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VERSITA

A new species of parasitic copepod *Nothobomolochus* and redescription of *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959) (Cyclopoida: Bomolochidae) off Iraq

Balu Alagar Venmathi Maran[1]*, Seong Yong Moon[2], Thamir K. Adday[3], Najim R. Khamees[3] and Jung-Goo Myoung[1]

[1]Marine Ecosystem Research Division, Korea Institute of Ocean Science and Technology, P. O. Box 29, Ansan, Seoul 425-600, Korea;
[2]Fisheries and Ocean Information Division, National Fisheries Research and Development Institute, Busan 619-705, Korea;
[3]Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, Basrah, Iraq

Abstract

A new species of bomolochid copepod *Nothobomolochus ilhoikimi* sp. n., (Cyclopoida), is described based on adult females collected from the gills of hilsa shad *Tenualosa ilisha* (Hamilton) (Actinopterygii, Clupeidae) captured in waters off Iraq. The new species differs from its congeners by having the following combination of characters in the adult female: 1) anal somite not spinulate; 2) paragnath blunt and robust; 3) maxilla with slender proximal segment and distal segment with 2 accessory processes terminally; 4) the distal exopodal segment of leg 1 with 3 small spines; and 5) the terminal endopodal segment of leg 4 carrying one long and one short spine. It closely resembles *N. triceros* (Bassett-Smith, 1898) but prominently differs in above features and also in host specificity. In addition, another bomolochid *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959) is redescribed based on material collected from Japanese threadfin bream *Nemipterus japonicus* (Bloch) (Perciformes, Nemipteridae) captured in waters off Iraq. Two species clusters, the *hapalogenyos* and the *analogus* groups are recognized in this genus.

Keywords

Copepoda, taxonomy, Bomolochidae, parasite, new species, redescription, Iraq

Introduction

The family Bomolochidae comprises 20 genera and the largest genus, *Nothobomolochus* currently contains 37 species while *Orbitacolax* contains 10 species (Boxshall and Halsey 2004; WoRMS Editorial Board 2014). *Nothobomolochus* has been reported from various fishes around the world, as summarised in detail recently by El-Rashidy and Boxshall (2014). In this study, a new species of *Nothobomolochus* is described based on material collected from the hilsa shad *Tenualosa ilisha* (Hamilton, 1822) (Actinopterygii, Clupeidae), off Iraq. *Nothobomolochus fradei* Marques, 1965 was reported from the Arabian Gulf and the Mediterranean Sea (Ho and Sey 1996; El-Rashidy and Boxshall 2010), likewise *N. triceros* (Bassett-Smith, 1898) has also been reported from Kuwait Bay (Ho *et al.* 2000). In this study, another bomolochid *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959) is redescribed since previous descriptions were incomplete. It was captured from Japanese threadfin bream *Nemipterus japonicus* (Bloch, 1791) (Perciformes, Nemipteridae). Although, *O. hapalogenyos* has been reported by various authors (Ho and Dojiri 1976; Ho *et al.* 1983; Cressey and Cressey 1989; Ho *et al.* 2000), the setal structures appear very different in the illustrations of these authors and geographical variations has been proposed to explain these differences. After our first reports on taeniacanthid and also caligid and lernanthropid copepods from Iraq recently (Venmathi Maran *et al.* 2014a, b), this report is the first report on bomolochid copepods from Iraq.

*Corresponding author: venmathiba@gmail.com; bavmaran@kiost.ac

Materials and Methods

Parasitic copepods were collected from the gills of *T. ilisha* and *N. japonicus* caught in waters off Iraq on 21 July 2011 (Temperature 30°C, Salinity 39.5 ppt). They were carefully removed using fine forceps and observed under a dissecting microscope. The collected copepods were preserved in 70% ethanol. Selected copepods were cleared in a drop of 85% lactic acid or lactophenol for 24 h prior to examination using an Olympus BX51 differential phase contrast microscope. Selected specimens were measured intact using an ocular micrometer and/or dissected and examined according to the wooden slide procedure (Humes and Gooding 1964). Measurements given are the range followed by the mean in parentheses. Drawings were made with the aid of a drawing tube. Morphological terminology follows Huys and Boxshall (1991) and El-Rashidy and Boxshall (2014) and fish names conform to FishBase (Froese and Pauly 2014). Type specimens are deposited at the National Institute of Biological Resources (NIBR), Incheon, Korea.

Results and Discussion

Order Cyclopoida Burmeister, 1835
Family Bomolochidae Sumpf, 1871
Genus *Nothobomolochus* Vervoort, 1962
***Nothobomolochus ilhoikimi* sp. n. (Figs 1–3)**

Material examined

3♀♀ from gills of hilsa shad *Tenualosa ilisha* (Hamilton) from Al-Faw City, Iraq (29°46′N, 48°51′E), 21 July, 2011. Holotype female (NIBRIV0000293976) and 2 Paratypes (NIBRIV0000293977) deposited in the collections of NIBR Museum, Incheon, Korea.

Description

Female (based on holotype specimen). Body (Fig. 1A) 1.44 (1.34–1.54) mm in length (n = 3). Prosome 0.82 (0.80–0.84) mm long; comprising broad cephalothorax and 3 free pedigerous somites; tergite on third pedigerous somite slightly longer than second but not concealing fourth somite in dorsal view. Urosome 0.72 (0.71–0.73) mm long, comprising fifth pedigerous somite, genital double somite and 3 free abdominal somites. Genital double somite (Fig. 1B) 595 (594–596) µm in length and bearing 3 long, naked setae at egg attachment area of genital opening (Fig. 1B). First urosomal somite 155 (154–156) × 147 (143–151) µm longer than other 2 somites; second urosomite 95 (93–97) × 134 (131–137) µm, shorter than previous and third urosomite 91 (89–93) × 126 (124–128) µm, shortest; anal somite not spinule (arrow) (Fig. 1C). Caudal ramus (Fig. 1C) 110 (108–112) × 42 (41–43) µm, 2.62 times longer than wide, bearing single principal seta plus 5 small setae.

Antennule (Fig. 1D) with sclerotized proximal segment and slender distal segment; proximal segment indistinctly 4- or 5-segmented, first segment bearing 2 plumose setae plus 3 processes (modified setae) on pedestal; three processes more or less similar in length (arrow); second to fourth segments carrying 10 plumose, 12 slender and 2 small setae. Distal part of antennule 3-segmented with setal formula: 4, 2 + 1ae, 7 + 1ae. Antenna (Fig. 1E) uniramous, 3-segmented; comprising robust, long proximal segment (coxobasis) bearing single seta, short first endopodal segment armed with naked seta, and apical segment bearing blunt process distally bearing setule, plus 2 pectinate processes medially; distal armature (Fig. 1F) comprising 4 long curved hooks and 3 unequal setae, ventral surface of segment and process ornamented with rows of tiny spinules.

Labrum (Fig. 2A) with small cilia on lateral margin and patches of denticles on ventral surface. Paragnath (Fig. 2B) forming long blunt process (arrow) fringed with short spinules basally. Mandible (Fig. 2C) bearing 2 unequal spinulate blades distally. Maxillule (Fig. 2D) forming rounded lobe bearing one naked and 3 unequal plumose setae. Maxilla (Fig. 2E) 2-segmented; proximal syncoxa slender (arrow) with naked seta; tapering distal basis bearing small seta and produced into terminal process armed with 2 unequal accessory processes. Maxilliped (Fig. 2F) comprising syncoxa armed with 1 spinulate seta; basis armed with 2 plumose setae; free endopodal segment incorporated into claw and bearing hirsute seta posteriorly; claw simple, lacking accessory process. Armature on legs 1–4 as follows (Roman numerals = spines; Arabic numerals = setae):

	Coxa	Basis	Exopod	Endopod
Leg 1	0–1	1–0	I–0; III, 6	0–1; 0–1; 5
Leg 2	0–1	1–0	I–0; I–1; III, I, 5	0–1; 0–2; II, 3
Leg 3	0–1	1–0	I–0; I–1; II, I, 5	0–1; 0–2; II, 2
Leg 4	0–0	1–0	I–0; I–1; II, I, 4	0–1; 0–1; II

Leg 1 (Fig. 2G) biramous, modified with flattened, lamellate rami: protopod with plumose outer basal seta; protopod ornamented with rows of surface spinules, inner seta of protopod transformed into flattened element with bluntly rounded tip, fringed with long setules. Exopod 2-segmented; first segment with 1 small spine at outer distal corner (flagellate), spine ornamented bilaterally with spinules; second segment bearing 6 setae, and 3 small spines (arrow). Endopod 3-segmented, first and second segments each with inner seta, third segment

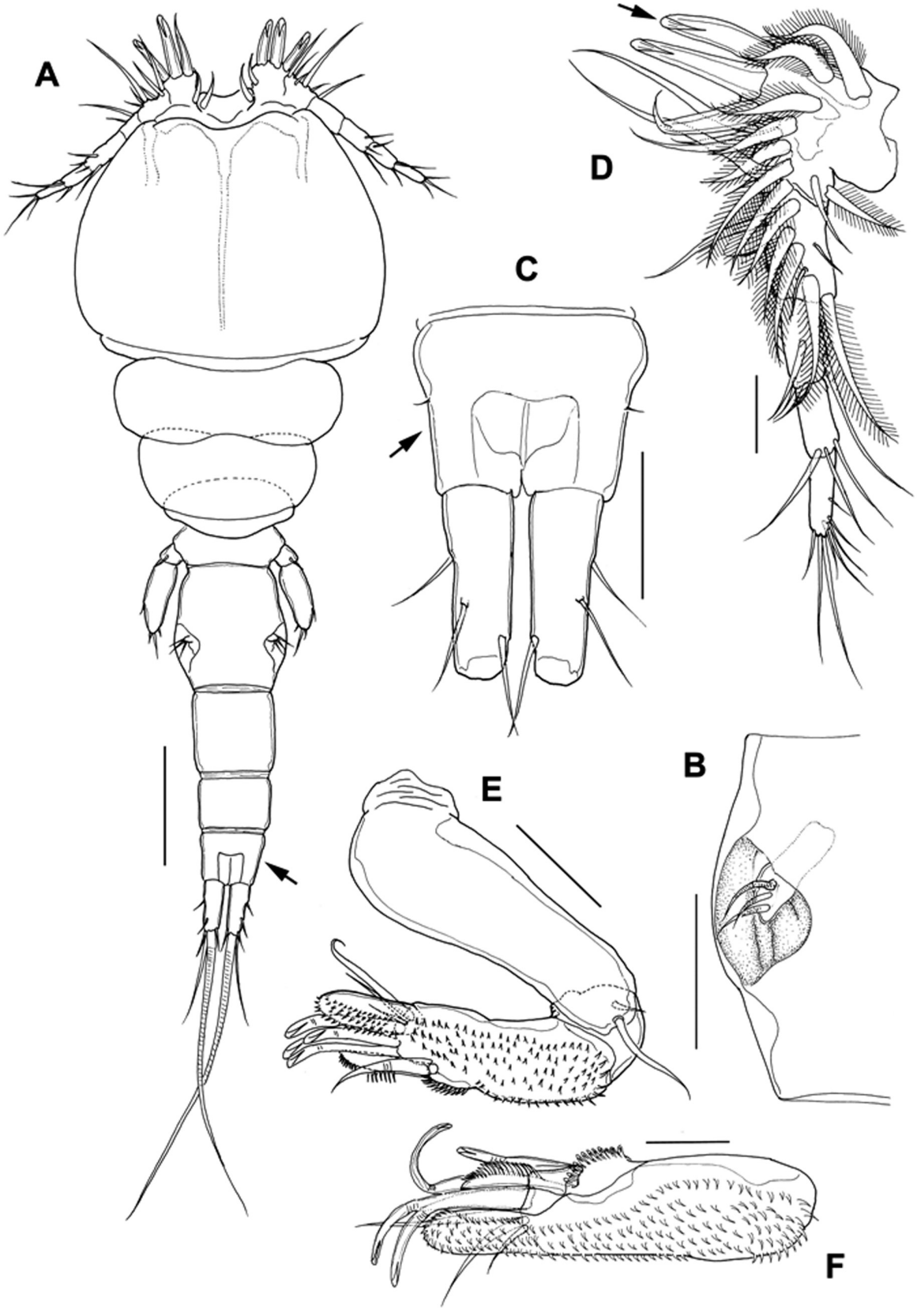

Fig. 1. *Nothobomolochus ilhoikimi* sp. n., adult female. **A** – habitus, dorsal; **B** – left side of genital double-somite, dorsal side showing leg 6; **C** – anal somite (arrow) and caudal rami, dorsal; **D** –antennule, 3 modified setae (arrow); **E** – antenna; **F** – distal segment of antenna. Scale bars: A = 200 µm; B, C = 100 µm; D, E, F = 25 µm

with 5 setae. Legs 2–4 (Figs 3A-C) biramous, with 3-segmented rami; outer margin of outer spines on exopod of legs 2–4 spinulate. Ornamentation of long setules present along outer margin of endopodal segments and inner margin of first exopodal segments of legs 2 and 3. Coxa and basis of legs 2 and 3, each with outer basal and inner coxal setae. Leg 2 (Fig. 3A) coxa and basis with patch of long setules at outer distal angle and another proximally on inner margin; long setules present on outer and inner margins of first exopodal segment; interpodal plate ornamented with spinules. Leg 3 (Fig. 3B) exopodal segments bearing outer spines and inner plumose setae; interpodal plate ornamented with spinules. Leg 4 (Fig. 3C) ornamentation of setules present along outer margin of all endopodal segments; coxa lacking inner seta, basis with outer seta. Inner seta on first endopodal segment extending beyond articulation between second and third segments; inner seta on second endopodal segment extending just beyond distal margin of third; third endopodal segment with long inner apical spine and outer small spinulate spine (arrow). Leg 5 (Fig. 3D) 2–segmented, protopodal segment small armed with small outer seta; free exopodal segment ornamented distally with two patches of spinules, armed with subterminal spinulate seta plus 3 terminal setae, middle terminal seta naked, longer than outer and inner setae. Leg 6 (Fig. 1B) represented by 3 setae located in egg sac attachment area.

Etymology

The species named in honor of Prof. Il-Hoi Kim (South Korea) for his many contributions to our knowledge of parasitic copepods.

Remarks

Nothobomolochus ilhoikimi sp. n. reported off Iraq, differs from its congeners by having the following combination of characters in the adult female: 1) anal somite not spinulate; 2) paragnath blunt and robust; 3) maxilla with slender proximal segment and distal segment with 2 accessory processes terminally; 4) the distal exopodal segment of leg 1 with 3 small spines; and 5) the terminal endopodal segment of leg 4 carrying one long and one short spine.

The two congeners, *N. fradei* and *N. triceros*, have been reported from the Arabian Gulf (Ho and Sey 1996; El-Rashidy and Boxshall 2010). The new species closely resembles *N. triceros* in the body structure but prominently differs in: i) anal somite without spinules (vs. two patches of spinules in *N. triceros*); ii) paragnath has setules basally (vs. presence of setules both distally and basally in *N. triceros*); iii) maxilla has a slender proximal segment (vs. stout in *N. triceros*); iv) the distal exopodal segment of leg 1 has 3 small spines (vs. 4 spines in *N. triceros*); v) the terminal endopodal segment of leg 4 has 2 spines (vs. 3 spines in *N. triceros*). The body length of *N. triceros* (3.3 mm) was larger than our new species (1.4 mm).

The new species also differs from *N. fradei* in: i) the inner seta on the first endopodal segment of leg 4 is short (vs. long in *N. fradei*); ii) the distal exopodal segment of leg 1 has 3 small spines (vs. 4 spines in *N. fradei*); iii) the terminal endopodal segment of leg 4 has 2 spines (vs. 3 spines in *N. fradei*).

Nothobomolochus triceros has so far been reported only from the host silver pomfret *Pampus argenteus* (Euphrasen, 1788) (Perciformes, Stromateidae) and according to El-Rashidy and Boxshall (2014), it exhibits high host specificity towards the silver pomfret. In contrast, *N. fradei* has been reported from several fishes, but not from silver pomfret or hilsa shad (Ho and Sey 1996; El-Rashidy and Boxshall 2010). The new species from Iraq was found on a host *T. ilisha* of the family Clupeidae. Hitherto, four species have been reported from clupeid hosts, *N. fradei*, *N. sagaxi* Avdeev, 1986, *N. teres* (Wilson, 1911) and *N. thambus* Ho, Do et Kasahara, 1983 (El-Rashidy and Boxshall 2014). The new species is the fifth species known to utilize hosts of this family, but it is the first, so far, to be reported from *T. ilisha*.

Genus *Orbitacolax* Shen, 1957

***Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959) (Figs 4, 5)**

Taeniacanthus hapalogenyos Yamaguti and Yamasu, 1959, p. 95; Yamaguti 1963, p. 21.

Orbitacolax hapalogenyos: Vervoort 1962, p. 84; Ho and Dojiri 1976, p. 257; Ho *et al.* 1983, p. 11; Cressey and Cressey 1989, p. 2904; Ho *et al.* 2000, p. 670.

Material examined

1♀ (NIBRIV0000293975) from gills of Japanese threadfin bream *Nemipterus japonicus* (Bloch), Al-Faw City, Iraq (29°46´N, 48°51´E), 21 July, 2011.

Description

Female. Body (Fig. 4A) 1.72 mm in length. Prosome longer than urosome. Cephalothorax wider than long. Urosome (Fig. 4B) 0.43 mm, 5-segmented, distinctly shorter than prosome. Genital double-somite 155 × 220 μm, with convex lateral margins, wider than long. Three free abdominal somites (Fig. 4C) 78 × 136, 78 × 130, and 52 × 101 μm, respectively, from anterior to posterior, each with spinules on ventral surface. Caudal ramus longer than wide; each ramus 69×34 μm, with spinules on ventral surface, bearing 1 long and 5 short setae. Labrum (Fig. 4D) longer than wide; ventral surface covered with spinules. Antennule (Fig. 4E) 5-segmented, with armature formula of 5, 20, 4, 2+1 aesthetasc, and 7+1 aesthetasc. Second seta on second segment largest among setae. Antenna (Fig. 4F) 4-segmented; first segment with 1 distal seta; short second segment also with 1 seta; third segment with rows of minute spinules on medial surface and distally 1 plate-like process tipped by small seta, 1 claw, and 1 spine bearing spin-

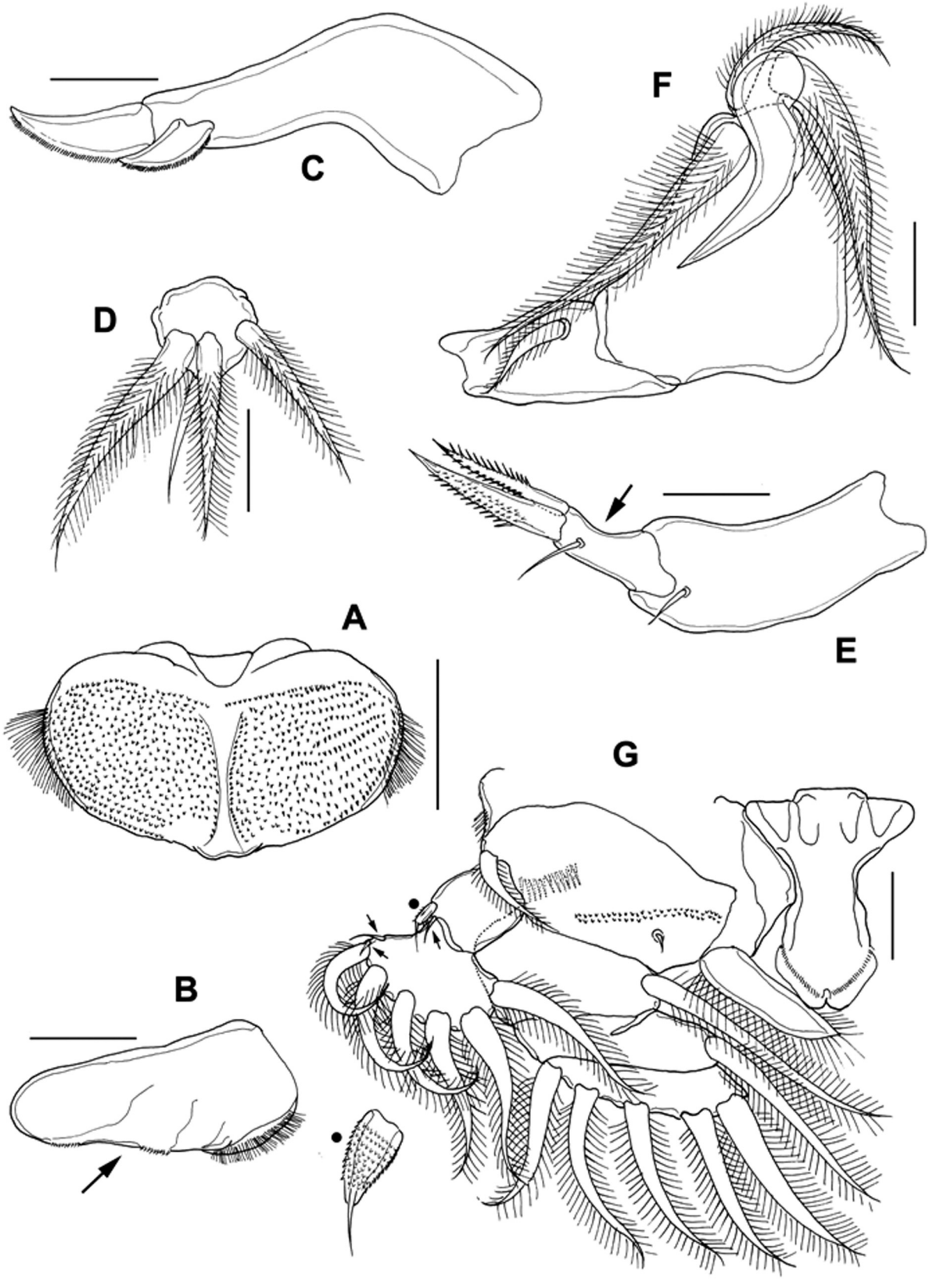

Fig. 2. *Nothobomolochus ilhoikimi* sp. n., adult female. **A** – labrum, ventral; **B** – paragnath, ventral (arrow); **C** – mandible, dorsal; **D** – maxillule, dorsal; **E** – maxilla, ventral (arrow); **F** – maxilliped, dorsal; **G** – l eg 1, dorsal, spines (arrow). Scale bars: B-F = 25 μm, A, G = 50 μm

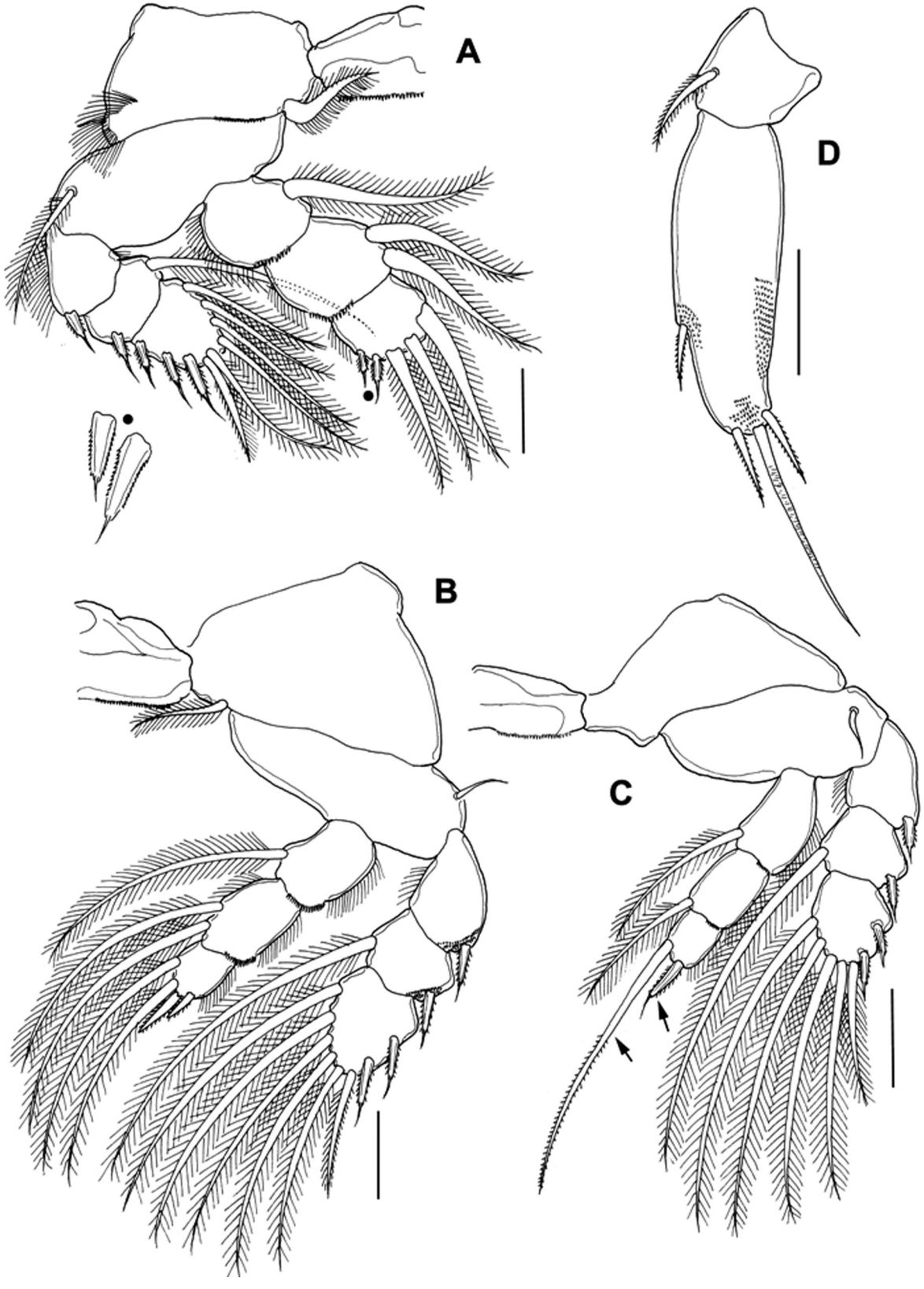

Fig. 3. *Nothobomolochus ilhoikimi* sp. n., adult female. **A** – leg 2, ventral; **B** – leg 3, dorsal; **C** – leg 4, dorsal, 2 spines long and short (arrow); **D** – leg 5, dorsal. Scale bars: A-C = 25 μm, D = 50 μm

ules along inner margin; terminal segment distally with 3 claws and 1 large and 2 small setae. Mandible (Fig. 4G) long process tipped with 2 spines bearing serrate anterior edge. Paragnath (Fig. 4H) bluntly pointed process fringed basally with cilia and distally with spinules. Maxillule (Fig. 4I) lobate, bearing 4 setae consisting of 1 long plumose seta (pointed), and 1 spinulate and 2 simple setae.

Rostrum with 2 pointed tines on ventral surface (Fig. 5A). Maxilla (Fig. 5B) 2-segmented; distal segment with proximal protuberance on posterior side and distally 2 spinulose spines and 1 small seta. Maxilliped (Fig. 5C) 3-segmented; first segment with 1 naked seta in middle; second segment with strongly produced outer margin and 2 pinnate medial setae; small third segment unarmed; terminal segment as strongly curved claw bearing 1 seta proximally and clawlet on outer margin. Armature on legs 1–4 as follows (Roman numerals = spines; Arabic numerals = setae):

	Coxa	Basis	Exopod	Endopod
Leg 1	0–1	1–0	I–0; III, 6	0–1;0–1; 5
Leg 2	0–0	1–0	I–0; I–0; II, I, 3	0–1; 0–2; 4
Leg 3	0–0	1–0	I–0; I–0; II, I, 3	0–1; 0–1; 3
Leg 4	0–0	1–0	I–0; I–0; II, I, 3	0–1; 0–1; 3

Leg 1 (Fig. 5D) biramous; exopod 2-segmented, but second segment with vestigial suture on outer side; endopod 3-segmented. Legs 2–4 with 3 segmented rami (Fig. 5E-G). Basis and segments on both rami of all four legs bearing patches of spinules. Exopods of legs 2–4 having simple outer spines. Coxa of legs 2–4 with 1 inner process, instead of seta. Basis of legs 1–4 with 2 large patches of minute spinules on ventral surface. Third endopodal segment legs 3 (Fig. 5F) and 4 (Fig. 5G) longer than wide. Leg 5 (Fig. 5H) 2-segmented; proximal segment armed with 1 plumose seta; distal segment armed with 2 small outer setae and 2 long terminal setae. Leg 6 (Fig. 4B) represented by 3 setae in genital opening, egg attachment area.

Remarks.

According to Ho *et al.* (1983), the most striking feature of *O. hapalogenyos* is the presence of 2 long inner plumose setae on the second endopodal segment of leg 2 (vs. no seta or 1 inner seta in other species). This feature is shared with three other congeneric species *O. pteragogi* Kim and Moon, 2013, *O. trichiuri* Kim and Moon, 2013 and *O. unguifer* Kim and Moon, 2013 (Kim and Moon 2013). Previously, it was compared only with *O. aculeatus* (Pillai, 1962), from which *O. hapalogenyos* differs in having 2 setae on the second endopodal segment of leg 2 (vs. 1 in *O. aculeatus*) and 9 elements on the terminal exopodal segment of leg 1 (vs. 8 in *O. aculeatus*). It differs from *O. pteragogi* in the terminal endopodal segments of legs 3 and 4 having 3 setae (vs. 2 in *O. pteragogi*); and from *O. trichiuri* and *O. unguifer* in having 3 setae on the terminal endopodal segment of leg 3 (vs. 4 in *O. trichiuri* and *O. unguifer*).

Originally *O. hapalogenyos* was reported by Yamaguti and Yamasu (1959) as *Taeniacathus hapalogenyos* based on seven gravid females collected from the gills and mouth cavity of broadbanded velvechtin *Hapalogenys analis* Richardson, 1845 (= *Hapalogenyos mucronatus*) captured from the Seto Inland Sea, Japan. Later, Vervoort (1962) transferred this species to *Orbitacolax* and Ho and Dojiri (1976) also reported this species from the Great Barrier Reef, Australia. Ho *et al.* (1983) reported the species based on specimens collected from the same host off Kojima Bay, Japan. Subsequently, Cressey and Cressey (1989), reported some features of this species based on material collected from the same host [off Onomichi, Japan] from the Smithsonian Collections, and they reported it from various hosts from different countries (Table I). Finally, Ho *et al.* (2000) collected this species from Kuwait Bay but from different host and redescribed by revealing minor differences. All redescriptions except Ho *et al.* (1983) show differences in setal formula, which are discussed here.

Our illustrations agree well with the illustrations of Japanese specimens given by Yamaguti and Yamasu (1959) and Ho *et al.* (1983), but not with Cressey and Cressey (1989), Ho and Dojiri (1976) and Ho *et al.* (2000). Ho *et al.* (2000) pointed out some minor differences in the setation of legs 2 and 3 (p. 673) compared with Cressey and Cressey's (1989) illustrations. In our specimen, the same features highlighted by Ho *et al.* (2000) are missing. Likewise, our specimen differs from Australian specimen in the presence of a small seta on the terminal endopodal segment of leg 4 (vs. absent in Ho and Dojiri 1976) and in the presence of a small seta on the terminal exopodal segment of leg 2 and the terminal endopodal segment of leg 3 (vs. absent in Ho *et al.* 2000). Leg 3 was not illustrated and hence was compared with the setal formula table (see: p.671, Ho *et al.* 2000). In addition, in leg 4, the terminal endopodal segment has a long whip-like seta, can be considered as a striking feature of the species, but it is simple in our specimen. These differences have been attributed due to geographical variation by Ho *et al.* (2000). We agreed, but our specimen collected from Iraq waters, is close to *O. hapalogenyos* but is not like the Kuwait specimen illustrated by Ho *et al.* (2000), hence we redescribed and consider that the specimen from Kuwait might represent a new species. Recently, three new species were reported from Korea (Kim and Moon 2013), bringing the

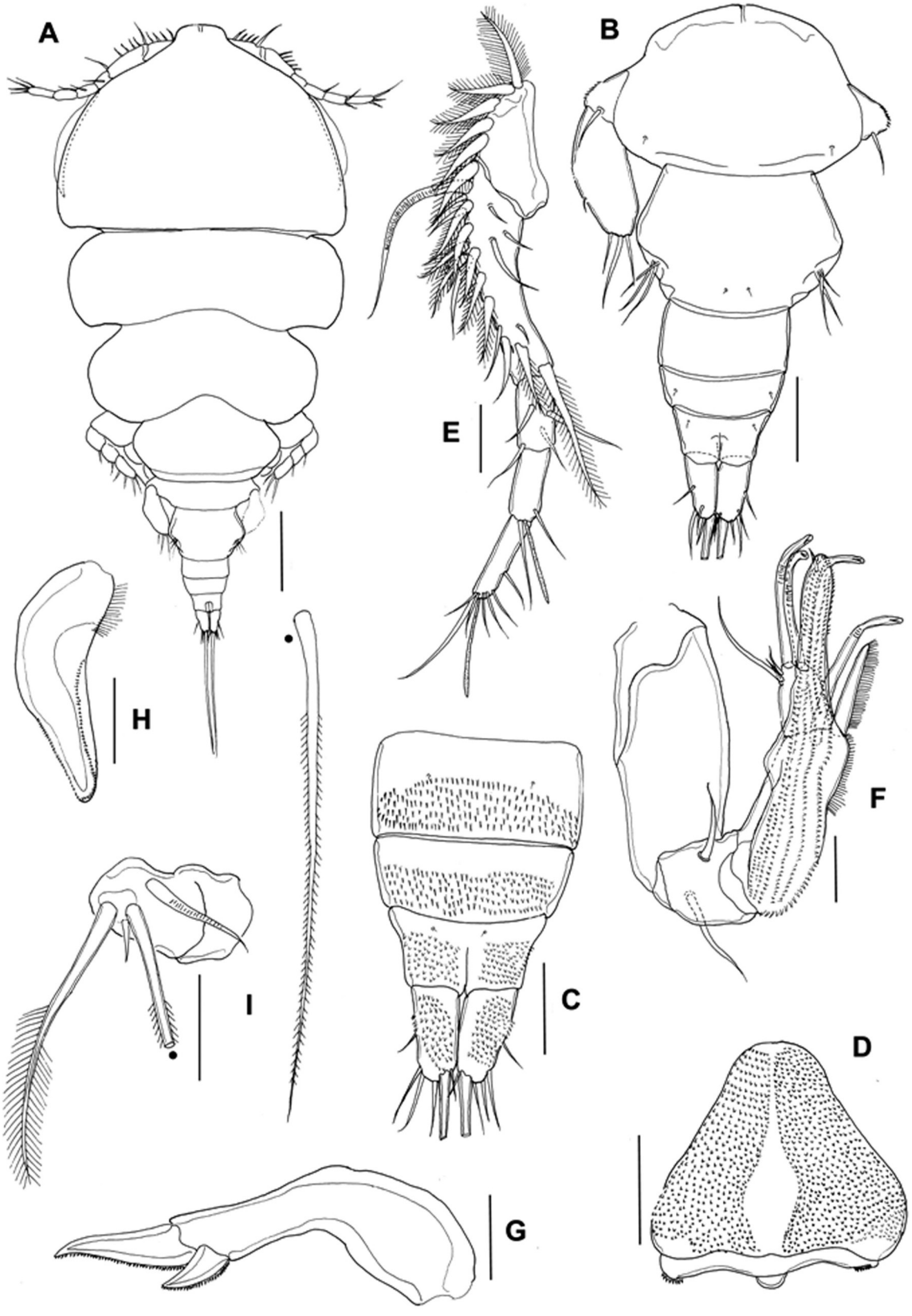

Fig. 4. *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959), adult female. **A** – habitus, dorsal; **B** – genital double-somite and urosome, dorsal; **C** – free abdominal somites, ventral; **D** – labrum, ventral; **E** – antennule; **F** – antenna; **G** – mandible; **H** – paragnath; **I** – maxillule. Scale bars: A = 200 μm; B, C = 100 μm; D = 50 μm; E-I = 25 μm

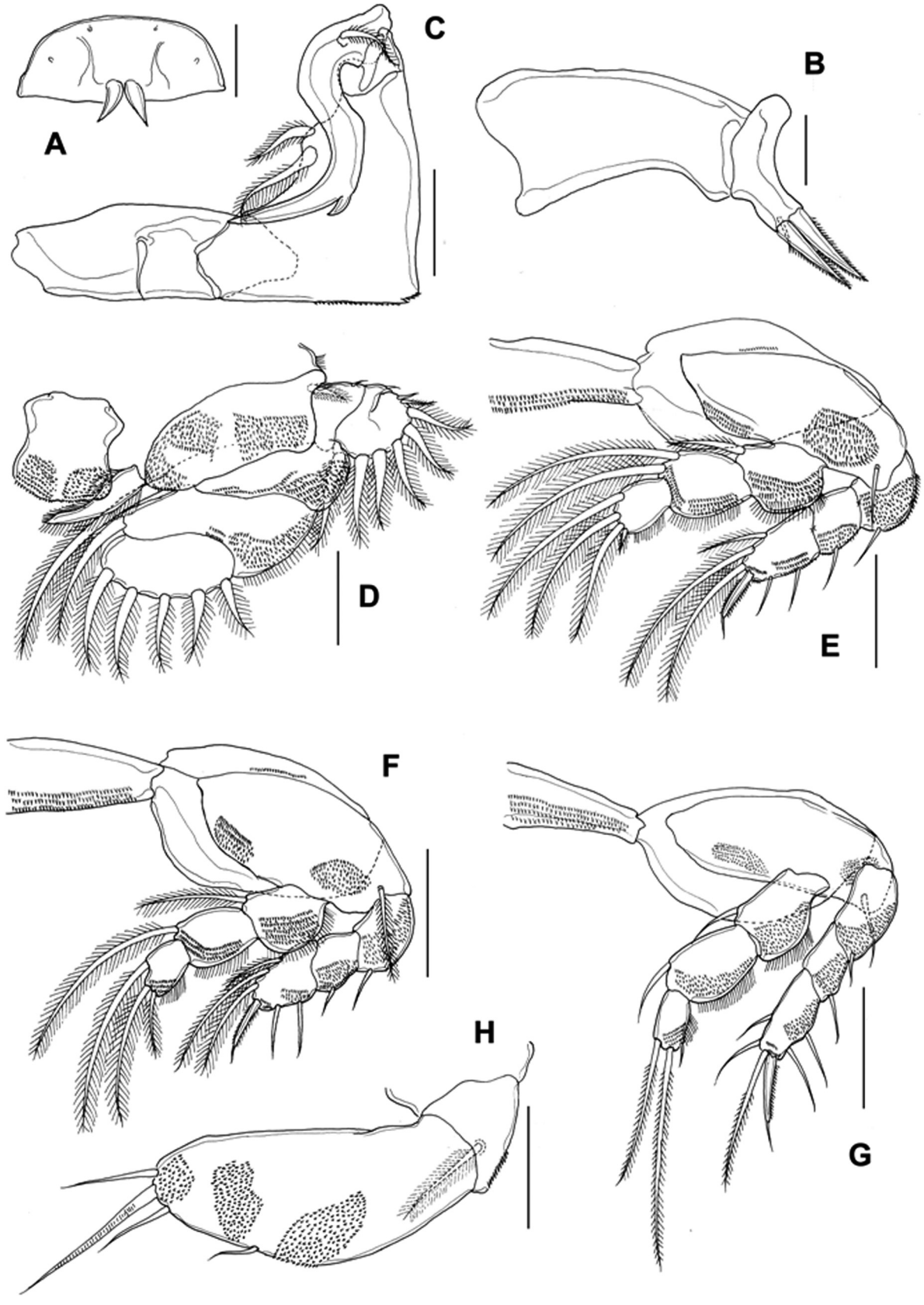

Fig. 5. *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959), adult female. **A** – rostrum, ventral; **B** – maxilla, ventral; **C** – maxilliped, ventral; **D** – leg 1, dorsal; **E** – leg 2, ventral; **F** – leg 3, ventral; **G** – leg 4, ventral; **H** – leg 5, ventral. Scale bars: A, D-H = 50 μm; B, C = 25 μm

Table I. Distribution and records of *Orbitacolax hapalogenyos* (Yamaguti and Yamasu, 1959) from different localities

Host	Order: Family: Common name	Distribution	References
Hapalogenys analis Richardson, 1845 (= *Hapalogenyos mucronatus*)	Perciformes: Hapalogenyidae: Broadbanded velvechtin	the Seto Inland Sea, Japan	Yamaguti and Yamasu (1959)
Ostracion cubicus L, 1758 (= *O. tuberculatus*)	Tetraodontiformes: Ostraciidae: Yellow boxfish	Great Barrier Reef, Australia	Ho and Dojiri (1976)
Hapalogenys analis (= *H. mucronatus*)		Kojima Bay, Japan	Ho *et al*. (1983)
Hapalogenys analis (= *H. mucronatus*)		Onomichi, Japan	Cressey and Cressey (1989)
Clepticus parrae (Bloch and Schneider, 1801)	Perciformes: Labridae: Creole wrasse	Puerto Rico	
Synodus sp.	Aulopiformes: Synodontidae: Lizard fishes		
Acanthurus coerulus Bloch and Schneider, 1801	Perciformes: Acanthuridae: Blue tang surgeonfish		
Epinephelus itajara (Lichtenstein, 1822)	Perciformes: Serranidae: Atlantic goliath grouper	Charlotte Harbor, Florida, U.S.A.	
Stephanolepis hispidus (L, 1766) (= *Monacanthus hispidus*)	Tetraodontiformes: Monacanthidae: Planehead filefish		
Prionotus nudigula Ginsburg, 1950	Scorpaeniformes: Triglidae: Red searobin	Plata, Brazil	
Abudefduf saxatilis (L, 1758)	Perciformes: Pomacentridae: Seargeant major	Belize	
*Holacanthus ascencionis**	Perciformes: Pomacanthidae		
Pseudupeneus maculatus (Bloch, 1793)	Perciformes: Mullidae: Spotted goatfish		
Hemirhamphus marginatus (Forsskål, 1775)	Beloniformes: Hemiramphidae: Yellow halfbeak	Kuwait Bay, Kuwait	Ho *et al*. (2000)
Nemipterus japonicus (Bloch, 1791)	Perciformes: Nemipteridae: Japanese threadfin bream	Al Faw City, Iraq	Present study

*the genus is not having this reported species and vice versa according to FishBase (Froese and Pauly 2014)

total in this genus to ten: *O. aculeatus*, *O. analogus* Vervoort, 1969, *O. dactylopterusi* (Carvalho, 1958), *O. hapalogenyos*, *O. leptoscari* (Yamaguti, 1953), *O. pteragogi*, *O. trichiuri*, *O. unguifer*, *O. uniunquis* Shen, 1957 and *O. williamsi* Cressey and Cressey, 1989.

There is some evidence that the group of species possessing the plesiomorphic character, ie: the presence of 2 long inner plumose setae on the second endopodal segment of leg 2, represents a paraphyletic lineage within the genus. In this study, off 10 species, two species clusters or groups are recognized, the *hapalogenyos*-group and the *analogus*-group. Four species, *O. hapalogenyos*, *O. pteragogi*, *O. trichiuri*, and *O. unguifer* are placed in the *hapalogenyos*-group based on the plesiomorphic character of the presence of 2 long inner plumose setae on the second endopodal segment of leg 2; and six species *O. analogus*, *O. dactylopterusi* (having no inner seta), *O. aculeatus* *O. leptoscari*, *O. uniunquis*, and *O. williamsi* (having 1 inner seta) are placed in the *analogus*-group based on the second endopodal segment of leg 2 either no inner seta or having 1 inner seta.

Orbitacolax hapalogenyos is the most widely distributed species of the genus, occurring on teleosts from different countries of Japan, Australia, Kuwait, Puerto Rico, Brazil, Belize and U.S.A. (Table I).

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