.) at depth of 0-1 m (Kim et al. 2016c).

**Remarks.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016 is closely similar to *S. foveatus* Bartsch, 1994 reported from southwestern Australia in almost aspects. However, the new species represents a noticeable difference from the latter in having two inner setae on exp-1 of P2 and P3, respectively, while only single seta is presented in *S. foveatus*.

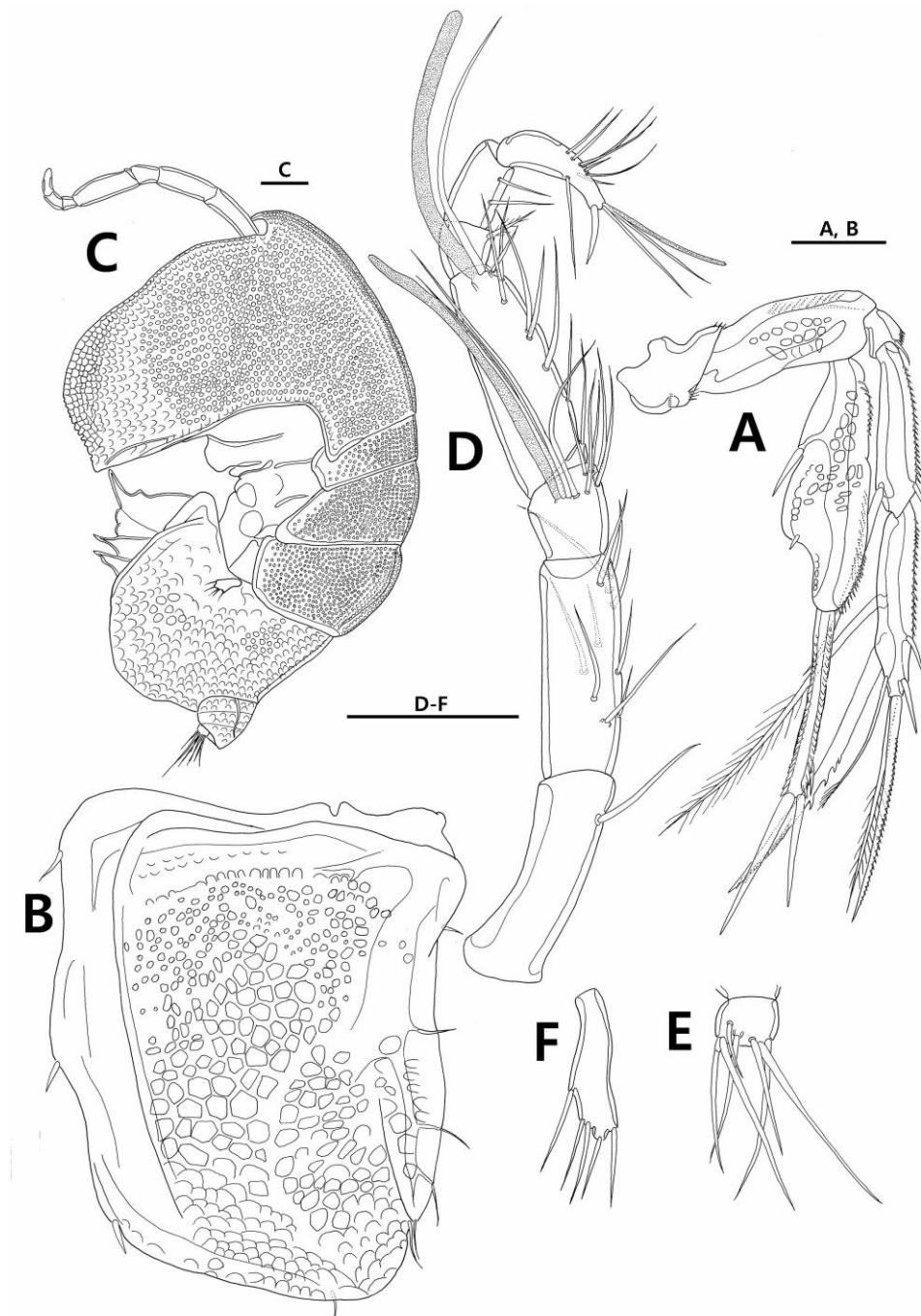
Among the congeners having two setae on exp-1 of P2 and P3, the new species shares the characteristic feature of the seven-segmented antennule in both sexes with *S. langi* Geddes, 1968 and *S. spinifer* Fiers, 1983. However, they can be easily distinguished from each other by a combination of the characteristics such as the number of setae on antennary exopod, the setal armature of endopod on P4, and the structure of female P5. *Syngastes pseudofoveatus* has three setae on the second segment of antennary exopod, while the other two species have two setae on that. The new species has one moderate and one small spines on the P4 emp-1. However, *Syngastes langi* has a large spine and two vestigial setae while *S. spinifer* has a moderate seta only on the P4 emp-1. The exopod of female P5 on *S. langi* and *S. spinifer* are also distinct from P5 endopodal lobe. In *S. pseudofoveatus*, the exopod of female P5 is fused with endopodal lobe and split by a fissure. Such structure of *S. pseudofoveatus* is also observed in seven other *Syngastes* species: *S. gregoryi* Pesta, 1932, *S. pietshmanni* Pesta, 1932, *S. glomeratus*, Geddes, 1968, *S. craterifer* Bartsch, 1993, *S. foveatus* Bartsch, 1994, *S. porellus* Bartsch, 1994, and *S. parillis* Bartsch, 1994 (Pesta 1932; Geddes 1968; Bartsch 1993; Bartsch 1994) (Kim et al. 2016c).



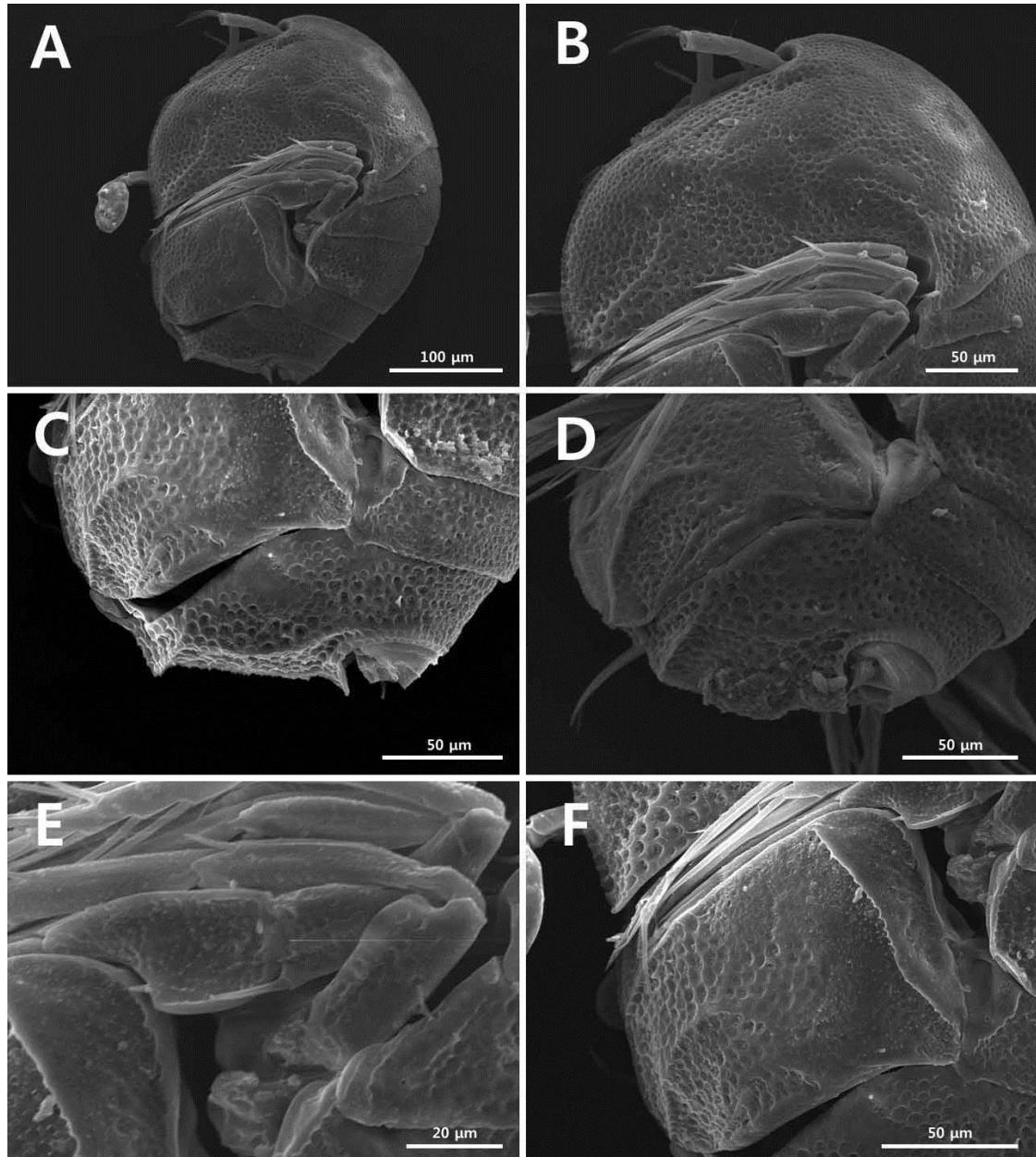
**Fig. 129.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, female. A, habitus, lateral; B, urosome, lateral; C, urosome, posterior; D, caudal rami; E, antennule; F, antenna; G, mandible. Scale bars: 30 μm (D–G); 50 μm (A–C) (cited from Kim et al. 2016c).



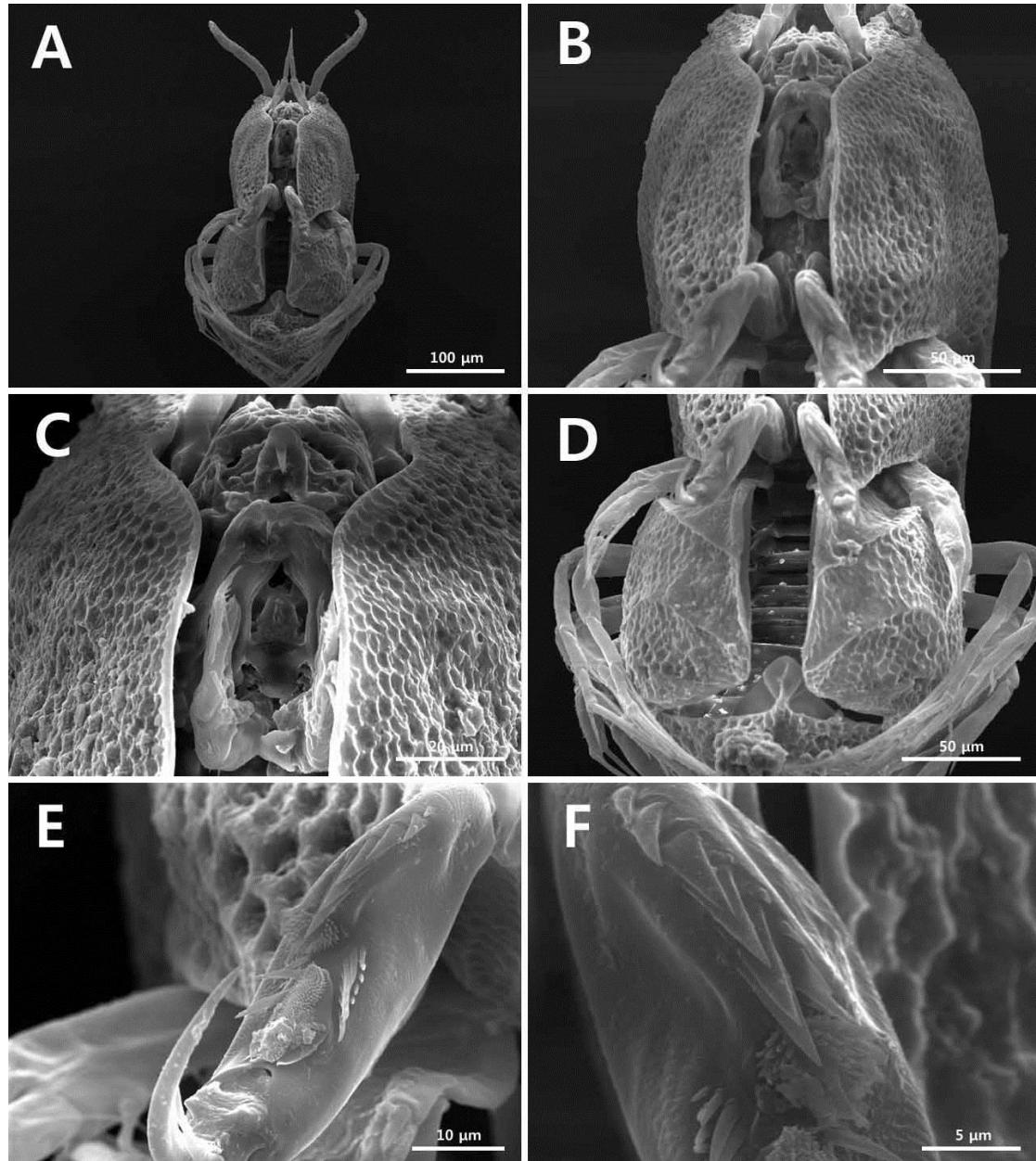
**Fig. 130.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, female. A, maxillule; B, maxilla; C, maxilliped; D–F, P1–P3. Scale bars: 30  $\mu\text{m}$  (cited from Kim et al. 2016c).



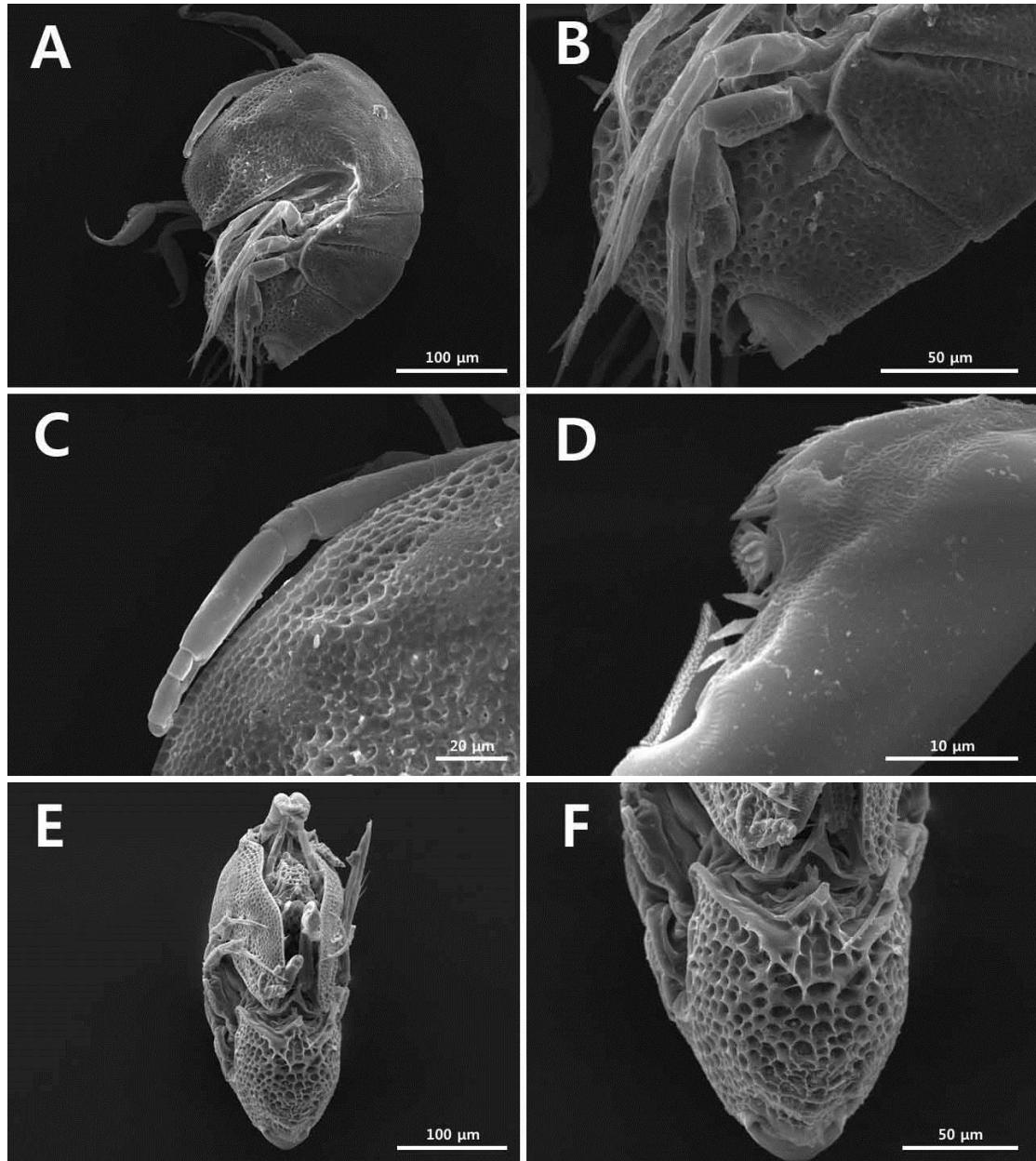
**Fig. 131.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, female (A, B); A, P4; B, 5. Male (C-F); C, habitus, lateral; D, antennule; E, caudal ramus; F, P5. Scale bars: 30  $\mu$ m (cited from Kim et al. 2016c).



**Fig. 132.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, scanning electron micrographs, female: A, habitus, lateral; B, cephalothorax, lateral; C, D, urosome, lateral and posterolateral, E, surfaces of basis and enp-1 on P4; F, P5 (cited from Kim et al. 2016c).



**Fig. 133.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, scanning electron micrographs, female. A, habitus, ventral; B, C, cephalosome, ventral; D, thoracic somites, ventral; E, F, maxilliped, ventral (cited from Kim et al. 2016c).



**Fig. 134.** *Syngastes pseudofoveatus* Kim, Jung & Yoon, 2016, scanning electron micrographs, male. A, habitus, lateral; B, urosome, lateral; C, antennule, lateral; D, proximal portion of maxilliped; E, habitus, ventral; F, urosome, ventral (cited from Kim et al. 2016c).

**Table 5.** Comparisons of the morphological characteristics of species in the genus *Syngastes* Monard, 1924 (cited from Kim et al. 2016c)

Species	Body length (♀♂; μm)	prosome outline (♀)	A1 no. seg. (♀♂)	A2 exp no. seg. (no. seta)	P1 exp. length to emp	Setal formula of P1-P5 (exp/emp)					P4 emp-1*	P5 exp**	Distribution	References
						P1	P2	P3	P4	P5 (♂)				
<i>S. donnani</i> (Thompson & Scott, 1903)	370/unknown	gibbosus	7/unknown	?	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.222/1.021	unknown	1 MS	hidden?	Ceylon	Thompson & Scott, 1903
<i>S. imnithurni</i> (Thompson & Scott, 1903)	450-600/unknown	weakly rounded	6/unknown	?	subequal,	023/221	1.222/1.2.221	1.322/1.2.321	0.1.222/1.021	unknown	1 MS	hidden?	Ceylon	Thompson & Scott, 1903
<i>S. twynmani</i> (Thompson & Scott, 1903)	540/unknown	rounded	6/unknown	?	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.222/1.021	unknown	1 MS	hidden?	Ceylon	Thompson & Scott, 1903
<i>S. cornalinus</i> Monard, 1924	500-700/460	rounded	5/7	1(2 or 3)	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	unknown	1MS	hidden	France, Bahamas	Monard, 1924; Geddes, 1968
<i>S. macrognathus</i> Monard, 1924	460/unknown	unknown	5/unknown	1(3)	subequal	023?/221?	1.?/1.2.5?	1.?/?2.6?	0.1.6/?3	unknown	?	hidden?	France	Monard, 1924; Wells, 2007
<i>S. gregoryi</i> Pesta, 1932	425/306	unknown	7/7	?	subequal,	031/030	1.?/?	1.?/?	0.0.222/2.210	?	2 VS	fissure	Hawaii	Pesta, 1932; Wells, 2007
<i>S. latus</i> Pesta, 1932	unknown/?	unknown	unknown/7	?	subequal	022/320	1.?/?	1.?/?	?	?	?	unknown	Hawaii	Pesta, 1932; Wells, 2007
<i>S. pietschmanni</i> Pesta, 1932	510-550/390-400	weakly rounded	8/8	2(1,3)	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	3/1	1 MS	fissure	Hawaii, Indian ocean, Bahamas	Pesta, 1932; Geddes, 1968; Marcus, 1977
<i>S. serratus</i> Lang, 1965	unknown/470	unknown	unknown/8	1(3)	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	4	1 MS	unknown	California	Lang, 1965
<i>S. glomeratus</i> Geddes, 1968	470/unknown	weakly rounded	8/unknown	1(4)	subequal	023/212	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	unknown	1SS	fissure	Bahamas	Geddes, 1968

**Table 5.** (continued).

Species	Body length (♀/♂; μm)	prosome outline (♀)	A1 no. seg. (♀/♂)	A2 exp no. seg. (no. seta)	P1 exp. length to enp	Setal formula of P1-P5 (exp/enp)					P4 enp-1*	P5 exp**	Distribution	References
						P1	P2	P3	P4	P5 (♂)				
<i>S. tanzaniae</i> Marcus, 1977	330/ unknown	rounded	7/ unknown	1(3)	subequal	023/030	1.222/1.2.221	1.322/1.2.320	0.1.222/2.220	unknown	2 MS	hidden	Indian ocean	Marcus, 1977
<i>S. foveatus</i> Bartsch, 1994	360-395/ 310-322	rounded	7/7	2(1,3)	subequal,	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/2.021	5	1SS, 1SP	fissure	Australia	Bartsch, 1994
<i>S. porellus</i> Bartsch, 1994	447-550/ 440-447	rounded	7/7	2(1,2)	subequal	023/120	1.222/1.2.221	1.322/1.2.320	0.1.322/2.220	5	2 MS	fissure	Australia	Bartsch, 1994
<i>S. dentipes</i> Bartsch, 1995	530-560/ 427-458	weakly rounded	5/7	2(1,2)	subequal,	023/320	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	5	1 MS	completely fused	Australia	Bartsch, 1995
<i>S. subgibbus</i> Bartsch, 1999	437-443/ 345-360	gibbosus	5/7	2(1,3)	subequal	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/1.021	5	1 MS	hidden	Australia	Bartsch, 1999
<i>S. indicus</i> Sewell, 1940	470/ unknown	weakly rounded	7/ unknown	1(3)	short	022/220	unknown	unknown	0.1.222/2.221	?	1SS, 1VS	unknown	Maldives	Sewell, 1940
<i>S. kunzi</i> Marcus, 1977	343/ unknown	weakly rounded	7/ unknown	2(1,2)	short	112/221	1.222/1.2.221	1.322/1.2.321	0.1.322/3.221	unknown	1MS, 2SP	fused	Indian ocean	Marcus, 1977
<i>S. craterifer</i> Bartsch, 1993	458-470/ 371-396	rounded	7/8	2(1,3)	short	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/2.221	3	1SM, 2VS	fissure	Australia	Bartsch, 1993
<i>S. parilis</i> Bartsch, 1994	527-589/ 371-415	weakly rounded	7/8	2(1,3)	short	023/221	1.222/1.2.221	1.322/1.2.321	0.1.322/2.221	3	1SM, 2VS	fissure	Australia	Bartsch, 1994

**Table 5.** (continued).

Species	Body length (♀/♂; μm)	prosome outline (♀)	Setal formula of P1-P5 (exp/enp)								P4 enp- 1*	P5 exp**	Distribution	Reference
			A1 no. seg. (♀/♂)	A2 exp no. seg. (no. seta)	P1 exp. length to enp	P1	P2	P3	P4	P5 (♂)				
<i>S. clausii</i> (Thomson, 1883)	?/unknown	weakly rounded	6/ unknown	1 or 2	subequal	023/322	?	2.321/1.2.321	0.1.321/1.020	?	1 MS	hidden?	New Zealand	Thomson, 1883
<i>S. gibbus</i> Geddes, 1968	600/?	linear	8/8	2(1,2)	subequal	023/321	2.222/1.2.221	2.322/1.2.321	0.1.322/3.221	4/1	1 SS, 2 NS	distinct	Bahamas	Geddes, 1968
<i>S. langi</i> Geddes, 1968	500/?	rounded	7/7	2(1,2)	subequal	023/321	2.222/1.2.221	2.322/1.2.321	0.1.322/1.021	3/1	1 SS, 2 VS	distinct	Bahamas	Geddes, 1968
<i>S. spinifer</i> Fiers, 1983	465/448	rounded	7/7	2(1,2)	subequal	023/321	2.222/1.2.221	2.322/1.2.321	0.1.322/1.021	4/1	1 MS	distinct	Maldives	Fiers, 1983
<i>S. australiensis</i> Bartsch, 1999	615/563	rounded	7/8	2(1,2)	subequal	023/321	2.222/1.2.221	2.322/1.2.321	0.1.322/1.021	4/1	1 MS	distinct	Australia	Bartsch, 1999
<i>S. gibbosus</i> Bartsch, 1999	437-443/ 410-411	gibbosus	5/7	2(1,3)	subequal	023/221	2.222/1.2.221	2.322/1.2.321	0.1.322/1.021	5	1 MS	hidden	Australia	Bartsch, 1999
<i>S. multicavus</i> Kim, Jung & Yoon, 2016	730/596	weakly rounded	5/7	2(1,3)	subequal	023/221	2.222/1.2.221	2.322/1.2.321	0.1.322/1.021	5	1 MS	hidden	Korea	Kim et al. 2016c
<i>S. pseudofoveatus</i> Kim, Jung & Yoon, 2016	520/416	rounded	7/7	2(1,3)	subequal	023/221	2.222/1.2.221	2.322/1.2.321	0.1.322/2.021	5	1MS, 1 SP	fissure	Korea	Kim et al. 2016c

\* MS, moderate seta; SM, spiniform membrane; SP, small spinule; SS, spine-like seta; VS, small vestigial seta.

\*\* Distinct, P5 exopod distinct from baseoendopod; hidden, P5 exopod fused, but hidden behind baseoendopod; fissure, P5 exopod fused to baseoendopod, split by a fissure.

## Family Porcellidiidae Boeck, 1865 딱정노벌레 과

딱정노벌레 과(Porcellidiidae)의 속에 대한 검색표(Harris, 2014c)

1. 암컷 제 5 흉지는 사다리꼴형이다 ..... *Kensakia*
  - 암컷 제 5 흉지는 직사각형이다 ..... 2
2. 악각 기절의 내돌기는 분리되어 있다 ..... *Dilatatio cauda*
  - 악각 기절의 내돌기는 분리되어 있지 않다 ..... 3
3. 암컷의 미자는 오각형이다 ..... *Kioloaria*
  - 암컷의 미자는 직사각형이며, 간혹 말단부에서 넓어진다 ..... 4
4. 암컷 제 5 흉지의 배면에는 낫 형태의 능선을 가진다; 수컷 제 1 촉각의 세 번째 마디에 빗 형태의 돌기를 가진다 ..... *Kushia*
  - 암컷 제 5 흉지의 배면에는 낫 형태의 능선을 가진다; 수컷 제 1 촉각의 세 번째 마디에 빗 형태의 장식을 가지지 않는다 ..... 딱정노벌레 속 *Porcellidium*

**고찰:** Harris (1994, 2002), Harris & Iwasaki (1996b, 1997), Harris & Robertson (1994)은 이 과에서 10 개의 속을 제안하였다. 그러나 이 속들의 정당성에 대한 의문이 제기되었고, 일부 속의 경우(*Acutiramus* Harris & Robertson, 1994, *Kensakia* Harris & Iwasaki, 1997, *Kioloaria* Harris, 1994 등) 딱정노벌레 속(*Porcellidium*)으로 동종이명처리되기도 하였다(Huys et al. 1996; Walker-Smith 2001). 그 결과 우리나라에 보고된 딱정노벌레 과의 9 종 모두 딱정노벌레 속에 배치되어 있었다. 그러나 최근 Harris (2014a)는 딱정노벌레 속의 41 종에 대하여 분류학적으로 재검토하여, 다른 파생형질들을 가지고 있는 21 종들은 다른 속들에 재배치 하였다. 본 연구에서는 Harris (2014a)를 따라 위의 검색표를 제시하였다.

### Genus *Porcellidium* Claus, 1860 딱정노벌레 속

**모식종:** *Porcellidium viride* (Philippi, 1840)

**한국산 딱정노벌레 속(*Porcellidium*)의 종에 대한 검색표(Harris, 2014a)**

1. 수컷 제 1 촉각의 세 번째 마디에 끝, 혹은 손잡이 형의 돌기를 가진다.....  
..... 보통딱정노벌레 *P. viride*
- 수컷 제 1 촉각의 세 번째 마디에 어떤 돌기도 가지지 않는다..... 2
2. 수컷 제 1 촉각 네 번째 마디에 있는 돌기는 둥글납작하다; 체색은 푸른색을 띤다  
..... 완도딱정노벌레 *P. wandoensis*
- 수컷 제 1 촉각 네 번째 마디에 있는 돌기는 끝이 뾰족하다; 체색을 푸른색이  
아니다..... 3
3. 생식이중절의 말단 가장자리의 흙은 전체 길이의 1/3 정도 이다 .....  
..... 짧은구멍딱정노벌레 *P. brevicavum*
- 생식이중절의 말단 가장자리의 흙은 전체 길이의 1/3 이상이다; 체색은  
오렌지색이다 ..... 오후나토딱정노벌레 *P. ofunatense*

**94. *Porcellidium ofunatense* Harris & Iwasaki, 1996 오후나토딱정노벌레**

*Porcellidium ofunatense* Harris & Iwasaki, 1996a, p. 137, pls. 2–5; Kim & Kim, 1997a, p. 153, figs. 7–9; Lee et al., 2012, p. 190, figs. 132–137.

**관찰재료:** 1♀, 통영시 한산면, 대매울도, 2014.3.23.

**분포:** 한국, 일본.

**고찰:** 이 종은 일본의 카도노하마만에서 처음 기록이 되었으며, 이 후 Kim & Kim (1997a)에 의하여 우리나라의 남해안과 동해안에서 보고되었다. 한국산 시료와 일본산 시료는 암컷의 몸 길이, 생식이중절의 길이 : 너비의 비, 미치의 길이 : 너비의 비에서 차이를 보이고 있으나 Kim & Kim (1997a)은 이를 종내변이로 보았다.

**95. *Porcellidium brevicavum* Kim & Kim, 1997 짧은구멍딱정노벌레**

*Porcellidium brevicavum* Kim & Kim, 1997a, p. 162, figs. 16–18; Lee et al., 2012, p. 183, figs. 127–129.

**관찰재료:** 1♀, 울산시 울주면 서생면 솔개해수욕장, 2012.5.18.

**분포:** 한국.

**고찰:** Harris & Robertson (1994)은 딱정노벌레 속(*Porcellidium*)의 종들을 수컷의 제 1 촉각의 형질에 따라 *hormosirii*-그룹, *fimbriatum*-그룹, *naviculum*-그룹으로 나누었다. 이 종은 *naviculum*-그룹에 속하며 미자와 암컷 제 5 흉지를 제외한 형질들에서 *P. naviculum* Harris & Robertson, 1994 과 매우 유사하다(Lee et al. 2012).

**Genus *Kushia* Harris & Iwasaki, 1996**

**모식종:** *Kushia zosteraphila* Harris & Iwasaki, 1996

**96. *Kushia gamoi* (Harris & Iwasaki, 1996) 가모딱정노벌레**

*Kushia gamoi* Harris & Iwasaki, 1996b, p. 208, figs. 4, 6C–D, 7A–B.

*Porcellidium gamoi*: Kim & Kim, 1997a, p. 161, figs. 13–15; Lee et al., 2012, p. 187, figs. 130–131.

**관찰재료:** 1♀, 전남 완도군 금일면 연지리, 금일도(잘피밭), 2012.7.20; 1♀, 1♂ 전남 신안군 흑산면 가거도리, 가거도, 2013.7.29; 1♀, 제주 제주시 조천읍 함덕리, 함덕해수욕장, 2014.06.23.

**분포:** 한국, 일본.

**고찰:** Harris & Iwasaki (1996)은 *Kushia zosteraphila* Harris & Iwasaki, 1996, *K. gamoi* Harris & Iwasaki, 1996, *K. igaguria* Harris & Iwasaki, 1996 으로 구성된 *Kushia* Harris & Iwasaki,

1996 속을 설정하였으나, 이 속의 정당성에 대하여 의심받아 왔다(Lee et al. 2012). 그러나 Harris (2014b)는 딱정노벌레 과(Porcellidiidae)에 대한 재검토(Harris, 2014a, b, c)를 통하여 이 속을 다시 재정립하였다.

### Genus *Kensakia* Harris & Iwasaki, 1997

모식종: *Kensakia acuta* (Kim & Kim, 1997)

#### 97. *Kensakia acuta* (Kim & Kim, 1997) 뾰족뿔딱정노벌레

*Porcellidium acutum* Kim & Kim, 1997a, p. 153, figs. 10–12; Lee et al., 2012, p. 172, figs. 119–121.

관찰재료: 1♀, 경북 울릉군, 을릉읍, 죽도(14m, 해조류),

분포: 한국.

고찰: *Kensakia* 속은 Harris & Iwasaki (1997)에 의하여 설정이 되었으나, Walker-Smith (2001)는 이 속의 고유파생형질이 없음을 주장하고 이 속을 *Porcellidium* 으로 동종이명처리하였다. 그러나 최근 Harris (2014b)는 다시 *Kensakia* 를 살리면서, 뾰족뿔딱정노벌레(*K. acuta*)를 모식종으로 지정하였다.

### Family Tisbidae Stebbing, 1910 티스베노벌레 과

한국산 티스베노벌레 과(Tisbidae)의 속에 대한 검색표

1. 전체부는 넓고, 등배로 납작하다; 제 1 소악의 외지는 잘 발달되어 있다; 제 1 흉지 내지 세 번째 마디의 강모는 빗살무늬의 잔가시열을 가진다.....  
.....방패노벌레 속 *Scutellidium*

- 체형은 cyclopiform이며, 전체부는 뒷 부분에서 가늘어진다; 제 1 소악은 외지를 가지지 않는다; 제 1 흉지 내지 세 번째 마디의 강모는 빗살무늬의 잔가시열을 가지지 않는다 ..... 티스베노벌레 속 *Tisbe*

### Genus *Scutellidium* Claus, 1866 방패노벌레 속

모식종: *Scutellidium longicauda* (Philippi, 1840)

#### 98. *Scutellidium longicauda acheloides* Itô, 1976 마녀긴꼬리방패노벌레

*Scutellidium longicauda acheloides* Itô, 1976, p. 545, figs. 71–78; Song & Chang, 1995, p. 69, fig. 3; Lee et al., 2012, p. 260, figs. 181–184.

관찰재료: 5♀♀, 전남 신안군 흑산면 가거도리, 가거도, 2013.7.30; 4♀♀, 제주 제주시 조천읍 함덕리, 함덕해수욕장.

분포: 한국, 일본.

고찰: Itô (1976)는 Lang의 collection 중 *Scutellidium longicauda*의 스웨덴산 표본을 직접 해부, 관찰한 후 Sars (1905)가 기록한 *Scutellidium longicauda*와 차이점을 발견하였다. 이 종의 형질상태를 명확하게 하기 위하여 그는 자신이 관찰한 개체를 *S. longicauda longicauda*로 제안하였다. 또한, Itô (1976)는 일본산 시료들이 *S. longicauda longicauda*와 제 1 촉각에서 작은 차이를 나타내는 점을 인식하고, 이들을 아종(*S. longicauda acheloides*)으로 배치하였다.

## 4. 논의

### 1) 분포 및 서식환경

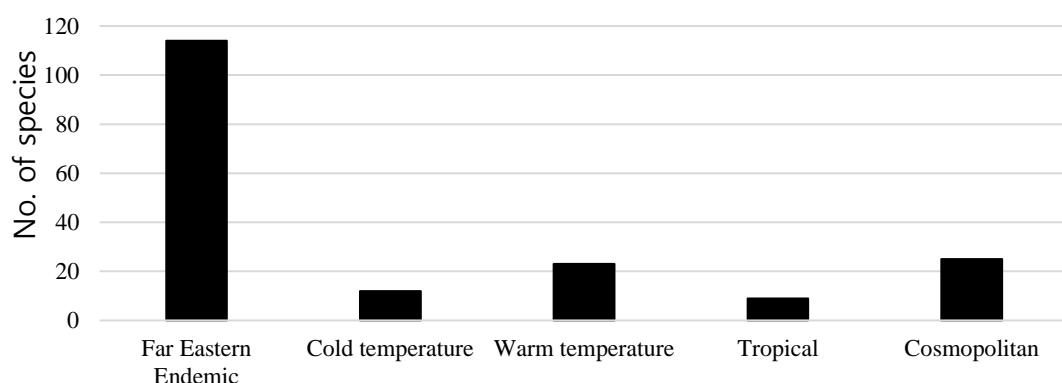
한국의 해수 및 기수역에 서식하는 갈고리노벌레류의 분포 및 서식환경을 알아보기 위하여, 기존에 우리나라에서 기록된 170 종과 본 연구에 의하여 새롭게 밝혀진 신종후보 13 종 등 총 183 종을 대상으로 이들에 대한 문헌 기록을 조사, 분석하였다(Table 7). 갈고리노벌레류 종들의 지리적 분포 구역을 동물지리구(zoogeographic region)에 따른 6 개의 권역(신북구, 구북구, 신열대구, 에디오피아구, 동양구, 오스테레일리아구)으로 나누었으며, 이를 바탕으로 분포형을 제시하였다. 아울러 문헌에 기록된 각 종의 서식지, 조위, 영도 등과 본 연구의 채집기록을 바탕으로 주생활사를 알아보았다.

각 종들의 지리적 분포를 바탕으로, 분포 특성에 따라 각 종을 광포종(cosmopolitan), 열대종(tropical form), 온대종(warm temperature from), 냉수종(cold temperature form), 극동아시아 고유종(Far Eastern Asia endemic)으로 구분하였다(Tables 6, 7). 우리나라를 포함한 일본, 중국 동부 및 동해 북쪽까지의 극동아시아 고유종이 114 종(62.3%)으로 가장 많았으며, 광포종 25 종(13.7%), 온대종 23 종(12.6%), 냉수종 12 종(6.5%), 그리고 열대종 9 종(4.9%)순으로 나타났다(Tables 6, 7; Fig. 135). 극동아시아 고유종 또한 온대종에 포함될 수 있으므로 우리나라에 출현하는 갈고리노벌레류의 대부분은 온대종(137 종, 74.9%)인 것으로 판단된다. 우리나라 해역에 서식하는 절지동물상에 관한 연구 중, 온대종이 높은 비율을 차지하고 있다는 결과는 옆새우류와 등각류의 동물상에 대한 연구 결과에서 보고된 적이 있으며, 또한 극동아시아 해역의 고유성(옆새우류 70.8%; 등각류, 76.8%)이 높게 나타났다는 점도 본 연구의 결과와 일치하였다(Kwon 1987; Kim 2008). Kim (2008)은 옆새우류와 등각류의 높은 고유성이 이 분류군들이 직접 발생을 하는 생활사의 특징에 기인한다고 하였으나, 이들과 달리 갈고리노벌레류를 포함하는 요각류는 nauplius 와 copepodid 유생시기를 가지는 생활사를 가진다. 그러나 다른 요각류들과는 달리 대부분의 갈고리노벌레류는 저질 틈과 해조 주변에서 저서생활을 하는 것으로 알려져 있는 것으로 보아(Huys et al. 1996), 이들의 높은 지역고유성은 생활형과 관련이 깊은 것으로 판단된다. 실제로 본

연구에서 확인된 한국산 갈고리노벌레류의 서식 특성을 분석한 결과, 대부분의 종들이 이동성이 적은 저서성(114 종, 62.3%)으로서 모래나 니질의 저질에서 채집되었으며, 이러한 저서성 종들 가운데에서는 극동아시아 고유종이 79 종(69.3%)으로 높은 구성비를 차지하고 있었다. 이와 반대로 상대적으로 종의 확산에 유리한 플랑크톤성종의 경우 광포종이 4 종(*Macrosetella gracilis*, *Miracia efferata*, *Euterpinia acutifrons* *Microsetella norvegica*)으로 가장 많은 비율을 차지하고 있었으며, 극동아시아 해역 고유종은 1 종(*Goniopsyllus dokdoensis*)뿐인 것으로 드러났다. 한편, 조사된 전체 갈고리노벌레류 가운데에서 냉수종으로는 12 종(6.5%)이, 열대종으로는 9 종(4.9%)이 출현하여 각각 매우 낮은 구성비를 차지하고 있었다(Table 6, 7; Fig. 135).

**Table 6.** Numbers of Korean harpacticoid species categorized by distributional forms.

Distributional form	Far Eastern Endemic	Cold temperature	Warm temperature	Tropical	Cosmopolitan
Number of species	114	12	23	9	25
Component ratio (%)	62.3	6.5	22.6	4.9	13.7



**Fig. 135.** Numbers of Korean harpacticoid species categorized by distributional forms.

**Table 7.** The distribution and habitats of the Korean harpacticoid copepods.

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AT	OR	ET	Forms	SS	MS	S&M	AL	AS	TP	IN	SU	BR	MA		
<b>Family Longipediidae</b>																			
1. <i>Longipedia weberi</i>	+					+	Cos.			+				+			+	B	Kim, 2013
<b>Family Canuellidae</b>																			
2. <i>Brianola</i> sp. nov.	+						FEE	+						+			+	B	present study
3. <i>Scottolana bulbifera</i>	+						FEE	+	+	+					+		+	B	Park & Lee 2011
4. <i>Scottolana</i> sp. nov.	+						FEE	+						+			+	B	present study
5. <i>Sunaristes japonica</i>	+						FEE					+		+			+	AI	Kim 1998; Kim 2013
<b>Family Darcythompsoniidae</b>																			
6. <i>Leptocaris brevicornis</i>	+	+	+				Cos.			+				+		+		B	Lee & Chang 2008b
7. <i>Leptocaris trisetosus pacificus</i>	+						FEE			+				+		+		B	Lee & Chang 2008b
<b>Family Harpacticidae</b>																			
8. <i>Harpacticus uniremis</i>	+						Col.	+	+	+	+		+	+	+	+	+	B	Song & Chang 1993; Chang 2010
9. <i>Harpacticus compsonyx</i>	+	+				+	Cos.	+						+			+	B	Song & Chang 1993
10. <i>Harpacticus nipponicus</i>	+						FEE	+	+	+	+			+	+	+	B	Song & Chang 1993	
11. <i>Zaus robustus</i>	+						FEE				+			+			+	AA	Song & Chang 1993
12. <i>Zaus unisetosus</i>	+						FEE				+			+			+	AA	Song & Chang 1993
13. <i>Zaus wonchoelleei</i>	+						FEE				+			+			+	AA	Kangita et al. 2014
14. <i>Tigriopus angulatus</i>	+						War.			+							+	B	Kim 2013
15. <i>Tigriopus japonicus</i>	+						FEE	+	+	+	+		+	+		+	+	B	Song & Chang 1993
16. <i>Harpacticella paradoxa</i>	+	+					War.		+	+				+		+		B	Chang & Yoon 2008; Cordell et al. 2007
17. <i>Harpacticella oceanica</i>	+						FEE		+	+				+		+	+	AA	Song & Chang 1993
18. <i>Harpacticella itoi</i>	+						FEE		+	+				+		+		B	Chang & Kim 1991
19. <i>Harpacticella jejuensis</i>	+						FEE						+	+			+	B	Lee et al. 2014
<b>Family Pseudotachidiidae</b>																			
20. <i>Fladenia</i> sp. nov.	+						FEE		+						+		+	B	present study

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
21. <i>Sentiopsis coreana</i>	+						FEE	+						+			+	B	Kim et al. 2011
<b>Family Parastenhelidae</b>																			
22. <i>Parastenhelia spinosa</i>	+				+		Cos.		+	+	+			+			+	B	Yoo & Lee 1995
23. <i>Parastenhelia pyriformis</i>	+						FEE	+	+	+	+			+			+	B	Song et al. 2003
<b>Family Dactylopusiidae</b>																			
24. <i>Dactylopusia falcifera</i>	+	+			+		Cos.	+	+	+	+			+			+	B	Song et al. 2001
25. <i>Dactylopusia pauciarticulata</i>	+						FEE	+			+						+	B	Chang & Song 1997
26. <i>Paradactylopodia koreana</i>	+						FEE	+	+		+			+			+	B	Chang & Song 1997
27. <i>Dactylopusiodes macrolabris</i>	+						War.				+			+			+	AA	Lee 2004
<b>Family Hamondiidae</b>																			
28. <i>Ambunguipes rufocincta</i>	+	+				+	Cos.				+			+			+	AA	Song et al. 1999
<b>Family Miraciidae</b>																			
29. <i>Diosaccus ezoensis</i>	+						FEE				+			+			+	AA	Song et al. 1999
30. <i>Sarsamphiascus polaris</i>	+	+					Col.			+		+		+			+	B	Kim 2013
31. <i>Sarsamphiascus kawamurai</i>	+						FEE		+	+			+	+		+	B	Chang 2009a	
32. <i>Schizopera neglecta</i>	+						War.		+	+				+		+	B	Chang 2009a	
33. <i>Schizopera clandestina</i>	+						War.	+	+					+		+	B	Chang 2009a	
34. <i>Schizopera daejinensis</i>	+						FEE	+						+		+	B	Karanovic & Cho 2016	
35. <i>Schizopera yeonghaensis</i>	+						FEE	+						+		+	B	Karanovic & Cho 2016	
36. <i>Schizopera gangneungensis</i>	+						FEE	+						+		+	B	Karanovic & Cho 2016	
37. <i>Schizopera sindoensis</i>	+						FEE	+						+			+	B	Karanovic & Cho 2016
38. <i>Amphiascoides coreanus</i>	+						FEE	+		+				+			+	B	Lee et al. 2007
39. <i>Dactylopodamphiascopis latifolius</i>	+	+					Col.				+			+			+	B	Song et al. 1999
40. <i>Amonardia normani</i>	+		+				Col.				+			+			+	AA	Song & Chang 1995

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
41. <i>Amonardia coreana</i>	+						FEE			+				+			+	AA	Song et al. 2007
42. <i>Amphiascus</i> sp. nov.	+						FEE			+				+			+	AA	present study
43. <i>Bulbamphiascus spinulosus</i>	+						FEE		+					+	+		+	B	Lee et al. 2012
44. <i>Bulbamphiascus</i> sp.	+						FEE			+					+		+	B	present study
45. <i>Typhlamphiascus</i> sp. nov. 1	+						FEE			+					+		+	B	present study
46. <i>Typhlamphiascus</i> sp. nov. 2	+						FEE			+					+		+	B	present study
47. <i>Paramaphiacella fulvofasciata</i>	+	+					Col.	+			+				+		+	B	Kim et al. 2015
48. <i>Sinamphiascus dominatus</i>	+						FEE		+						+		+	B	Nam & Lee, 2012
49. <i>Delavalia longicaudata</i>	+	+	+				Cos.		+						+		+	B	Yoo & Lee 1995
50. <i>Delavalia giesbrechti</i>	+						Col.		+						+		+	B	Yoo & Lee 1995
51. <i>Stenhelia taiae</i>	+						FEE		+						+		+	B	Karanovic et al. 2014
52. <i>Amphiascopsis cinctus</i>	+	+					Cos.			+	+				+		+	B	Yoo & Lee 1995; Kim 2013
53. <i>Amphiascopsis southgeorgiensis</i>	+						Col.			+		+			+		+	B	Kim 2013
54. <i>Wellstenhelia caliope</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
55. <i>Wellstenhelia clio</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
56. <i>Wellstenhelia erato</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
57. <i>Wellstenhelia qingdaoensis</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
58. <i>Wellstenhelia euterpe</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
59. <i>Itostenhelia polyhymnia</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
60. <i>Willensteinhelia thalia</i>	+						FEE		+						+		+	B	Karanovic & Kim 2014
61. <i>Onychostenhelia bispinosa</i>	+						FEE		+						+		+	B	Kim et al. 2011

Table 7. (continued).

Species	Distribution								Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA			
62. <i>Macrosetella gracilis</i>	+			+	+	+	Cos.										+	P	Lee et al. 2012	
63. <i>Miracia efferata</i>	+					+	Cos.										+	P	Lee et al. 2012	
<b>Family Thalestridae</b>																				
64. <i>Amenophia orientalis</i>	+						FEE				+			+			+	AA	Ho & Hong 1988	
65. <i>Parathalestris bulbiseta</i>	+	+					War.				+			+			+	AA	Chang & Song 1997	
66. <i>Parathalestris verrucosa</i>	+						FEE				+			+			+	AA	Chang & Song 1997	
67. <i>Parathalestris pacificus</i>	+						FEE				+			+			+	AA	Chang & Song 1997	
68. <i>Parathalestris areolata</i>	+						FEE				+			+			+	AA	Chang & Song 1997	
69. <i>Parathalestris infestus</i>	+						FEE				+			+			+	AA	Ho & Hong 1988	
70. <i>Parathalestris parviseta</i>	+						FEE				+			+			+	AA	Chang & Song 1997	
71. <i>Parathalestris jejuensis</i>	+						FEE				+			+			+	AA	Song & Hwang 2010	
72. <i>Phyllothalistris sarsi</i>	+			+	+		Tro.				+			+			+	AA	Song et al. 2011	
73. <i>Eudactylopus andrewi</i>	+				+		Cos.				+			+			+	AA	Chang & Song 1995	
74. <i>Eudactylopus spectabilis</i>	+						War.				+			+			+	AA	Chang & Song 1995	
75. <i>Pseudonstrella longicaudata</i>	+						FEE				+			+			+	AW	Kim & Kim 1997b	
76. <i>Xylora longiantennulata</i>	+						FEE				+			+			+	AW	Kim & Kim 1997b	
<b>Family Ameiridae</b>																				
77. <i>Ameira parvula</i>	+	+	+	+		+	Cos.	+	+	+				+		+	+	B	Chang, 2007	
78. <i>Ameira zahaae</i>	+						FEE		+					+			+	B	Karanovic & Cho 2012	
79. <i>Ameira kimchi</i>	+						FEE			+					+		+	B	Karanovic & Cho 2012	
80. <i>Pseudameira mago</i>	+						FEE			+					+		+	B	Karanovic & Cho 2012	
81. <i>Proameira cf. simplex</i>	+	+					Cos.			+					+		+	B	Karanovic & Cho 2012	
82. <i>Nitokra spinipes</i>	+	+			+		Cos.		+	+				+		+	+	B	Chang & Yoon 2008	

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
83. <i>Nitokra lacustris</i>	+	+					Cos.		+	+				+		+		B	Chang & Yoon 2008
84. <i>Nitokra pietschmanni</i>	+	+					War.			+				+		+		B	Chang & Yoon 2008
85. <i>Nitokra affinis californica</i>	+	+				+	Cos.		+	+				+		+	+	B	Chang & Yoon 2008
86. <i>Nitokra koreanus</i>	+						FEE		+	+				+		+		B	Chang 2007
<b>Family Canthocamptidae</b>																			
87. <i>Heteropsyllus coreanus</i>	+						FEE		+					+		+		B	Nam & Lee 2006
88. <i>Itunella arenaria</i>	+						FEE	+						+		+		B	Lee & Chang 2008b
89. <i>Mesochra suifumensis</i>	+						FEE			+				+		+		B	Lee & Chang 2003
90. <i>Mesochra alaskana</i>	+	+					Col.	+						+		+		B	Lee & Chang 2003
91. <i>Mesochra hinumaensis</i>	+						FEE		+	+				+		+		B	Chang 2009b
92. <i>Mesochra bisetosa</i>	+						FEE			+				+		+		B	Lee & Chang 2008b
<b>Family Cylindropsyllidae</b>																			
93. <i>Leptastacus japonicus</i>	+						FEE	+						+		+		B	Yoo & Lee 1995
<b>Family Louriniidae</b>																			
94. <i>Lourinia armata</i>	+	+	+		+		Cos.			+				+		+		B	Yoo & Lee 1993
<b>Family Cletodidae</b>																			
95. <i>Enhydrosoma curticauda</i>	+						War.	+	+	+				+		+		B	Kim 2013
96. <i>Enhydrosoma coreana</i>	+						FEE		+					+		+		B	Kim et al. 2014
97. <i>Enhydrosoma apimelon</i>	+						FEE		+					+		+		B	Karanovic et al. 2015
98. <i>Enhydrosoma robustum</i>	+						FEE		+					+		+		B	Karanovic et al. 2015
99. <i>Enhydrosoma kosmetron</i>	+						FEE		+					+		+		B	Karanovic et al. 2015
100. <i>Limnocletodes behningi</i>	+				+		Cos.			+				+		+		B	Lee & Chang 2007
101. <i>Limnocletodes angustodes</i>	+						FEE			+					+			B	Lee & Chang 2007
102. <i>Kollerua longum</i>	+						FEE		+	+				+		+		B	Lee & Chang 2007
103. <i>Strongylacron glabrum</i>	+						FEE		+	+				+		+		B	Kim et al. 2016
104. <i>Paracrenhydrosoma kiai</i>	+						FEE		+					+		+		B	Song et al. 2014
105. <i>Geehydrosoma intermedia</i>	+						FEE		+	+				+	+	+		B	Kim et al. 2014

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
<b>Family Nannopodidae</b>																			
106. <i>Huntemannia doheoni</i>	+						FEE	+		+				+			+	B	Song et al. 2007
107. <i>Nannopus palustris</i> sensu You & Lee, 1995	+						FEE		+	+				+		+	+	B	Yoo & Lee 1995
108. <i>Nannopus</i> sp. nov.	+						FEE			+				+		+		B	present study
109. <i>Iyophilus ganhwaeensis</i>							FEE		+					+		+		B	Vakati et al. 2016
<b>Family Rhizothricidae</b>																			
110. <i>Rhizothrix sejongi</i>	+						FEE	+						+			+	B	Nam & Lee 2005
<b>Family incertae sedis</b>																			
111. <i>Apolethon articulatus</i>	+						FEE		+	+				+		+		B	Lee & Chang 2008a
112. <i>Laophontoidea</i> gen. & sp. nov.	+						FEE	+						+			+	B	present study
<b>Family Laophontidae</b>																			
113. <i>Laophonte cornuta</i>	+	+	+	+		+	Cos.	+			+						+	B	Kim 2013
114. <i>Laophonte thoracica</i>	+						War.						+				+	AW	Kim 2013
115. <i>Laophonte inopinata</i>	+						War.	+					+			+	B	Kim 2013	
116. <i>Laophonte denticornis</i>	+		+				Tro.				+			+			+	AA	Kim 2013
117. <i>Laophonte inornata</i>	+	+	+			+	Cos.						+				+	AI	Kim 2013
118. <i>Laophonte dinocerata</i>	+			+			Tro.						+			+	AI	Kim 2013	
119. <i>Laophonte elongate barbata</i>	+		+				War.						+				+	AW	Kim 2013
120. <i>Laophonte longistyliata</i>	+						War.						+				+	AW	Kim 2013
121. <i>Onychocamptus mohammed</i>	+			+		+	Cos.												
122. <i>Onychocamptus bengalensis</i>	+			+	+		Tro.		+							+		B	Lee & Chang 2005
123. <i>Onychocamptus vitiospinulosa</i>	+						FEE			+				+		+		B	Lee & Chang 2005
124. <i>Herrietella simulans</i>	+	+					War.				+	+					+	AW	Kim 2013
125. <i>Echinolaophonte mirabilis</i>	+				+		Tro.	+				+		+		+	AW	Kim 2013	
126. <i>Heterolaophonte discophora</i> sensu Itô, 1974	+						War.				+			+		+	AA	Kim 2013	
127. <i>Paralaophonte congenera</i>	+	+		+			Cos.				+			+		+	AA	Lee et al. 2012	

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
128. <i>Paralaophonte macera</i>	+						War.					+		+			+	AW	Kim 2013
129. <i>Paralaophonte lacerdi</i>	+		+				Tro.				+			+			+	AA	Kim 2013
130. <i>Paralaophonte obscura</i>	+				+		Tro.					+						AI	Kim 2013
131. <i>Quinquaophonte koreana</i>	+						FEE	+						+			+	B	Lee 2003
132. <i>Folioquinpes mangalis</i>	+	+					War.					+		+			+	AI	Kim 2013
133. <i>Robustunguis minor</i>	+	+					War.					+		+			+	AI	Kim 2013
134. <i>Psammoplatypus proprius</i>	+	+					War.	+						+			+	B	Kim 2013
135. <i>Microchelonia koreensis</i>	+						FEE					+		+			+	AI	Kim 1991
136. <i>Jejulaophonte hyeopjaeensis</i>	+						FEE	+						+			+	B	Back & Lee 2014
<b>Family Normanellidae</b>																			
137. <i>Normanella</i> sp. nov.	+						FEE			+				+			+	B	present study
<b>Family Orthopsyllidae</b>																			
138. <i>Orthopsyllus cf. linearis</i>	+						FEE				+			+	+		+	AA	Park et al. 2012
<b>Family Cletopsyllidae</b>																			
139. <i>Cletopsyllus sagamiensis</i>	+						FEE				+			+			+	AA	Kim 2013
140. <i>Isocletopsyllus maximus</i>	+						FEE	+			+				+		+	B	Song et al. 2010
<b>Family Ancorabolidae</b>																			
141. <i>Laophontodes bicornis</i>	+				+		Cos.	+				+		+			+	AW	Kim 2013
<b>Family Ectinosomatidae</b>																			
142. <i>Microsetella rosea</i>	+				+	+	Tro.										+	P	Lee et al. 2012
143. <i>Microsetella norvegica</i>	+					+	Cos.										+	P	Lee et al. 2012
144. <i>Halectinosoma perforatum</i>	+						FEE	+						+			+	B	Kim et al. 2015
145. <i>Halectinosoma</i> sp. nov.	+						FEE	+						+			+	B	present study
<b>Family Zosimeidae</b>																			
146. <i>Zosime destituta</i>	+						FEE		+						+		+	B	Kim et al. 2016
<b>Family Paramesochridae</b>																			
147. <i>Paramesochra taeana</i>	+						FEE	+							+		+	B	Back & Lee 2010

**Table 7.** (continued).

Species	Distribution							Habitats						Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA		
148. <i>Paramesochra parasimilis</i>	+						FEE	+							+		+	B	Back & Lee 2013
149. <i>Paramesochra pungdoensis</i>	+						FEE	+							+		+	B	Back & Lee 2013
150. <i>Paramesochra mirabilis</i>	+						FEE	+							+		+	B	Back & Lee 2013
151. <i>Remanea naksanensis</i>	+						FEE	+						+			+	B	Back & Lee 2011
152. <i>Wellsopsyllus egregius</i>	+						FEE	+						+			+	B	Back & Lee 2014
153. <i>Wellsopsyllus koreanus</i>	+						FEE	+						+			+	B	Back & Lee 2014
154. <i>Apodopsyllus gwakjiensis</i>	+						FEE	+						+			+	B	Back & Lee 2012
155. <i>Apodopsyllus unisetosus</i>	+						FEE	+						+			+	B	Back & Lee 2012
<b>Family Euterpinidae</b>																			
156. <i>Euterpina acutifrons</i>	+	+	+			+	Cos.									+	P	Cho et al. 2011	
<b>Family Tachidiidae</b>																			
157. <i>Tachidius discipes</i>	+	+					Col.		+	+				+		+		B	Chang 2010
158. <i>Microarthridion littorale</i>	+	+					Col.		+	+				+		+	+	B	Kim et al. 2016
159. <i>Microarthridion litospinatus</i>	+						FEE			+				+		+		B	Chang 2008
160. <i>Geeopsis incisipes</i>	+						Col.			+				+		+		B	Chang 2008
161. <i>Neotachidius coreanus</i>	+						FEE			+				+		+	+	B	Huys et al. 2005; Chang 2008
162. <i>Neotachidius parvus</i>	+						FEE			+				+		+	+	B	Huys et al. 2005; Chang 2008
<b>Family Peltidiidae</b>																			
163. <i>Peltidium quinquesetosum</i>	+						FEE				+			+		+	AA	AA	Song & Yun 1999
164. <i>Alteutha depressa</i>	+						War.				+			+		+	AA	AA	Yoo & Lee 1995; Song & Chang 1995
165. <i>Alteutha</i> sp. nov.	+						FEE				+			+		+	AA	present study	
166. <i>Alteuthella</i> sp. nov.	+						FEE				+			+		+	AA	present study	
167. <i>Alteuthoides affinis</i>	+						FEE				+	+		+		+	AI	Kim. & Kim. 1998	
<b>Family Clytemnestriidae</b>																			
168. <i>Goniopsyllus dokdoensis</i>	+						FEE									+	P	Cho et al. 2010	

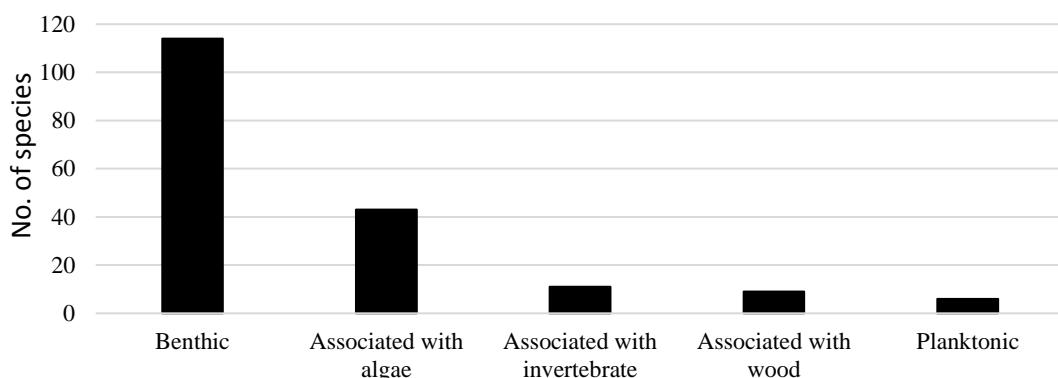
Table 7. (continued).

Species	Distribution							Habitats							Tidal level		Salinity		Life style	References
	PA	NA	NT	AU	OR	ET	Forms	SS	MS	S&M	MA	AS	TP	IN	SU	BR	MA			
<b>Family Tegastidae</b>																				
169. <i>Syngastes multicavus</i>	+						FEE				+			+			+	AA	Kim et al. 2016	
170. <i>Syngastes pseudofoveatus</i>	+						FEE				+			+			+	AA	Kim et al. 2016	
<b>Family Porcellidiidae</b>																				
171. <i>Porcellidium viride</i>	+						War.				+			+			+	AA	Yoo & Lee 1995; Kim, 2013	
172. <i>Porcellidium ofunatense</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
173. <i>Porcellidium brevicavum</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
174. <i>Porcellidium wandoensis</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
175. <i>Kioloaria similis</i>	+						FEE					+		+			+	AI	Kim & Kim 1996	
176. <i>Kioloaria brevicaudata</i>	+				+	+	Tro.					+		+			+	AI	Kim & Kim 1996	
177. <i>Kushia gamoi</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
178. <i>Kensakia acuta</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
179. <i>Dilatatioicauda bipartita</i>	+						FEE				+			+			+	AA	Kim & Kim 1997a	
<b>Family Tisbidae</b>																				
180. <i>Tisbe cf. ensifer</i>	+						+	War.			+			+			+	AA	Karanovic & Lee 2016	
181. <i>Tisbe graciloides</i>	+						Col.				+						+	AA	Kim 2013	
182. <i>Tisbe japonica</i>	+				+		War.					+					+	AI	Kim 2013	
183. <i>Scutellidium longicauda acheloides</i>	+						FEE				+						+	AA	Song & Chang 1995	

\*Abbreviations: AA, associated with algae; AI, associated with invertebrates; AS, associated with other invertebrates or wood infested by other invertebrates; AU, Australian region; AW, associated with wood; B, benthic; BW, brackish water; Col., cold temperature; Cos., cosmopolitan; ET, Ethiopian region; FEE, far eastern endemic; IN, intertidal zone; MA, macro algae; MS, mud sediment; MW, marine water; NA, Nearctic region; NT, Neotropical region; OR, Oriental region; P, planktonic; PA, Palaearctic region; SS, sand sediment; S&M, sandy mud or muddy sand sediment; SU, subtidal zone; TP, tidal pool; Tro., tropical; War., warm temperature.

**Table 8.** Numbers of Korean harpacticoid species categorized by life style.

Habitats	Benthic	Associated with algae	Associated with invertebrate	Associated with wood	Planktonic
Number of species	114	43	11	9	6
Component ratio (%)	62.3	23.5	6.0	4.9	3.3

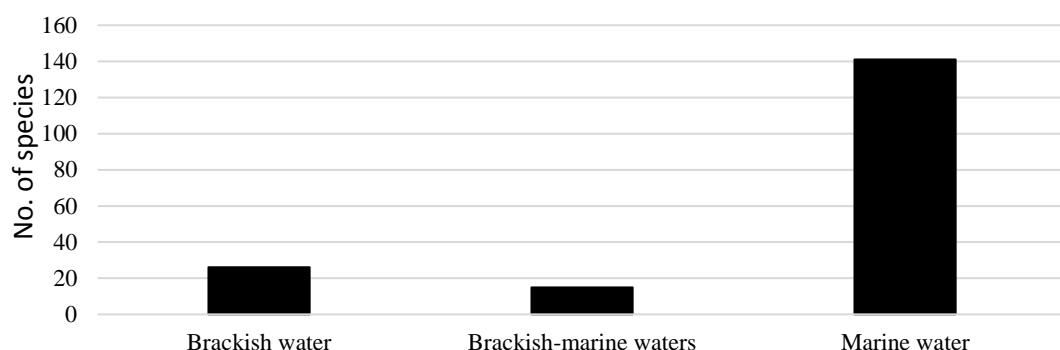
**Fig. 136.** Numbers of Korean harpacticoid species categorized by life style.

갈고리노벌레류는 해저 1 만 m 의 수심에서부터 히말라야 산정에 이르기까지 매우 다양한 서식지에 적응한 것으로 알려져 있다(Huys & Boxshall 1991; Lee et al. 2002). 본 연구의 갈고리노벌레류를 서식지별로 구분한 결과, 앞에서 언급한 바와 같이 대부분은 저서성(114 종; 62.3%)이었으며, 해조류에 연관되어 출현한 43 종(23.5%), 다른 무척추동물에 공생하는 것으로 나타난 11 종(6.0%), 썩은 나무에서 채집된 9 종(4.9%), 그리고 플랑크톤성 6 종(3.3%)의 순으로 나타났다(Tables 7, 8; Fig. 136). 저서성종들 대부분은 진흙질, 또는 진흙이 섞인 사질에서 서식하는 것으로 나타났지만, 일부 종들(Brianola sp. nov., Scottolana sp. nov., Sentiropsis coreana, Schizopera daejinensis, S. yeonghaensis, S. gangneungensis, S. sindoensis, Itunella arenaria, Mesochra alaskana, Leptastacus japonicas, Rhizothrix sejungi, Laophonoidea gen. nov. sp. nov., Quinquaophonte koreana, Jejulaophonte hyeopjaeensis, Halectinosoma perforatum, Halectinosoma sp. nov.)은 주로 사질

저질에서만 채집되는 것으로 드러났다. 특히, 부큰뿔장수노벌레과(Paramesochridae)의 모든 종들은 모래사장에서만 출현하였다. 본 연구에서 많은 종들이 특정 저질에서만 서식하고 있었음을 고려할때, 입도, 유기물 함량 등의 요인들이 저서성 갈고리노벌레류의 분포에 영향을 미치는 것으로 판단된다. 본 연구에서는 많은 과(Harpacticidae, Dactylopusiidae, Miraciidae, Thalestridae, Lourinidae, Laophontidae, Peltidiidae, Tegastidae, Porcellidiidae, Tisbidae)의 종들이 해조류 및 해초류에 연관된 서식지에서 채집되었다. 이와 같이 해조류 및 해초류에 서식하는 종들은 일반적으로 제1흉지가 불잡이형(prehensile)으로 발달되어 있으며, Peltidiidae 와 Porcellidiidae 의 체형은 등배로, Tegastidae 는 좌우로 각각 납작한 특징을 가지고 있는 것으로 알려져 있다(Boxhsall & Halsey 2004). 현재 우리나라에서 갈고리노벌레류의 출현과 해조류 사이의 상관관계에 잘 알려져 있지 않는데, 딱정노벌레과의 종의 경우, 2종(*Porcellidium brevicavum* *Dilatatioeca bipartita*)이 특정 해조류에서만 출현하며, 다른 종들(*P. wandoensis*, *P. ofnatense*, *Kensakia acuta*, *Kushia gamoi*)은 이러한 특이성이 약하다는 것이 보고된 바 있다(Kim & Kim 1997a). 또한, 자유생활을 하는 종들 이외에 다른 무척추동물에 공생하는 종들도 알려져 있다. 즉, *Suaristes japonica*, *Tisbe japonica*, *Porcellidium brevicaudatum*, 및 *P. similis* 는 집게류에, *Robustunguis minor* 는 게류에, *Laophonte inornata* 는 따개비류에, *L. dinocerata* 와 *Alteuthoides affinis* 는 해면류에, *Namakosiramia koreensis* 는 해삼의 피부에, 그리고 *Paralaophonte obscura* 와 *Folioquinpes mangalis* 는 다양한 무척추동물들에 각각 공생하는 것으로 보고되었다(Kim 1991; Kim 1998; Kim & Kim 1996, 1998; Kim 2013). 한편, 등각류에 의하여 구멍이 뚫린 썩은 나무에서도 9종(Thalestridae 의 *Pseudonsiella longicaudata* 와 *Xylora longiantennulata*; Laophontidae 의 *Laophonte thoracica*, *L. elongate barbata*, *L. longistylata*, *Herrietella simulans*, *Echinolaophonte mirabilis*, *Paralaophonte macera*; Ancorabolidae 의 *Laophontodes bicornis*)이 서식하는 것으로 보고되었다(Kim & Kim 1997b; Kim 2013).

**Table 9.** Numbers of Korean harpacticoid species categorized by the occurrence according to salinity.

Habitats	Brackish water	Marine water	Brackish-marine waters
Number of species	26	142	15
Component ratio (%)	14.2	77.0	8.2

**Fig. 137.** Numbers of Korean harpacticoid species categorized by the occurrence according to salinity.

영도에 따른 종들의 분포를 살펴보면, 해수에서만 서식하는 종이 142 종(77.0%)으로서 기수에서만 출현하는 종들(26 종, 14.2%) 보다 훨씬 많은 구성비를 차지하고 있었다(Table 7, 9; Fig. 137). 대표적인 기수성 종들로는 *Schizopera* spp., *Nitokra* spp., *Mesochra* spp., 그리고 *Tachidiidae* 과의 종들이 있으며, *Harpacticus uniremis*, *H. nipponicus*, *Kollerua longum* 등과 같은 일부 종(15 종, 8.3%)들은 해수 및 기수역에서 모두 출현하여 광염성종들인 것으로 판단된다. 한편, 현재까지 보고된 종들이 출현한 조위를 살펴보면, 대부분의 종들(149 종, 81.4%)이 조간대에 서식하는 것으로 보고되어 있다(Table 7, 10). 이는 지금 까지 상대적으로 채집이 손쉬운 조간대 지역에서 연구가 집중되었기 때문에 나타난 결과로 해석될 수 있다. 최근 들어, 조하대에 서식하고 있는 종들에 대한 연구가 증가하고 있는데, Karanovic & Cho (2012),

Karanovic & Kim (2014), Kim et al. (2014), Song et al. (2014), Karanovic et al. (2015) 등과 본 연구에 의하여 조하대에 서식하는 종으로서 현재까지 34 종(18.6%)이 알려지게 되었다(Tables 7, 10). 한편, Kim (2014)의 한반도 주변 및 제주해역의 조하대에서 수행된 갈고리노벌레류의 분류학적 연구에 따르면, 정확한 종명을 밝히지는 않았지만 290 종(국내미기록종 및 신종 후보종 포함)이 확인된 바 있으므로 우리나라 전체 해역의 조하대에는 그보다 훨씬 많은 종류의 갈고리노벌레류가 서식하고 있을 것으로 여겨지며, 따라서 앞으로 많은 조하대 종들이 새로이 기록될 것으로 기대된다.

**Table 10.** Numbers of Korean harpacticoid species categorized by tidal level.

Habitats	Intertidal zone	Subtidal zone
Number of species	149	34
Component ratio (%)	81.4	18.6

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## 국문 초록

한국의 해수 및 기수역에 서식하는 갈고리노벌레류(갑각강: 요각아강:  
갈고리노벌레목)의 분류학적 연구

김 종 국

지도교수: 윤 성 명

해양생명과학과

조선대학교 대학원

본 연구에서는 한국의 기수 및 해수에 서식하고 있는 갈고리노벌레류의 형태학적 분류에 대한 내용을 수행하였다. 2011년 6월부터 2016년 8월까지 전국 해안을 따라 95개 정점에서 채집된 표본들을 관찰한 결과 총 28과 70속 98종이 확인되었다. 그 중, 본 연구를 통하여 *Strongylacron glabrum* Kim, Jung & Yoon, 2016, *Zosime destituta* Kim, Jung & Yoon, 2016, *Syngastes multicavus* Kim, Jung & Yoon, 2016, *S. pseudofoveatus* Kim, Jung & Yoon, 2016 의 신종 4종과 *Paramphiascella fulvofasciata* Rosenfield & Coull, 1974, *Halectinosoma perforatum* Itô, 1981, *Microarthridion littorale* (Poppe, 1881)의 국내미기록종 3종이 새로이 보고되었다. 또한 신속•신종 후보 1종(*Laophontoidea* gen. nov. & sp. nov.)과 신종 후보 12종(*Brianola* sp. nov., *Scottolana* sp. nov., *Fladenia* sp. nov., *Amphiascus* sp. nov., *Bulbamphiascus* sp. nov., *Typhlamphiascus* sp. nov. 1, *Typhlamphiascus* sp. nov. 2, *Nannopus* sp. nov., *Normanella* sp. nov., *Halectinosoma* sp. nov., *Alteutha* sp. nov., 그리고 *Alteuthella* sp. nov.)에 대한 기재문과 도판을 작성하였다. 이와 더불어 본 연구에서 확인된 모든 종들과 상위분류군에 대한 검색표를 제시하였다.

우리나라의 해수 및 기수역에 서식하는 것으로 보고된 163종과 더불어 본 연구에서 새로이 발견된 20종에 대한 갈고리노벌레류의 동물지리학적 분포 및 서식환경을 분석하였다. 지리적 분포를 살펴보면, 극동아시아 고유종이 114종(62.3%), 광포종이 25종(13.7%), 온대종이 23종(12.6%), 냉수종이 12종(6.5%), 그리고 열대종

9 종(4.9%) 순으로 우리나라에 기록된 것으로 나타났다. 극동아시아 고유종이 높은 구성비를 차지하고 있는 점은 대부분의 갈고리노벌레류가 저질 틈과 해조 주변에서 저서생활을 하여 이동성이 적기 때문인 것으로 판단된다. 생활형으로 구분하여 살펴보았을 때, 저서성이 114 종(62.3%), 해조류에 연관된 서식지에서 출현하는 종이 43 종(23.5%), 다른 무척추동물에 공생하는 11 종(6.0%), 썩은 나무에서 채집된 9 종(4.9%), 그리고 플랑크톤성 6 종(3.3%)의 순으로 나타났다. 지금까지 우리나라에서는 조간대 지역에 서식하는 149 종(81.4%)과 조하대 지역에서 서식하는 34 종(18.6%)이 각각 보고된 것으로 파악되었다. 그러나, 최근 우리나라의 조하대 지역에 대한 연구가 활발히 진행되고 있으므로, 저서성 요각류의 분포 특성을 고려할 때 많은 갈고리노벌레류의 종들이 조하대 지역의 종들을 중심으로 새로이 밝혀질 것으로 기대된다.

## 감사의 글

제가 실험실에 들어와 생활한지 벌써 10년이란 시간이 흘렀습니다. 이 기간 동안 많은 분들의 격려와 도움으로 학위를 잘 마무리 할 수 있게 되어 감사의 마음을 전하고자 합니다.

부족한 저를 제자로 받아주시고 공부할 수 있는 기회를 주신 은사 윤성명 교수님께 머리숙여 감사드립니다. 교수님의 가르침을 잊지 않도록 노력하겠습니다. 바쁘신 와중에도 심사를 맡아주시고, 조언해 주신 장천영 교수님, 이정섭 교수님, 송상기 교수님, 그리고 이지민 박사님께 진심으로 감사드립니다. 장천영 교수님께서 소중한 문헌들을 훤히 빌려 주셔서 이렇게 조금이나마 성과를 이룰 수 있었습니다. 학부와 대학원 생활하는 기간 동안 많은 가르침을 주신 이규배 교수님, 조은희 교수님, 조태오 교수님, 이건호 교수님, 정원교 교수님, 조정훈 교수님께도 감사드립니다.

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