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Acanthochondria hoi, a new species of parasitic copepod (Poecilostomatoida: Chondracanthidae) on the California halibut, *Paralichthys californicus,* from Santa Monica Bay, California, with an amended key to the genus *Acanthochondria*

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Abstract.—A new species of parasitic copepod, *Acanthochondria hoi,* is described from specimens collected within the gill cavity of the California halibut, *Paralichthys californicus* (Ayers), from Santa Monica Bay, California. *Acanthochondria hoi* can be distinguished from its congeners by the combination of a Type B-V antennule and Type A leg 2, in addition to leg 1 ornamentation. A revision of the key of *Acanthochondria* prepared by previous authors is provided and includes three new species.

Santa Monica Bay is located in the Southern California Bight and is an open coastal embayment bounded by Point Dume to the north and Palos Verdes Point to the south. The Hyperion Treatment Plant (Bureau of Sanitation, Department of Public Works, City of Los Angeles) provides secondary treatment and disposal of treated wastewater through a 5-mile effluent outfall located in Santa Monica Bay. The Environmental Monitoring Division conducts quarterly otter trawls to monitor the effects of the effluent on the fishes and macroinvertebrates living in the vicinity of the outfall (Dojiri & Brantley 1991). During the July/August and November 1998, and February and May 1999 trawls, several specimens of California halibut, *Paralichthys californicus* (Ayers), were collected with parasitic copepods within the gill cavity. These parasites represent a new species of *Acanthochondria,* which is described below.

Materials and methods.—The fishes were collected in Santa Monica Bay, California. Quarterly otter trawls were made aboard the R/V *La Mer* in association with the Environmental Monitoring Division, Bureau of Sanitation, Department of Public Works, City of Los Angeles. Immediately after the catch was brought on board, the fishes were placed in plastic bags and kept on ice in a cooler for a later examination in the laboratory. The copepods were removed and preserved in 70% isopropyl alcohol, then cleared in 85% lactic acid. They were measured with an ocular micrometer and selected specimens were dissected. Illustration were drawn with the aid of a camera lucida. Holotype and paratypes were deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (1001623–1001628). Additional specimens are in the collection of the author.

Systematic Account

Order Poecilostomatoida Thorell, 1859
Family Chondracanthidae
Milne-Edwards, 1840
Genus *Acanthochondria* Oakley, 1927
Acanthochondria hoi, new species
Figs. 1–3

Material examined.—A total of seven nonovigerous and 22 ovigerous females

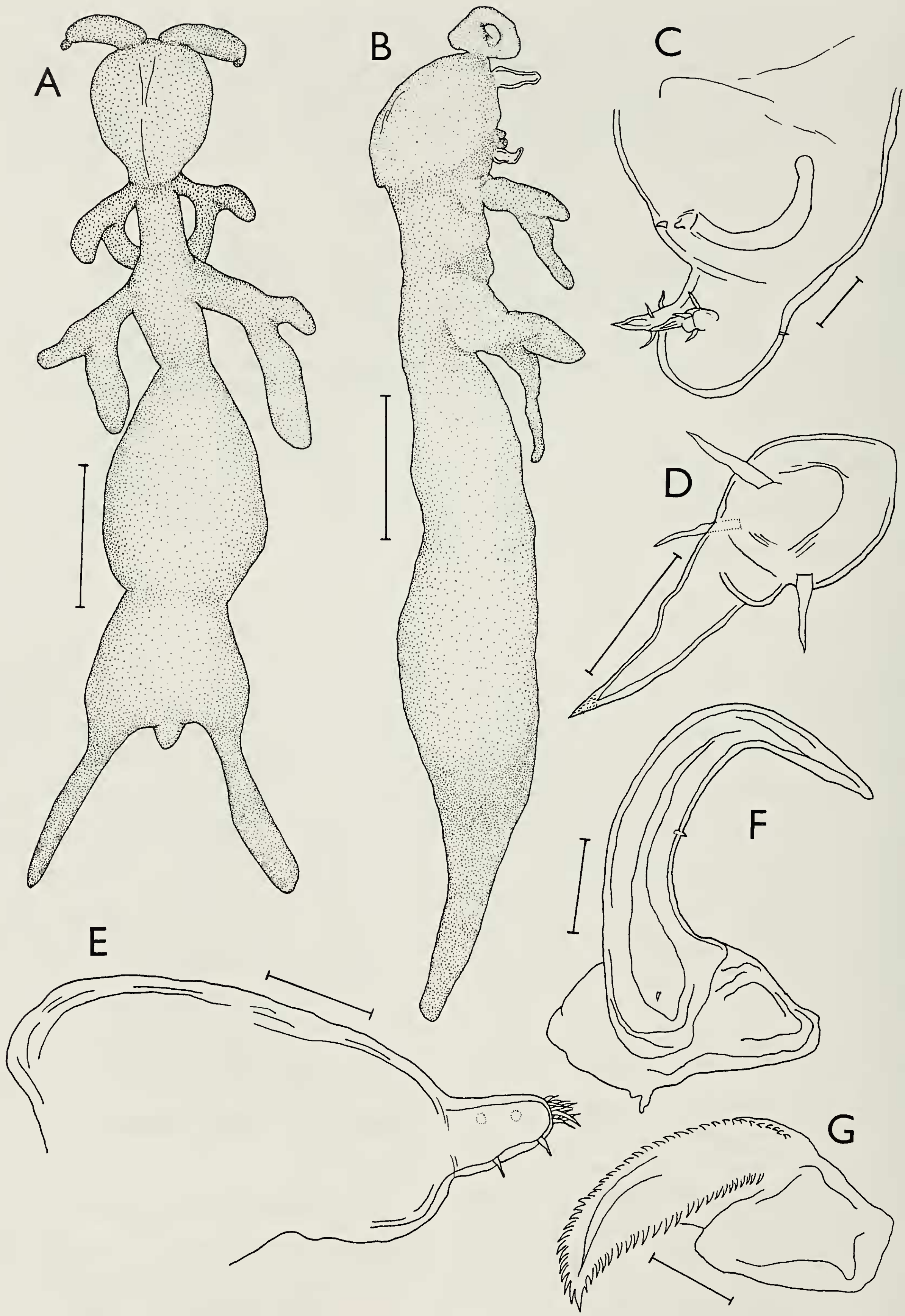

Fig. 1. *Acanthochondria hoi* n. sp., female. A, habitus, dorsal; B, habitus, lateral; C, genito-abdomen, lateral; D, caudal ramus; E, antennule; F, antenna; G, mandible. Scale: 1.0 mm in A, B; 0.1 mm in C, F; 0.05 mm in D, G; 0.2 mm in E.

(each with an attached male) was collected from within the gill cavity (inner side of operculum and floor of oral cavity at the base of gill arches) of the California halibut, *Paralichthys californicus* (Ayers).

Female.—The trunk (Fig. 1A, B) is long and slender. The cephalosome is slightly longer than wide. Neck region consisting of first and second pedigers. Trunk with a single mid-lateral indentation and bearing a pair of posterior processes, which are moderately long and slender. The genital segment (Fig. 1C) is longer than wide; and the abdomen (Fig. 1C) is shorter than the genital segment and bears two dorsal setules. The caudal ramus (Fig. 1D) has three setae, a knob, and a large spinulated terminal process. The antennule (Fig. 1E) is of Type B-V (Ho & Kim 1995), consisting of a large unarmed basal portion and a small cylindrical distal portion with an armature formula of 2-2-8. The antenna (Fig. 1F) is 2-segmented; the basal segment is large and unarmed; the terminal claw possesses a small mid-lateral seta and a minute basal setule. The mandible (Fig. 1G) is 2-segmented; convex margin armed with 31–35 teeth, concave margin has 21–24 teeth.

The maxillule (Fig. 2A) is a lobe bearing two processes produced at the distal margin of the appendage. The maxilla (Fig. 2B) is 2-segmented, with the basal segment unarmed. The terminal segment carries a small seta, a large seta, and a large process armed with 15 teeth along its posterior margin. The maxilliped (Fig. 2C) is 3-segmented; the first segment is unarmed; the second segment bears a protruded portion on which one patch of spinules is located and a row of 12 teeth on the distal margin; the terminal segment is clawlike, bearing a proximal patch of small spinules and a subterminal accessory process. Leg 1 (Fig. 2D) is biramous with the exopod bearing an outer seta. The anterior surface is covered with irregular patches of spinules. Leg 2 (Fig. 2E) is biramous with long rami. The exopod carries an outer seta. The rami bear spinules at the distal tips of the anterior surfaces in addition to several setules.

Measurements.—Total length (tip of cephalosome to tip of posterior process) 6.84 mm; trunk width 0.44 mm; cephalosome 0.39 mm × 0.35 mm; genital segment 0.47 mm × 0.44 mm; abdomen 0.19 mm × 0.16 mm; posterior process 1.32 mm.

Male.—The body (Fig. 3A), 0.67 mm × 0.34 mm, is ventrally flexed. The cephalosome and the first pedigerous segment comprise more than half the total length. The antennule (Fig. 3B) is slender and bears an armature formula of 1-1-2-2-8. The antenna (Fig. 3C) is 2-segmented. The basal segment possesses a rounded knob near the articulation with the terminal claw. The terminal segment bears two setae on the basal portion. The mandible (Fig. 3D) is 2-segmented; terminal segment armed with 20 teeth along convex margin, 9 teeth along concave margin. The maxilla (Fig. 3E) is 2-segmented and exhibits the usual sexual dimorphism for this genus by possessing a naked terminal process. Leg 1 (Fig. 3F) is larger than leg 2 (Fig. 3G). Both legs are similarly armed, with the protopod bearing a long outer seta, the exopod with two small elements, and the endopod a smaller unarmed lobe. However, the two elements on the exopod of leg 2 are unequal in size.

Etymology.—This species is named after Dr. Ju-Shey Ho, an expert in parasitic copepod research and my mentor and former advisor.

Remarks.—*Acanthochondria hoi,* new species, was previously reported by Dojiri (1977) as *Acanthochondria* sp. C. However, a literature search revealed that a description of this species was never published. Ho (1975) tentatively identified a badly damaged specimen of *Acanthochondria* from the California halibut as *A. soleae* (?). In addition, Haaker (1975) and Allen (1990) reported *A. soleae* to occur on the California halibut, directly and indirectly citing Ho (1975), respectively. Ho's (1975) specimen is probably identifiable with *A. hoi.* Kabata (1979) comments that the literature contains

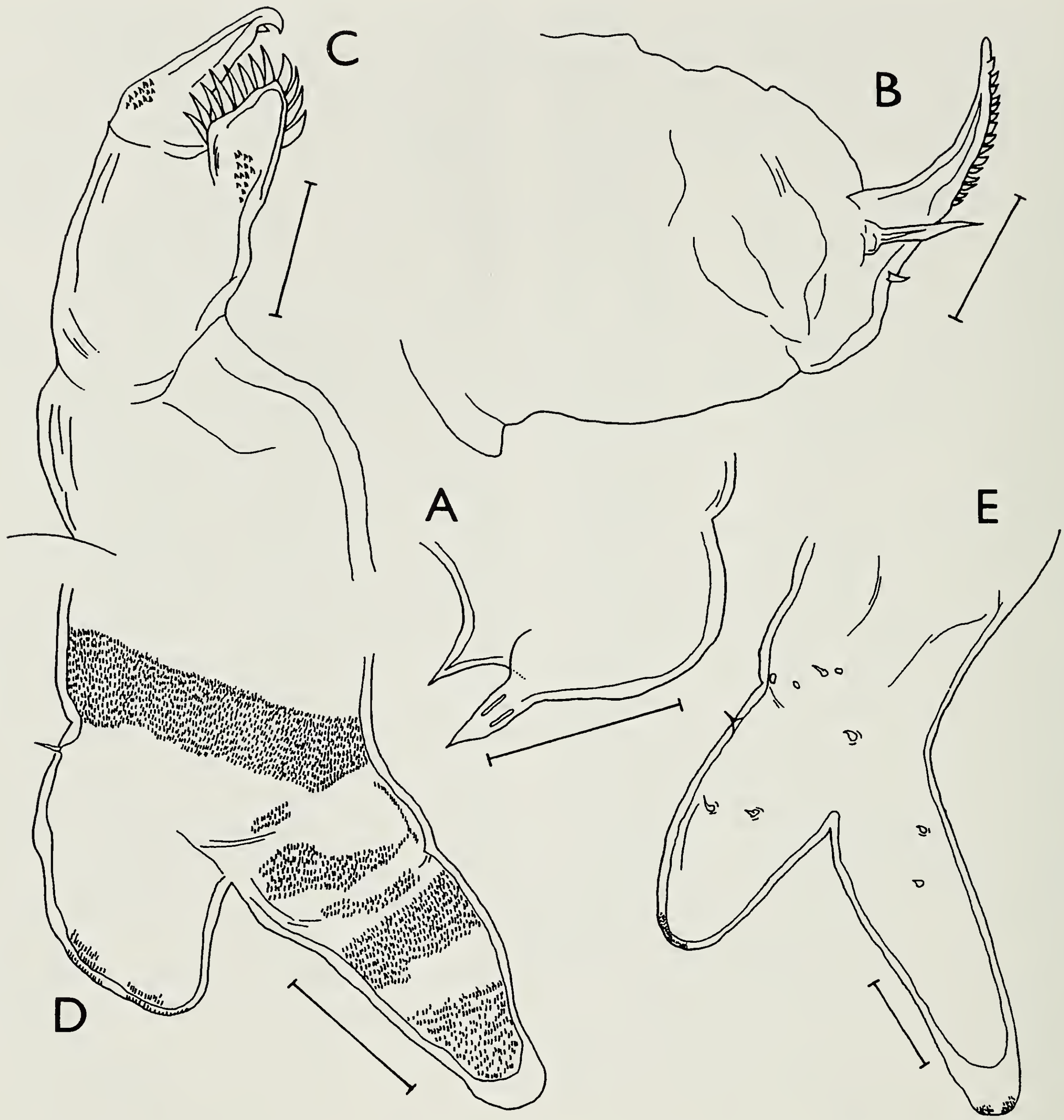

Fig. 2. *Acanthochondria hoi* n. sp., female. A, maxillule; B, maxilla; C, maxilliped; D, leg 1; E, leg 2. Scale: 0.05 mm in A, B, C; 0.3 mm in D, E.

a number of erroneous host listings of *A. soleae*. *A. soleae* is parasitic mainly on the sole, *Solea solea,* and its distribution is restricted to the Atlantic Ocean (Kabata 1979). *A. hoi* differs from *A. soleae* in the relative lengths of the endopod and exopod, leg 1 ornamentation, and structure of the maxilliped.

Acanthochondria hoi is distinguished from its congeners by the combination of a Type B-V antennule and Type A leg 2 (Ho & Kim 1995), in addition to leg 1 ornamentation. Legs 1 and 2 have relatively long rami with the endopod noticeably longer than the exopod. A check into the key of *Acanthochondria* prepared by Ho and Kim (1995) revealed that this specimen collected from the California halibut is new to science. This specimen keyed out to step 33a, which is equivalent to *A. exilipes* (Ho 1971). Table 1 lists differences between *A. hoi* and *A. exilipes.*

Key to the Species of *Acanthochondria*

The following revised key includes all accepted species of *Acanthochondria* (Ho & Kim 1995). Three new species were add-

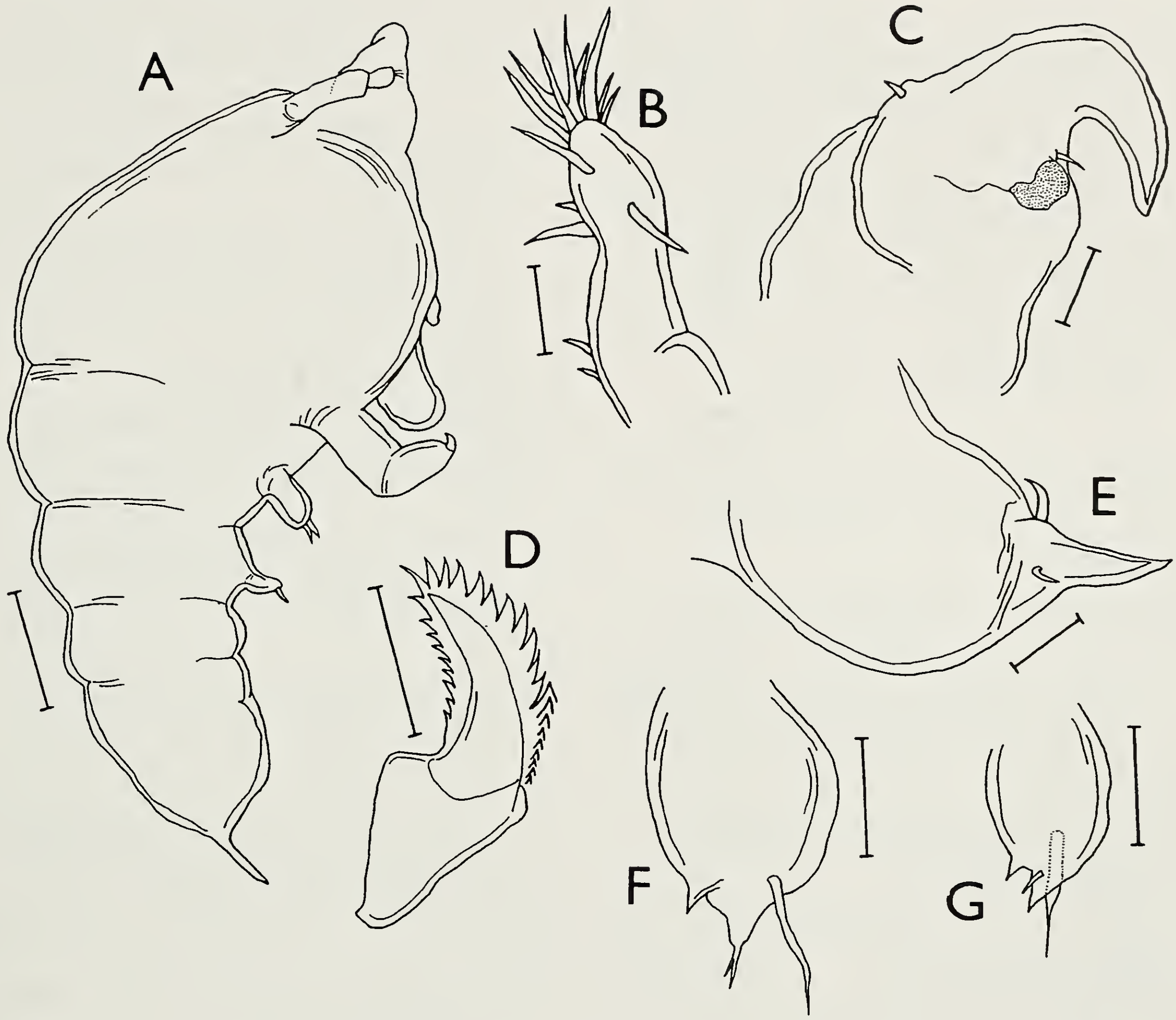

Fig. 3. *Acanthochondria hoi* n. sp., male. A, habitus, lateral; B, antennule; C, antenna; D, mandible; E, maxilla; F, leg 1; G, leg 2. Scale: 0.1 mm in A; 0.02 mm in B, C, D, E, F, G.

ed, *A. kajika* (Ho & Kim 1996), *A. zebriae* (Ho et al. 2000), and *A. hoi* (Kalman, this report), increasing the number of species to 46. In addition, all typographical errors have been corrected (most notable, from Ho and Kim (1995): step 16b should lead to step 29, not step 28 as previously noted; *A. cyclopsetta, A. exilipes, A. galerita,* and *A. physidis* should all be cited as Ho 1971, not Ho 1970 as previously noted).

Poly and Mah (2001) deeply criticize some of the characters used in the key by Ho and Kim (1995). However, this revised key is still valid and useful until further morphological characters can be discovered for some nominal species where the host

Table 1.—Differences between *Acanthochondria exilipes* and *A. hoi.*

	A. exilipes	*A. hoi*
Antennule type	B-III	B-V
Teeth on mandible	37–41 on convex margin 32–34 on concave margin	31–35 on convex margin 21–24 on concave margin
Maxillule	2 patches of spinules	naked
Leg 1 ornamentation	naked	patches of spinules
2nd segment of maxilliped	2 patches of spinules	1 patch of spinules and 12 teeth on outer margin

family is used as a "character". Thus, the publication containing the best information to aid in species identification is provided in parentheses after each species name.

The males of *Acanthochondria* do not show species differences; therefore, the characters used in this key refer strictly to adult ovigerous females (Ho 1970). For types of antennule and leg 2 found in this key, refer to Ho and Kim (1995).

1a Neck region consisting of first pediger only 2
b Neck region consisting of first and second pedigers 4
c Neck region consisting of second pediger only; first pediger incorporated into head region . . . . *triglae* (Herrera-Cubilla & Raibaut 1990:82–87)
2a Second pediger indistinguishably fused to trunk 3
b Second pediger distinctly separated from trunk and bearing a pair of large rounded swellings . . . . *limandae* (Kabata 1979:127–128)
3a Antenna of B-VII type . . . . . *laemonemae* (Capart 1959:102–103)
b Antenna of B-III type . . . . *lepidionis* (Ho 1972a:147–149)
c Antenna of B-I type . . . . *zebriae* (Ho et al. 2000:711–713)
4a Neck very long, at least 8 times longer than wide 5
b Neck moderately long, at most about 3 times as long as wide; leg 2 with extremely long protopod (Type E) 6
c Neck short; at most slightly longer than wide; protopod of leg 2 not greatly elongated 8
5a Posterolateral processes short and blunt; terminal process of maxilla bearing a short row of fine denticles . . . . *diastema* (Ho & Dojiri 1988:273–279)
b Posterolateral processes long and slender; terminal process of maxilla bearing a long row of large teeth . . *uranoscopi* (Ho & Kim 1995:48–51)
6a Endopod of leg 2 much reduced, represented by a little knob . . . . *tchangi* (Shiino 1959:361)
b Endopod of leg 2 at least half as large as exopod 7
7a Cephalosome about as long as wide; parasite of Platycephalidae . . *platycephali* (Ho 1973:127–130)
b Cephalosome distinctly longer than wide; parasite of fishes other than Platycephalidae . . . . *inimici* (Dojiri & Ho 1988:47–53)
8a Trunk cylindrical, long (at least twice longer than wide), and without lateral indentations 9
b Trunk appearance otherwise 11
9a Posterolateral processes shorter than head; caudal ramus shorter than abdomen 10
b Posterolateral processes longer than head; caudal ramus distinctly longer than abdomen . . . . *elongata* (Pillai 1985:125–127)
10a Cephalosome with small rounded knob at each anterior corner; hook-like antenna curved in distal region . . . . *fraseri* (Ho 1972b:523–527)
b Cephalosome with large anterolateral swellings; hook-like antenna curved in basal region . . . . *pingi* (Yü & Wu 1932:66–68)
11a Trunk trapezoidal; postoral region elongated . . . . *dilatata* (Shiino 1955:107–110)
b Trunk shaped otherwise; leg 1 close to oral region 12
12a Cephalosome bearing a pair of lateral horn-like projections; trunk without lateral indentations . . . . *bicornis* (Shiino 1955:103–107)
b Cephalosome without such projections; trunk mostly with lateral indentations 13
13a Leg 2 long and slender (Type D) . . . 14
b Leg 2 shaped otherwise 15
14a Posterolateral processes long, as long as or longer than 4th pediger . . . . *soleae* (Kabata 1979:128–129)
b Posterolateral processes short, distinctly shorter than 4th pediger . . . *cyclopsetta* (Ho 1971:3)
15a Legs 1 and 2 indistinctly bilobated (Type B) . . . . *physidis* (Ho 1971:11–15)
b Legs 1 and 2 distinctly bilobated . . . 16
16a Antennule without inflated basal part (Type A) 17

b Antennule with inflated basal part (Type B) 30
17a Leg 2 slightly larger than leg 1 18
b Leg 2 distinctly larger than leg 1 ... 24
18a Both legs 1 and 2 covered with spinules 19
b Both legs 1 and 2 without spinules or bearing at most only patches of spinules 20
19a First pediger with lateral protuberance ...... *sixteni* (Dojiri & Ho 1988:53–56)
b First pediger without such protuberance ... *dojirii* (Kabata 1984:1708–1910)
20a Cephalosome distinctly longer (at least 1.38 times) than wide 21
b Cephalosome about as long as wide .. 22
21a Distal part of leg rami covered with spinules .... *vancouverensis* (Kabata 1984:1710)
b Distal part of leg rami not covered with spinules .... *glandiceps* (Shiino 1955:93–96)
22a Trunk about as long as wide 23
b Trunk distinctly longer than wide .... *spirigera* (Shiino 1955:100–103)
23a Parasitic on Sillaginidae .... *shawi* (Yü 1935:7–9)
b Parasitic on Gobiidae .... *yui* (Shiino 1964:30–33)
24a Terminal process of maxilla armed with a long row of teeth (about 15) .. 25
b Terminal process of maxilla armed with a short row of teeth (at most 11) 26
25a Cephalosome round in dorsal view .. .. *brevicorpa* (Yamaguti 1939:535)
b Cephalosome pear-shaped in dorsal view .... *longifrons* (Shiino 1955:86–89)
26a Both legs bearing large, prominent patches of spinules .... *margolisi* (Kabata 1984:1705)
b Both legs naked or with small patches of spinules 27
27a Trunk distinctly longer than wide and with prominent lateral indentations ... 28
b Trunk about as long as wide with slight lateral indentations 29
28a Parasitic on Serranidae .... *constricta* (Shiino 1955:96–100)
b Parasitic on Pleuronectidae .. *hippoglossi* (Kabata 1987:215)
29a Labrum with lateral protrusion, legs 1 and 2 tipped with spinules on both rami .. *kajika* (Ho & Kim 1996:276–279)
b Labrum without lateral protrusion, legs 1 and 2 naked .... *fissicauda* (Shiino 1955:90–93)
30a Cephalosome with two lateral round swellings on ventral surface of head; antennule with prominent ventral protuberance .... *clavata* (Kabata 1979:126–127)
b Cephalosome and antennule without such features 31
31a Both rami of leg 2 large, coniform (Type C); a pair of large protuberances lateral to labrum in oral area ... *galerita* (Ho 1971:8–11)
b Leg 2 and oral area without such features 32
32a Leg 2 distinctly larger than leg 1 ... 33
b Leg 2 only slightly larger than leg 1 37
33a Trunk wider than long; posterolateral processes short and blunt .... *tasmaniae* (Heegaard 1962:154–155)
b Trunk about as long as wide; posterolateral processes long .... *priacanthi* (Ho & Kim 1995:53–56)
c Trunk distinctly longer than wide; posterolateral processes either long or short 34
34a Endopod of leg 2 about as long as protopod 35
b Endopod of leg 2 distinctly shorter than protopod 36
35a Antennule of B-III type; leg 1 naked .... *exilipes* (Ho 1971:3–7)
b Antennule of B-V type; leg 1 with patches of spinules .... *hoi* (Kalman this report)
36a Terminal process of maxilla bearing less than 10 teeth .... *epachthes* (Kabata 1968:339–344)
b Terminal process of maxilla armed with at least 15 teeth .... *oralis* (Yamaguti 1939:536–537)
37a Trunk as long as wide or slightly longer than wide 38
b Trunk distinctly longer than wide ... 40
38a Cephalosome large, as wide as trunk and bearing a pair of anterolateral protuberances .... *macrocephala* (Ho & Kim 1995:46–48)

b Cephalosome distinctly narrower than trunk, without protuberance 39
39a Cephalosome slightly longer than wide; endopod of leg 2 distinctly longer than exopod .... *incisa* (Shiino 1955:83–86)
b Cephalosome distinctly longer than wide; endopod of leg 2 about as long as exopod ... *ophidii* (Ho 1977:158–160)
40a Cephalosome about as long as wide; both legs covered with spinules .... *rectangularis* (Kabata 1984:1705)
b Cephalosome wider than long; both legs with spinules on rami only 41
41a Cephalosome with two prominent lateral protrusions; antennule of Type B-II .... *sicyasis* (Ho 1977:160–164)
b Cephalosome with swollen oral region; antennule of Type B-V .... *cornuta* (Ho 1970:121–127)

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