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Two species of bomolochid copepods (Crustacea) parasitic on marine fishes of Kuwait

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Abstract.—Two species of Bomolochidae (Poecilostomatoida) were found in the gill cavities of marine fishes caught in Kuwait Bay. They are *Nothobomolochus triceros* (Bassett-Smith, 1898) from *Pampus argenteus* (Euphrasen) and *Orbitacolax hapalogenyos* (Yamaguti & Yamasu, 1959) from *Hemirhamphus marginatus* (Forsskål). Both species are new to the Persian Gulf. A new key to the 30 species of *Nothobomolochus* is provided. *Nothobomolochus trichiuri* Hameed & Kumar, 1988 is a junior synonym of *Nothobomolochus trichiuri* Pillai & Natarajan, 1977.

In their preliminary report on 23 species of parasitic copepods from the marine fishes of Kuwait, Ho & Sey (1996) reported four species of poecilostomatoids belonging to the family Bomolochidae, *Bomolochus stocki*, Roubal, 1981, *Nothobomolochus denticulatus* (Basset-Smith, 1898), *N. fradei* Marques, 1965 and *N. quadriceros* Pillai, 1973. In this paper, we add to that list two more species of bomolochids: a species of *Orbitacolax* and a fourth species of *Nothobomolochus*.

The concept of the genus *Nothobomolochus* was started by Yamaguti (1939) but the current name of the genus was not given until 23 years later by Vervoort (1962). This genus has become the largest one in the family Bomolochidae, consisting of 30 species. We take this opportunity of adding a species of *Nothobomolochus* to the fauna of the Persian Gulf to create a new key to the species of the genus.

Materials and Methods

The fishes infested with the copepods reported herein were caught in Kuwait Bay of the Persian Gulf and purchased at a local fish market in Kuwait. Fishes were examined in the laboratory of the Department of Zoology at Kuwait University. Copepod parasites were carefully removed and preserved in 70% alcohol. Subsequent microscopic studies of the parasites were made in a drop of lactic acid. Appendages of the parasites were dissected and examined with a compound microscope magnified up to 1500 times. All drawings were made with the aid of a camera lucida.

Family Bomolochidae Sumpf, 1871

Orbitacolax hapalogenyos (Yamaguti & Yamasu, 1959)

Figs. 1–2

Taeniacanthus hapalogenyos Yamaguti & Yamasu, 1959, p. 95, pl. 3, figs. 44–55; Yamaguti, 1963, p. 21, pl. 19, fig. 8.

Orbitacolax hapalogenyos: Vervoort, 1962, p. 84, Ho & Dojiri, 1976, p. 257, figs. 2A–B.

Orbitacolax haplogenyos: Cressey & Cressey, 1989, p. 2904, figs. 16–27.

Material examined.—1 ♀ recovered

from gill cavity of *Hemirhamphus marginatus* (Forsskål) caught on 22 Oct 1997 from Kuwait Bay. Dissected specimen kept in junior author's (I–HK) collection.

Female.—Body (Fig. 1A) 1.16 mm in length. Cephalothorax wider than long, 375 × 495 μm, with protruded rostral area. Urosome (Fig. 1B) distinctly shorter than prosome, only 384 μm long. Genital double somite wider than long, 106 × 167 μm, and bearing 3 long, naked setae in egg sac attachment area. All 3 abdominal somites wider than long and bearing a large patch of spinules on ventral surface (Fig. 1C). Caudal ramus (Fig. 1C) longer than wide, 46 × 27 μm (1.70:1), bearing a large patch of spinules on ventral surface and carrying 1 long and 5 short setae.

Rostral area with 2 sharply diverging, pointed tines on ventral surface (Fig. 1D). Antennule (Fig. 1D) with 2-segmented base and 3-segmented terminal section; armature on base consisting of 5, thick setae on first segment and 10 similar setae plus another 10 naked setae on second segment; formula of armature on terminal 3 segments: 4, 2 + 1 aesthete, and 7 + 1 aesthete. Antenna (Fig. 1E) 3-segmented; basal and middle segments bearing a distal seta. Terminal segment bearing rows of spinules on ventral (inner) margin and protruded distally into a large, blunt, cylindrical process with ventral spinules; also armed distally with 4 unequal, curved claws, 3 naked setae, and 2 pectinate processes (Fig. 1F).

Labrum (Fig. 1G) with a large patch of denticles on either side of ventral surface. Mandible (Fig. 1H) a slightly bent, long process tipped with 2 spines bearing serrate, anterior edge. Paragnath (Fig. 1I) a bluntly pointed process fringed basally with cilia and distally with spinules. Maxillule (Fig. 1J) armed with 1 plumose seta and 3 (1 long and 2 short) simple setae. Maxilla (Fig. 1K) 2-segmented; proximal segment unarmed, distal segment protruded posteriorly in basal region and armed distally with 1 small, simple seta and 2 large, spinulated spines. Maxilliped (Fig. 2A) 3-segmented; proximal segment rod-like, with 2 small protuberances and 1 naked seta; middle segment greatly enlarged carrying 2 extremely unequal setulose setae; terminal segment a sigmoid, sharply pointed claw with an accessory hooklet at distal bend and bearing 1 small, plumose seta in basal region.

Legs 1 to 4 (Figs. 2B, 2C, 2D) biramous, with 3-segmented rami, except exopod of leg 1. Formula of spines (roman numerals) and setae (Arabic numerals) on these 4 legs as follows:

	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, 2	0–1; 0–2; 3
Leg 3	0–0	1–0	I–0; I–1; II, I, 2	0–1; 0–1; 2
Leg 4	0–0	1–0	I–0; I–0; II, I, 2	0–1; 0–1; 3

Basis of protopod and segments on both rami of all four legs bearing rows of spinules. Outer spines on all exopods weakly developed. Setae on ramal segments of legs 2, 3 and 4 sparsely armed. Leg 5 (Fig. 2E) 2-segmented and bearing rows of spinules; proximal segment armed with 1 plumose seta; distal segment, 112 × 40 μm (2.80:1), armed with 2 small outer setae and 2 long terminal setae. Leg 6 represented by 3 long setae in egg sac attachment area (Fig. 1B).

Remarks.—*Orbitacolax hapalogenyos* is the most widely distributed species of the genus, occuring on teleosts in the Seto Inland Sea, Japan (Ho et al. 1983); Great Barrier Reef, Australia (Ho & Dojiri 1976); Gulf of Mexico; Caribbean Sea; and Brazil (Cressey & Cressey 1989). It is characteristic in having two long inner plumose setae (instead of one short simple seta or no seta) on the second segment of the endopod of leg 2. This distinct character state is shared only with *O. aculeatus* (Pillai) among its congeners. However, *O. aculeatus* differs from the present species in having eight elements (2 small + 6 large) [instead of nine elements (3 small + 6 large)] on the terminal segment of the exopod of leg 1. Therefore, the specimen from Kuwait is identified as *O. hapalogenyos*. Neverthe-

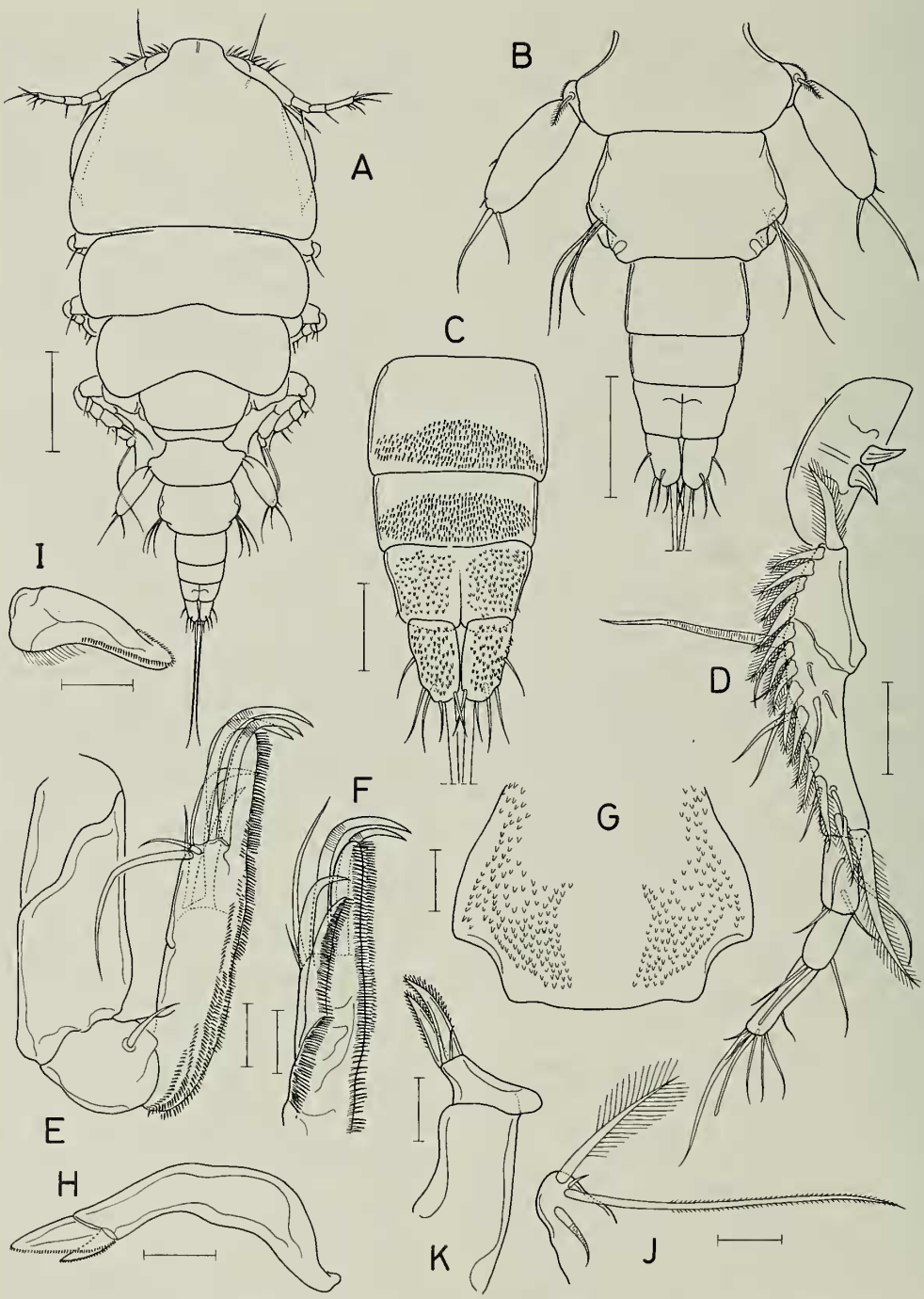

Fig. 1. *Orbitacolax hapalogenyos* (Yamaguti & Yamasu), female. A. habitus, dorsal; B. urosome, dorsal; C. abdomen, ventral; D. rostrum and antennule; E. antenna; F. distal part of antenna; G. labrum; H. mandible; I. paragnath; J. maxillule; K. maxilla. Scale bars: A, 0.2 mm; B, 0.1 mm; C, D, 0.05 mm; E–K, 0.02 mm.

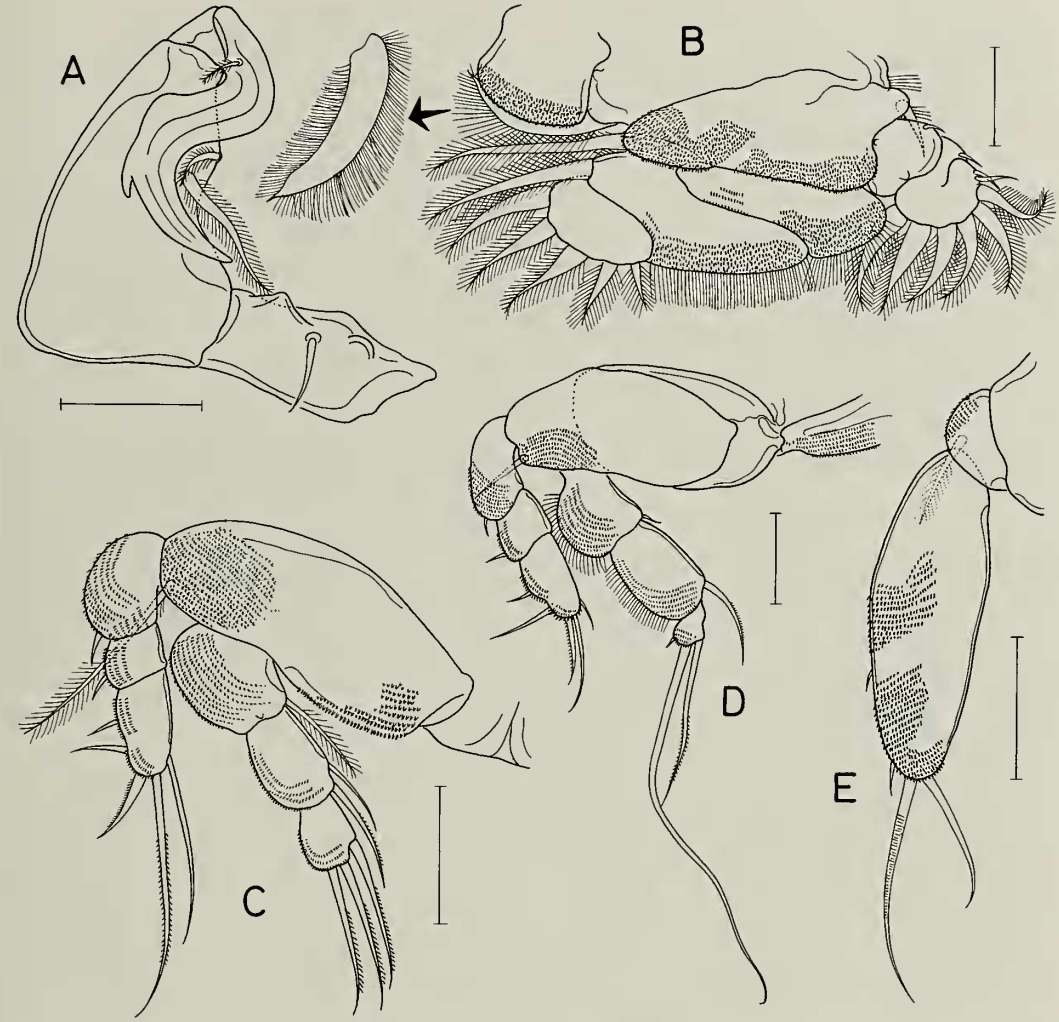

Fig. 2. *Orbitacolax hapalogenyos* (Yamaguti & Yamasu), female. A. maxilliped; B. leg 1; C. leg 2; D. leg 4; E. leg 5. Scale bars: A–E, 0.05 mm.

less, this can only be considered as a temporary identification, because some discrepancies have been detected.

According to Cressy & Cressey (1989), the specimens of *O. hapalogenyos* from the Gulf of Mexico and Caribbean Sea are somewhat different from those found in Japan described by Yamaguti & Yamasu (1959) and redescribed by Ho et al. (1983). There is one extra, small seta on the terminal segment of leg 2 exopod and leg 3 endopod in the specimens from the New world waters (Cressey & Cressey 1989: Figs. 24, 25; indicated with an arrow). Furthermore, the specimen of *O. hapalogenyos* found in the Great Barrier Reef (Ho & Dojiri 1976) differs from those found in the Seto Inland Sea, Japan and the New world waters in missing the medial, small seta on the terminal segment of leg 4 endopod. Thus, even though our specimen from Kuwait differs from the holotype (from Seto Inland Sea, Japan) in carrying one less seta on the terminal segment of both rami of leg 2, we consider it is better to call it *O. hapalogenyos* for the time being. Since there

is but one specimen from a new host (*Hemiramphus marginatus*) in a new locality (Kuwait Bay), we can not determine if there is an abnormality or geographical variation. Discovery of more specimens from the Persian Gulf will solve this problem.

It is interesting to note that *O. hapalogenyos* has not been found in India. The same host fish, a margin halfbeak (*H. mginatus*) that harbors *O. hapalogenyos* in Kuwait Bay, is known to carry another species of bomolochid, *Bomolochus hemiramphi* Pillai, in Kerala, India (Pillai 1965).

Notobomolochus triceros (Bassett-Smith, 1898)
Figs. 3–4

Bomolochus triceros Bassett-Smith, 1898, p. 2, pl. 1, figs. 1a–g; Pillai, 1965, p. 39, figs. 15A–O.

Bomolochus (*Pseudobomolochus*) *managatuwo* Yamaguti, 1939, p. 396, pl. 3, figs. 28–19, pl. 4, figs. 30–36; Shen, 1957, p. 304, pl. 4, figs. 33–45.

Nothobomolochus triceros: Vervoort, 1962, p. 64; Pillai, 1969, p. 149, figs. 1–4; Ho, Do & Kasahara, 1983, p. 9, figs. 82–101.

Nothobomolochus managatuwo: Vervoort, 1962, p. 66.

Pseudobomolochus managatuwo: Yamaguti, 1963, p. 15, pl. 10, fig. 1.

Pseudobomolochus triceros: Yamaguti, 1963, p. 16.

Material examined—1 ♀ recovered from gill cavity of *Pampus argenteus* (Euphrasen) caught on August 18, 1996 from Kuwait Bay. Dissected specimen kept in junior author's (I–HK) collection.

Female.—Body (Fig. 3A) 1.86 mm in length. Cephalothorax widest part of body, 0.56 mm long and 1.00 mm wide. Urosome (Fig. 3B) distinctly shorter than prosome, only 770 μm long. Genital double somite wider than long, 192 × 327 μm, and bearing 3 long, naked setae on a protuberance in attachment area of egg sac (Fig. 3B). All 3 abdominal somites wider than long, anal somite with two patches of spinules on ventral surface (Fig. 3C). Caudal ramus (Fig. 3B) longer than wide, 87 × 50 μm (1.74: 1), and carrying 1 long and 5 short setae. Egg sac (Fig. 3A) longer than urosome, with multiseriate eggs.

Rostral area unarmed. Antennule (Fig. 3D) with heavily sclerotized base (composed of 3 fused segments) and cylindrical, 3-segmented terminal section. Armature on base consisting of 3 equally developed processes on pedestal (tripartite plate) in addition to 12 stout setulose, setae, 11 slender setae and 2 setules. Formula of armature on terminal 3 segments being: 4, 2 + 1 aesthete, and 7 + 1 aesthete. Antenna (Fig. 3E) 3-segmented; basal segment largest and middle segment smallest, both carrying 1 simple seta. Terminal segment bearing spinules along ventral (inner) margin and protruded distally into a blunt, cylindrical process carrying a subterminal seta and a row of ventral spinules in addition to 4 curved claws, 2 naked setae, and 2 pectinate processes.

Labrum (Fig. 3F) with long cilia on lateral margin and 2 large patches of small denticles on ventral surface. Mandible (Fig. 3G) a slightly bent, long process tipped with 2 spines bearing serrated membranous plate on one (anterior) side. Paragnath (Fig. 3H) a bluntly pointed process armed with denticles and cilia. Maxillule (Fig. 3I) armed with 3 unequal plumose setae and 1 naked seta. Maxilla (Fig. 4A) 2-segmented; proximal segment large, carrying 1 small, naked seta; distal segment small tipped with 2 unequal, spinulose processes and 1 small, naked seta. Maxilliped (Fig. 4B) 3-segmented; proximal segment rod-like, carrying a small, naked seta; middle segment greatly enlarged, carrying 2 extremely unequal setulose setae; terminal segment assuming a sharply pointed bent claw bearing 1 large hairly seta at base.

Legs 1 to 4 (Fig. 4C, D, E, F) biramous, with 3-segmented rami, except exopod of leg 1. Formulae of spines (Roman numerals) and setae (Arabic numerals) on these 4 legs as follows:

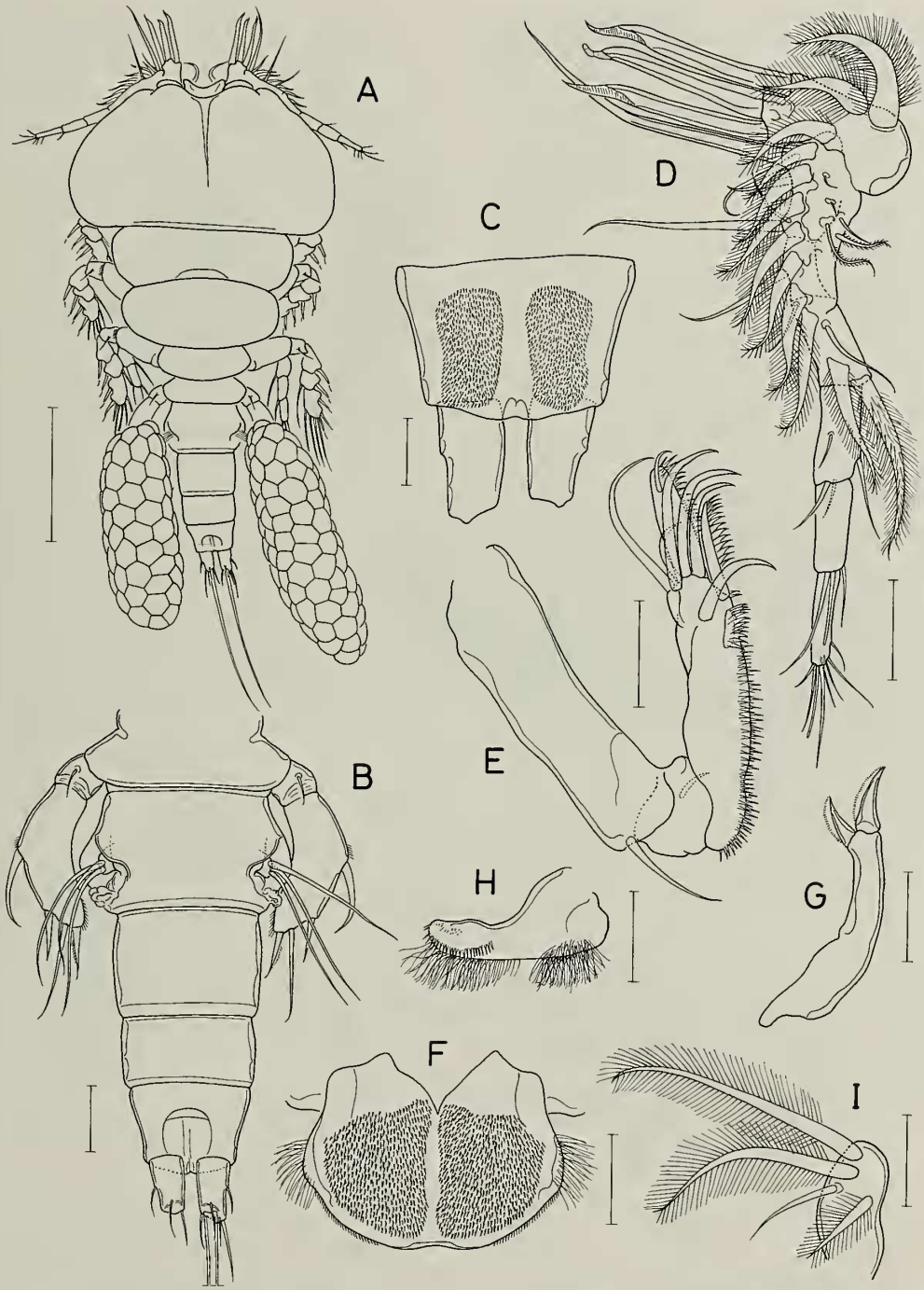

Fig. 3. *Notobomolochus triceros* (Bassett-Smith), female. A. habitus, dorsal; B. urosome, dorsal; C. anal somite and caudar rami, ventral; D. antennule; E. antenna; F. labrum; G. mandible; H. paragnath; I. maxillule. Scale bars: A, 0.5 mm; B, 0.1 mm; C, E–I, 0.05 mm; D, 0.1 mm.

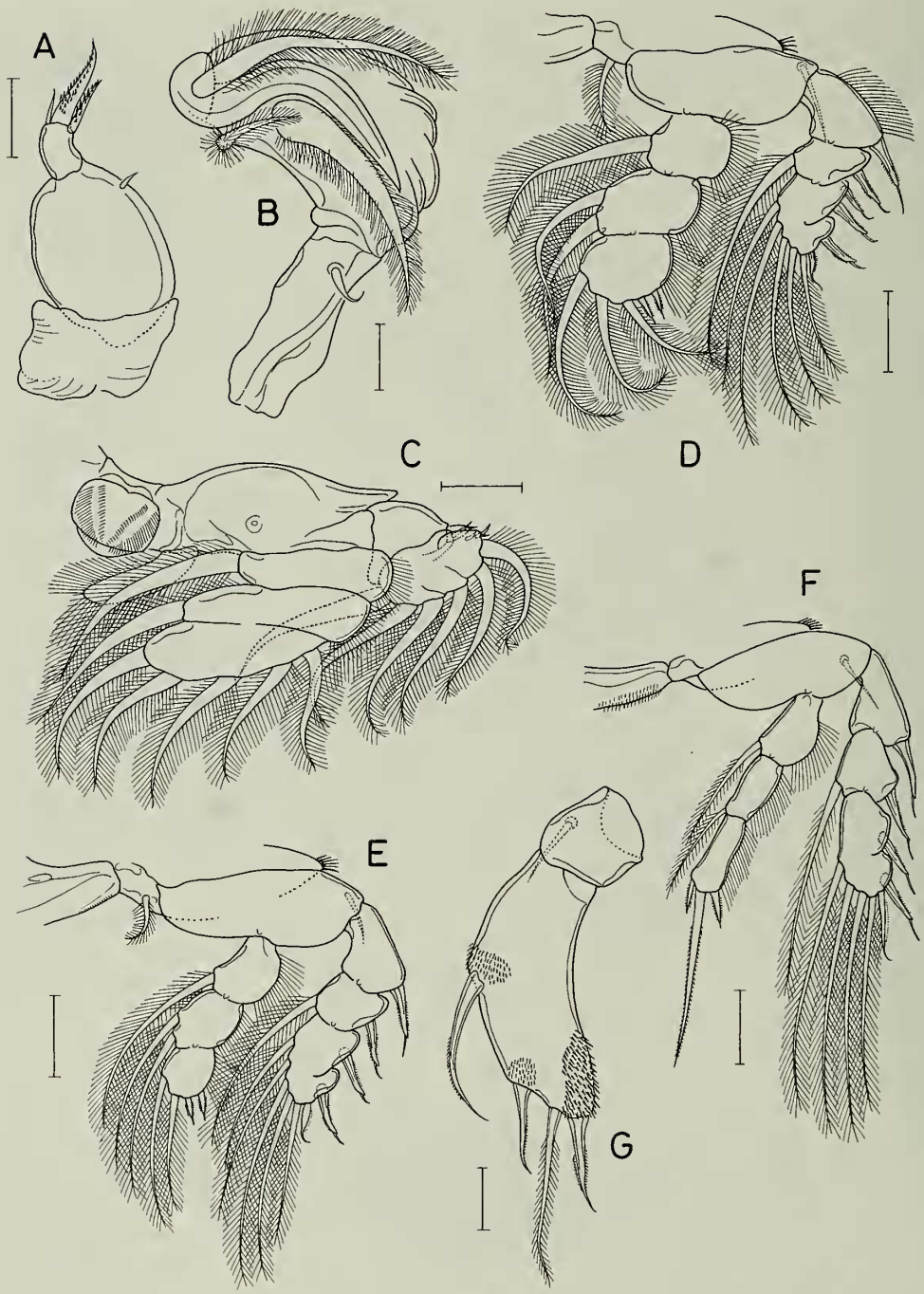

Fig. 4. *Notobomolochus triceros* (Bassett-Smith), female. A. maxilla; B. maxilliped; C. leg 1; D. leg 2; E. leg 3; F. leg 4; G. leg 5. Scale bars: A, B, G, 0.95 mm; C–F, 0.1 mm.

	Coxa	Basis	Exopod	Endopod
Leg 1	0–1	0–0	I–0; IV, 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; III

Outer spines on exopod of leg 1 weakly developed. Leg 5 (Fig. 4G) 2-segmented; proximal segment slightly longer than wide, 77 × 69 μm, and carrying 1 simple, outer seta; distal segment distinctly longer than wide, 212 × 85 μm (2.49:1), and armed with 3 patches of spinules, 3 spines tipped with a flagellum, and 1 plumose seta. Leg 6 represented by 3 setae on a protuberance in egg sac attachment area (Fig. 3B).

Remarks.—This species was first discovered by Bassett-Smith (1898) from the gill cavity of a pampano [*Pampus argenteus* (Euphrasen)] collected in the Arabian Sea. Since the original description is "very inaccurate" (Vervoort 1962:65), a complete redescription of the Kuwaiti specimen is therefore given above to supplement the original description.

A close comparison of our specimen from Kuwait with the description of *N. triceros* given by Pillai (1969) from India and by Ho et al. (1983) from Japan indicated that they are conspecific. However, it is interesting to note that while the total length of the specimen from Kuwait (1.86 mm) is not much different from those of India (2.2 mm; Pillai 1985), it is distinctly smaller then those from Japan (3.28 mm; Ho et al. 1983).

Key to Species of *Nothobomolochus* Vervoort, 1962

The most outstanding characteristic of this genus is the possession of a pedestal (well-sclerotized, tripartite plate) on the dorsal surface of the antennule in the basal region and carrying on it the modified third, fourth, and fifth setae. In the following key, these three seta-bearing processes of the plate are respectively called proximal, middle, and distal process. Since these three processes are constructed differently in different species groups of *Nothobomolochus*, they become one of the best character states for species identification.

Another useful character for the aid in species identification is the extent to which the fourth pediger is covered by a dorsal extension of the third pediger. The fourth pediger is not covered in five species; The fourth pediger is partly covered in nine species, and completely covered (in dorsal view) in 16 species. Since this feature is the easiest to recognize and has been properly illustrated for all nominal species, it is selected as the first morphological discriminator in the following key.

Discovering the above two features present concurrently in certain species of *Bomolochus*, Yamaguti (1939) created the subgenus *Pseudobomolochus* to accommodate the bomolochids with such morphology. However, since the name *Pseudobomolochus* had already been used for another group of bomolochids by Wilson (1913: 205), a new name *Nothobomolochus* was adopted when Vervoort (1962) revised the family Bomolochide and elevated the subgenus to a generic status. At that time, only 11 species were recognized under the genus *Nothobomolochus* and a key to the species was provided (Vervoort 1962). Later, the addition of 13 newly discovered species created difficulty in species identification. Avdeev (1978) updated the key to the species of *Nothobomolochus*. Since then, six more species have been added to this genus, making it the largest one in the family Bomolochidae with 30 species. Thus, a new key is provided here.

In preparation of the following key, it was discovered that "*Nothobomolochus trichiuri* n. sp." reported by Hameed & Kumar (1988) is not only bears the same species name but also is conspecific with *N. trichiuri* Pillai & Natarajan, 1977. Therefore, it is proposed to be relegated to a junior synonym of the latter.

Due to the lack of sufficient information in the original descriptions, three species of

Nothobomolochus can not be included in the following key. They are *N. cornutus* (Claus, 1864), *N. scomberesoci* (Krøyer, 1864), and *N. saetiger* (Wilson, 1911) The first species can be keyed beyond bracket 18 and the last two species can be keyed as far as bracket 20. As pointed out by Vervoort (1962:63), these three species need "an accurate redescription".

1. Pediger 3 normally developed 2
   Pediger 3 partly concealing pediger 4 6
   Pediger 3 entirely concealing pediger 4 12
2. Urosome as long as prosome; terminal claw of maxilliped with outer knob .. .. *teres* (Wilson, 1911)
   Urosome distinctly shorter than prosome; terminal claw of maxilliped smooth 3
3. Genital double somite wider than long; 3 processes on antennule much longer than first 2 setae 4
   Genital double somite longer than wide; 3 processes on antennule as long as or only slightly longer than first 2 setae 5
4. Caudal ramus short, 1.67:1; leg 5 with 2 patches of spinules along margin ... . *quadriceros* Pillai, 1973
   Caudal ramus long, 2.67:1; a large patch of spinules covering tip of leg 5 .... *vervoorti* Avdeev, 1986
5. Tip of leg 5 covered by a large patch of spinules; mandible with a row of denticles at base of terminal spines .. .. *elegans* Avdeev, 1977
   Tip of leg 5 otherwise; mandible otherwise ..... *atlanticus* Avdeev, 1978
6. Claw of maxilliped with auxiliary tooth or outer protrusion 7
   Claw of maxilliped smooth 8
7. Distal segment of leg 5 with spinules on inner margin; middle and distal processes on antennule longer than proximal process ..... *gazzae* (Shen, 1957)
   Distal segment of leg 5 with 2 patches of spinules; 3 processes on antennule long and subequal in length .... *kanagurta* (Pillai, 1965)
   Tip of leg 5 covered with a large patch of spinules; middle process on antennule stronger (thicker) than other two processes .... *ovalis* Avdeev, 1977
8. Three processes on antennule subequal in length 9
   Middle and distal process on antennule distinctly longer than proximal 10
   Middle process on antennule blunt and shorter than other two .... *thambus* Ho, Do & Kasahara, 1983
8. Formula of terminal segment of leg 4 endopod I, 1 ....*lateolabracis* (Yamaguti & Yamasu, 1959)
   Formula of terminal segment of leg 4 endopod I,1,I .... *triceros* (Bassett-Smith, 1988)
9. Proximal process on antennule longer than ½ of middle process; tip of leg 5 with patch of spinules along margin ... . *multispinosus* (Gnanamuthu, 1949)
   Proximal process on antennule shorter than ½ of middle process; tip of leg 5 covered with a large patch of spinules 11
10. Posterior margin of cephalothorax appearing as an inverted U, with large posterolateral protrusion; caudal ramus long, 2.18:1 .... *paruchini* Avdeev, 1978
    Posterior margin of cephalothorax straight; caudal ramus short, 1.75:1 .. .. *exocoeti* Avdeev, 1978
11. Pediger 2 enlarged, wider than cephalothorax; proximal process on antennule longer than other two processes ..... *marginatus* Avdeev, 1986
    Pediger 2 distinctly narrower than cephalothorax; proximal process on antennule shorter than or subequal in length with other two processes 13
12. Proximal process on antennule distinctly shorter than other two processes .. 14
    Proximal process on antennule subequal with one of other two processes 19
13. Anterior (dorsal) margin of outer spines on exopod of legs 2–4 heavily denticulated *denticulatus* (Bassett-Smith, 1898)
    Anterior (dorsal) margin of outer spines on exopod of legs 2–4 membranous or armed with spinules 15
14. Posterior margin of cephalothorax appearing as an inverted U, with large posterolateral protrusion 16
    Posterior margin of cephalothorax straight 18

15. Claw of maxilliped longer than inner seta on corpus .... *cypseluri* (Yamaguti, 1953)
Claw of maxilliped shorter than inner seta on corpus 17
16. Median process on antennule distinctly stronger and longer than distal process; caudal ramus 1.46:1 .... *oxyporhamphi* Avdeev, 1977
Median process on antennule only slightly stronger and longer than distal process; caudal ramus 2.06:1 .... *gibber* (Shiino, 1957)
17. Tip of leg 5 covered with a large patch of spinules; caudal ramus 1.36:1 .... *chilensis* Avdeev, 1974
Tip of leg 5 with 2 patch of spinules along margin; caudal ramus 2.83:1 .... *trichiuri* Pillai & Natarajan, 1977
18. Formula of terminal segment of leg 4 endopod I,1; dorsal margin of outer spines on exopod of legs 2–4 heavily denticulated ..... *fradei* Marques, 1965
Formula of terminal segment of leg 4 endopod I,1,I; armature of spines on exopod of legs 2–4 otherwise 20
19. Claw of maxilliped armed with an auxiliary tooth 21
Claw of maxilliped smooth 23
20. Formula of terminal segment of leg 4 endopod I,1; middle process on antennule distinctly stronger (thicker) than other two processes 22
Formula of terminal segment of leg 4 endopod I,1,I; middle process on antennule only slightly stronger other two processes ..... *sagaxi* Avdeev, 1986
21. Claw of maxilliped longer than setae on corpus; terminal segment of leg 4 endopod short, 1.45:1 .... *epulus* Vervoort, 1962
Claw of maxilliped shorter than setae on corpus; terminal segment of leg 4 endopod long, 2.26:1 ... *sagani* Hameed & Kumar, 1988
22. Processes on antennule stout, shorter than first plumose basal seta; paragnath with finger-like terminal processes ... . *digitatus* Cressey, 1970
Processes on antennule slender, longer than first plumose basal seta; paragnath armed otherwise ..... *gerresi* Pillai, 1973

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Literature Cited

Avdeev, G. V. 1978. Copepods of the genus *Notobomolochus* Vervoort (Cyclopoida, Bomolochidae) parasitizing on marine fishes. III. Composition diagnosis, key to species and geographical distribution.—Biologia Moria 3:39–45.

Bassett-Smith, P. W. 1898. Some new parasitic copepods found on fish at Bombay.—Annals and Magazine of Natural History, Series 7, 1:1–15.

Cressey, R., & H. B. Cressey. 1989. A new species of *Orbitacolax* (Copepoda: Bomolochidae) and redescriptions of two additional species.—Canadian Journal of Zoology 67:2901–2909.

Hameed, M. S., & K. A. Kumar. 1988. Two new species of *Nothobomolochus* (Copepoda: Bomolochidae) from Kerala.—Journal of the Marine Biological Association of India 28(1/2):124–129.

Ho, J. S., & M. Dojiri. 1976. Parasitic copepods on the fishes of the Great Barrier Reef, Australia, Part I. Cyclopoida.—Publication of the Seto Marine Biological Laboratory 23(3/5):257–273.

———, & O. Sey. 1996. Parasitic Copepoda of marine fishes from Kuwait: a preliminary report.—Kuwait Journal of Science & Engineering 23:61–69.

———, T. T. Do, & S. Kasahara. 1983. Copepods of the family Bomolochidae parasitic on fishes of Kojima Bay, Okayama Prefecture.—Journal of the Faculty of Applied Biological Science, Hiroshima University 22:1–41.

Pillai, N. K. 1965. Copepod parasitic on South Indian fishes: family Bomolochidae, 3.—Journal of the Bombay Natural History Society 62(1):38–55.

———. 1969. Notes on some copepod parasites in the collection of the British Museum (N. H.), London.—Journal of Marine the Biological Association of India 11(1/2):149–174.

Shen, C. J. 1957. Parasitic copepods from fishes of China, Part I. Cyclopoida (1).—Acta Zoologica Sinica 9(4):197–327.

Vervoort, W. 1962. A review of the genera and species of the Bomolochidae (Crustacea, Copepoda), including the description of some old and new species.—Zoologische Verhandelingen, Leiden 56:3–40.

Wilson, C. B. 1913. Crustacean parasites of West

Indian fishes and land crabs, with descriptions of new genera and species.—Proceedings of the U. S. National Museum 44:189–277.

Yamaguti, S. 1939. Parasitic copepods from fishes of Japan. Part 4. Cyuclopoida, II.—Volumen Jubilsre pro Professor Sado Yoshida 2:391–415.

———. 1963. Parasitic Copepoda and Branchiura. Interscience Publishers, New York, London, Sydney, 1104 pp., 333 pl.

———, & T. Yamasu. 1959. Parasitic copepods from fishes of Japan with descriptions of 26 new species and remarks on two known species.—Biological Journal of Okayama University 5(3/4): 89–165.