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Four species of *Caligus* Müller, 1785 (Copepoda, Siphonostomatoida, Caligidae) parasitic on marine fishes of Taiwan

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Abstract

Four species of *Caligus*, with two new species, are reported from five species of marine fishes of Taiwan. They are: *Caligus arii* Bassett-Smith, 1898 on the body surface of *Trichiurus lepturus* Linnaeus, *Caligus dasyaticus* Rangnekar, 1957 on the body surface of *Dasyatis navarrae* (Steindachner), *Caligus dactylus* n. sp. on the gill filaments of *Dactyloptera peterseni* (Nyström), and *Caligus lutjani* n. sp. in the oral/gill cavities of *Lutjanus argentimaculatus* (Forsskål) and *Lutjanus bohar* (Forsskål). Both *C. arii* and *C. dasyaticus* are reported for the first time from Taiwan. *Caligus dactylus* differs from its congeners by the possession of the following combination of features: large myxal process on the maxilliped; a pair of parallel tines on the sternal furca with truncate tip; simple elements (without accessory process) at the tip of leg 1 exopod; and an armature formula of I-0; I,III on leg 4. *Caligus lutjani* is distinguished by carrying a two-segmented abdomen; a pair of diverged tines on the sternal furca with acute tip; an accessory process on the middle two of the terminal four elements on the exopod of leg 1; and a bipectinate, spiniform process on the exopod of leg 4 at the insertion of each of the five outer spines.

Keywords: *Caligus*, marine fishes, new species, parasitic copepods, Taiwan

Introduction

Although 34 species of sea lice belonging to *Caligus* Müller, 1785 have been reported from Taiwan (Ho and Lin 2004), continuous examination of marine fishes landed at various fishing ports on Taiwan has yielded 21 more species of unrecorded congeners. In this paper we shall report four species, two of them new to science. The two known species, *Caligus arii* Bassett-Smith, 1898 and *Caligus dasyaticus* Rangnekar, 1957, are rare. We have found so far only one female specimen each in 10 years of examination of fishes of Taiwan for parasitic copepods.

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Materials and methods

Fishes caught and landed at fishing ports on Taiwan were purchased and transferred in an icebox to the National Chiayi University, where fishes were examined under a dissection microscope for the copepod parasites. The copepod parasites removed from the fish hosts were preserved in 70% ethanol. They were later cleared in 85% lactic acid for 1–2 h before dissection in a drop of lactic acid on a wooden slide (Humes and Gooding 1964). The removed body parts and appendages were examined under the compound microscope with a series of magnifications up to $1500\times$. All drawings were made with the aid of a camera lucida and measurements, in millimeters unless mentioned otherwise, were taken after soaking the specimens in lactic acid. In cases where there were more than 10 specimens in the collection, measurements were taken from 10 randomly selected specimens.

Descriptions

In the following descriptions, only those features showing sexual dimorphism are given in the cases when the male is available.

Caligus arii Bassett-Smith, 1898 (Figures 1, 2)

Material examined

One adult ♀ on body surface of *Trichiurus lepturus* Linnaeus collected on 14 June 2004 at Dong-shi Fishing Port of Chiayi County.

Female

Body (Figure 1A) 5.82 long, excluding setae on caudal ramus. Cephalothoracic shield subcircular, 2.12 long and 2.02 wide, excluding lateral, hyaline membrane. Fourth pediger distinctly wider than long, 0.22×0.54 . Genital complex, 1.86×1.18 , bottle-shaped, with posterolateral corners slightly protruded posteriorly. Abdomen (Figure 1A) with two unequal segments, proximal segment longer than wide 1.66×0.42 , and anal segment wider than long but measuring only $146\times 348\mu\text{m}$. Caudal ramus (Figure 2E) attaching to posterolateral surface of anal segment, distinctly wider than long, $28\times 64\mu\text{m}$; armed with three short and three long setae. Egg sac not seen.

Antennule (Figure 1B) two-segmented; proximal segment carrying on anterodistal surface 25 setose and two naked setae (on dorsal side), distal segment short, about 2.42 times as long as wide, with one subterminal seta on posterior margin and 11 setae plus two aesthetascs on distal margin. Antenna (Figure 1C, with broken tip) three-segmented; proximal segment smallest, with spatula-like process on posteromedial corner; second segment subrectangular and unarmed; distal segment long, curved claw bearing two setae, one proximal and other one close to medial region. Postantennal process lacking, except two usual, setule-bearing papillae. Mandible (Figure 1D) with four sections; bearing 12 teeth on medial margin of distal blade. Maxillule (Figure 1C) comprising stout dentiform process and basal papilla with two short and one long setae. Maxilla (Figure 1E) two-segmented; proximal segment (lacertus) unarmed; slender distal segment (brachium) carrying subterminal, hyaline membrane on outer edge, terminal calamus slightly longer than subterminal canna. Maxilliped (Figure 1F) three-segmented; proximal segment (corpus) unarmed, twice as long as next two segments

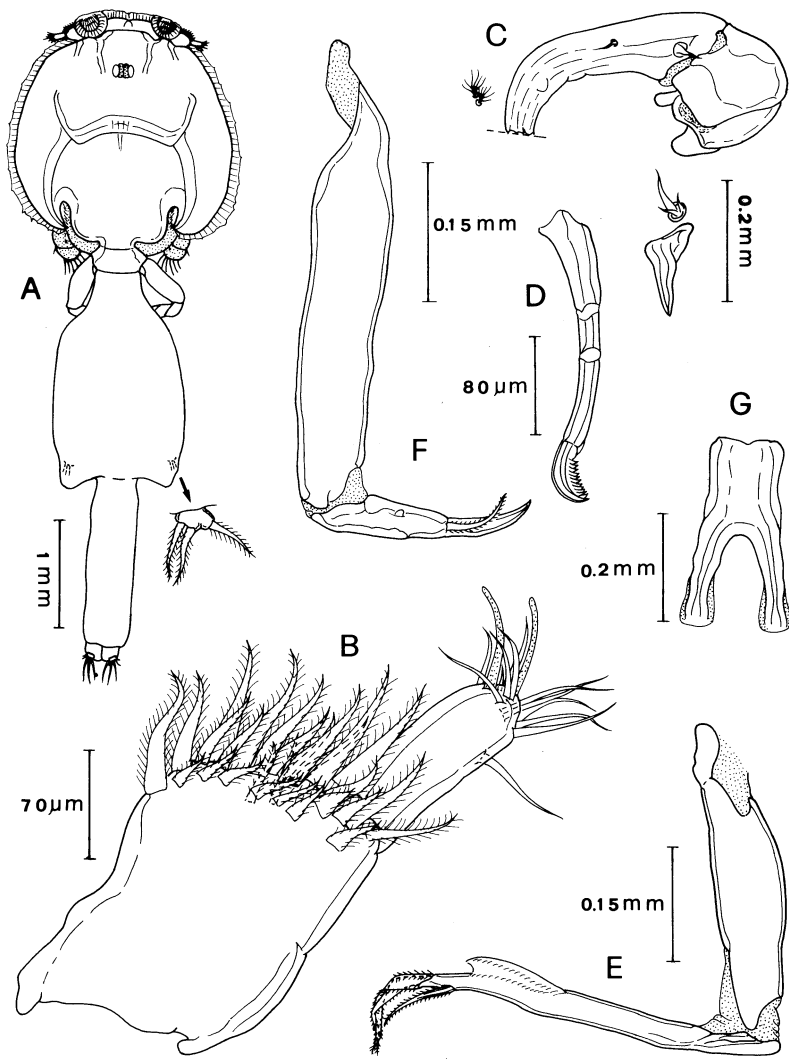


Figure 1. *Caligus arii* Bassett-Smith, adult female. (A) Habitus, dorsal; (B) antennule; (C) antenna, postantennal process, and maxillule; (D) mandible; (E) maxilla; (F) maxilliped; (G) sternal furca.

combined (subchela); middle (shaft) segment armed distally with a pinnate seta and in middle region small, blunt element; distal (claw) segment sharply pointed and slightly bent. Box of sternal furca (Figure 1G) subsquare, carrying two tines with truncate tip.

Armature on rami of legs 1–4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

	Exopod	Endopod
Leg 1	1-0; III,1,3	(Vestigial)
Leg 2	I-1; I-1; II,1,5	0-1; 0-2; 6
Leg 3	I-1; I-1; III,5	0-1; 6
Leg 4	I-0; I-0; III	(Absent)

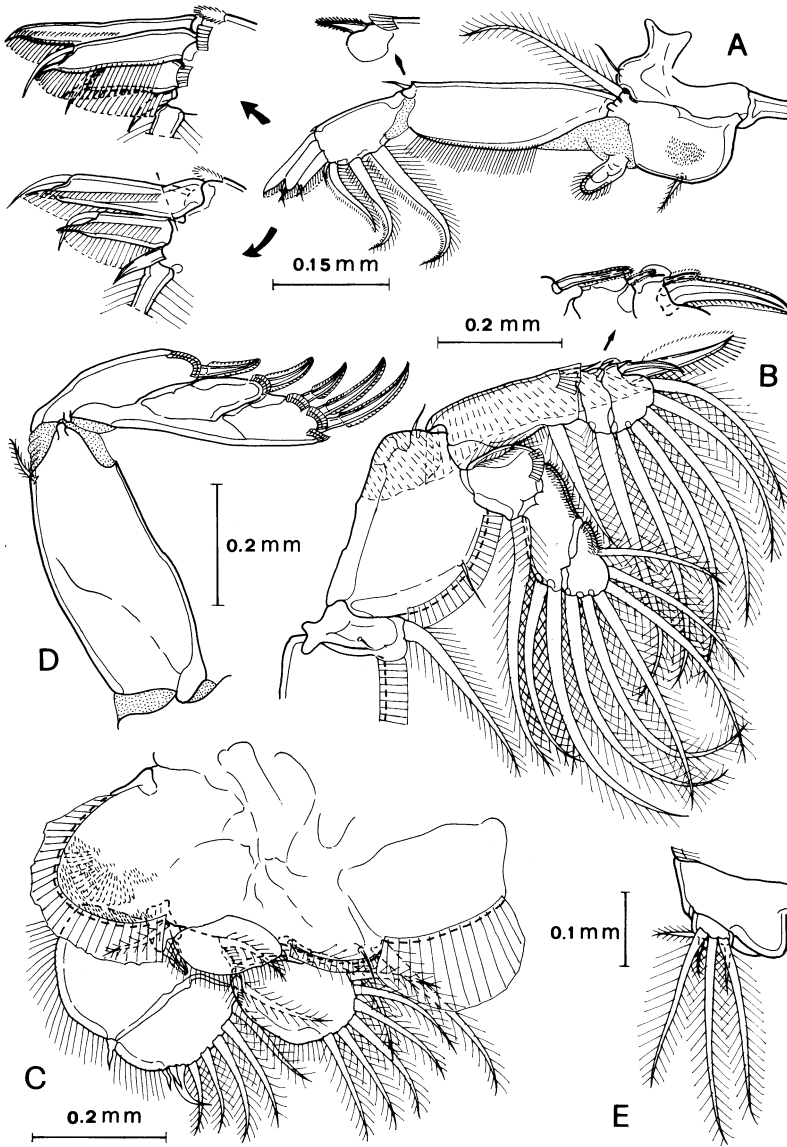


Figure 2. *Caligus arii* Bassett-Smith, adult female. (A) Leg 1, with tip shown in ventral view (upper insertion) and dorsal view (lower insertion); (B) leg 2; (C) leg 3; (D) leg 4; (E) left half of anal somite and caudal ramus, ventral.

Leg 1 (Figure 2A) protopod with long, plumose, outer seta and another small, plumose, inner seta in addition to a patch of spinules on ventral surface; vestigial endopod fringed with setules around distal region; first segment of exopod with row of setules on posterior edge and short spiniform seta at outer distal corner; outer three of four terminal elements on last segment of exopod with sharply pointed, slender tip and hyaline membrane on posterior margin, middle two elements with long accessory process and element four with a small, spiniform seta. Leg 2 (Figure 2B) coxa small, with large

plumose inner seta on posterior edge and setule-bearing papilla on ventral surface; basis with simple, outer seta and medial papilla bearing long setule; both outer and medial edges of protopod fringed with large marginal membrane; similar membrane on outer margin of elongated, proximal segment of exopod; basal segment of endopod with small distolateral membrane, but terminal two segments bearing rows of setules on outer surface. Leg 3 (Figure 2C) protopod (apron) with short, outer and long, inner seta; large marginal membrane on outer edge and another marginal membrane on posterior edge of basis inner to velum; setule-bearing papilla on basis near both ends of this posterior membrane; and a patch of spinules on lateral edge of ventral surface of protopod. Leg 4 (Figure 2D) protopod with small, plumose, outer seta; pectens on three exopodal segments at insertion of each of five outer spines. Leg 5 (inserted drawing in Figure 1A) represented by three small, plumose setae on a protuberance located on posterolateral margin of genital complex.

Remarks

This is the first record of *C. arii* from a host other than a marine catfish. However, we consider the carrier of our *C. arii*, a largehead hairtail, *Trichiurus lepturus* Linnaeus, to be a fortuitous host, because we have examined in the past 10 years no fewer than 1000 *T. lepturus*, and only one female *C. arii* has been recovered from them. Nevertheless, our specimen from Taiwan fits very well with the description of the syntype (reg. no. is 98.12.2.9, in the Natural History Museum, London) given by Pillai (1969). The characteristic features of the present species are: (1) two-segmented, long abdomen with tiny anal segment; (2) minute caudal ramus attaching subterminally to anal segment; (3) absence of postantennal process; (4) maxilliped with slender corpus; and (5) reduced proximal segment and spine on leg 3 exopod.

If Kirtisinghe's (1964) proposal to move Barnard's (1955) "*Caligus arii* B-S." to *Caligus dakari* van Beneden, 1892 is correct, then, *C. arii* is so far known only from Ceylon (Bassett-Smith 1898) and India (Pillai 1963). This means that the present report is the first record of *C. arii* outside of the Indian Ocean.

***Caligus dasyaticus* Rangnekar, 1957** (Figures 3, 4)

Material examined

One adult ♀ on body surface of *Dasyatis navarrae* (Steindachner) collected on 15 April 2005 at Dong-shi Fishing Port of Chiayi County.

Female

Body (Figure 3A) 5.62 long, excluding setae on caudal ramus. Cephalothoracic shield slightly longer than wide, 2.96×2.78 , excluding lateral, hyaline membrane. Fourth pediger slightly wider than long, 0.48×0.58 . Genital complex like a wide-mouthed bottle, 1.14×1.04 . Abdomen, 0.92×0.54 , with wider anterior half; narrow posterior half with central furrow on posterodorsal part (Figure 3A). Caudal ramus (Figure 3H) slightly longer than wide, 0.18×0.16 , with narrow base and armed with usual three short and three long plumose setae. Egg sac not seen.

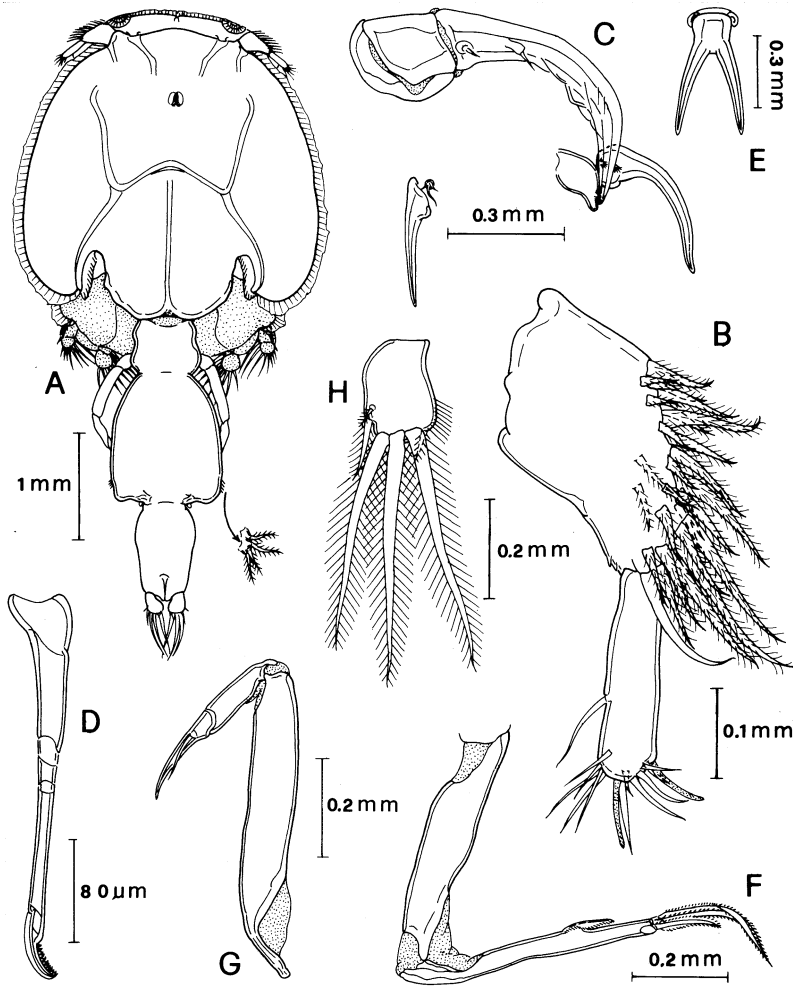


Figure 3. *Caligus dasyaticus* Rangnekar, adult female. (A) Habitus, dorsal; (B) antennule; (C) antenna, postantennal process, and maxillule; (D) mandible; (E) sternal furca; (F) maxilla; (G) maxilliped; (H) caudal ramus, ventral.

Antennule (Figure 3B) two-segmented; proximal segment carrying on anterodistal surface 24 setose and three naked setae (two dorsal and one terminal), distal segment armed as in *C. arii* but relatively longer, about 3.7 times as long as wide. Antenna (Figure 3C) three-segmented; first two segments small and unarmed; distal segment long claw with uneven medial margin, one small seta in basal region, and another one at about one-third length from base. Postantennal process (Figure 3C) comprising a long, bent claw with two setule-bearing basal papillae and a bluntly pointed lobe with small subterminal protuberance. Mandible (Figure 3D) as in *C. arii*. Maxillule (Figure 3C) comprising long, slender dentiform process and tiny basal papilla with two short and one long setae. Maxilla (Figure 3F) essentially as that in *C. arii*. Maxilliped (Figure 3G) slender as in *C. arii*. Box of

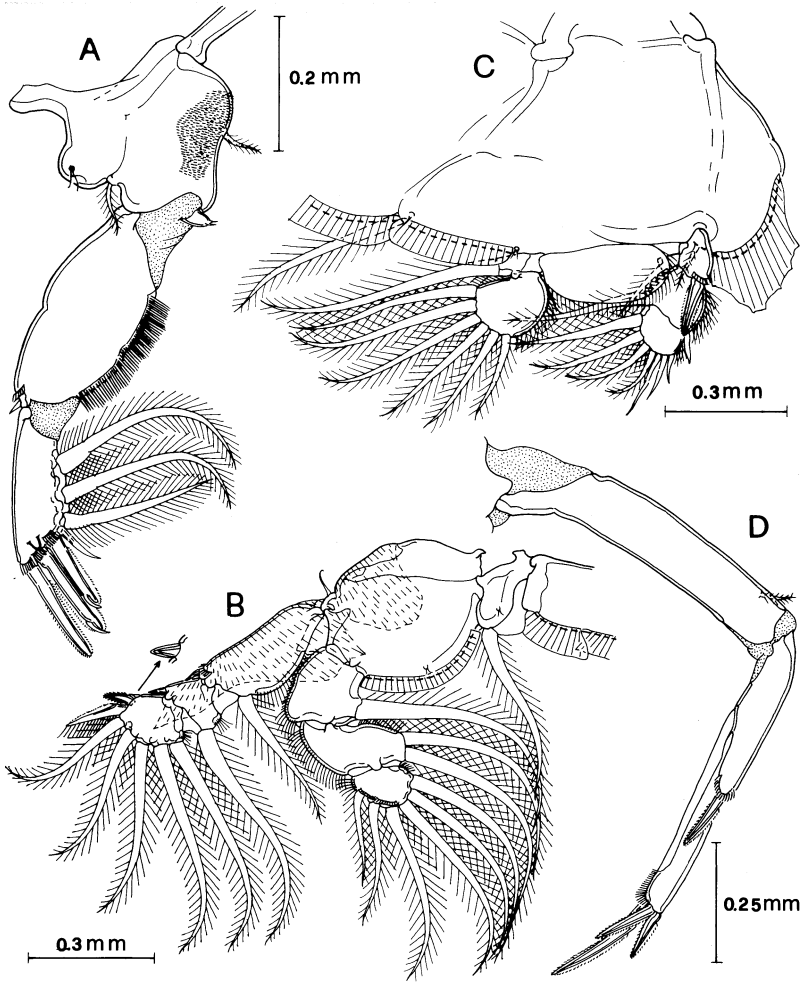


Figure 4. *Caligus dasyaticus* Rangnekar, adult female. (A) Leg 1; (B) leg 2; (C) leg 3; (D) leg 4.

sternal furca (Figure 3E) small, with ear-like projections at base and two slender tines at terminal end.

Armature on rami of legs 1–4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

	Exopod	Endopod
Leg 1	I-0; III,I,3	(Vestigial)
Leg 2	I-1; I-1; II,I,5	0-1; 0-2; 6
Leg 3	I-1; I-1; III,4	0-1; 6
Leg 4	I-0; III	(Absent)

Leg 1 (Figure 4A) protopod protruded laterally and bearing papilla tipped with two setules, also carrying plumose, outer seta and another similar inner seta in addition to a

large patch of spinules on ventral surface; vestigial endopod tipped with two tiny setae; first segment of exopod with row of setules on posterior edge and small hyaline membrane at base of short, spiniform, outer seta; middle two of four terminal elements on last segment of exopod bearing long accessory process; fourth element small as in *C. arii*; digitiform process on posterior surface close to pectens at base of outer three terminal elements. Leg 2 (Figure 4B) essentially armed and decorated as in *C. arii*, except for papilla on ventral surface of coxa and basis carrying two tiny setules instead of single, long setule. Leg 3 (Figure 4C) protopod (apron) with short, outer and long, inner seta; marginal membrane on posterior edge of basis except portion with velum; setule-bearing papilla on basis near both ends of inner marginal membrane; pecten on proximal segment of exopod close to insertion of outer spine. Leg 4 (Figure 4D) slender; protopod with small, plumose, outer seta; tip of exopod with two short, outer and one long, inner spines; pecten on exopodal segments at insertion of proximal outer spine and distal inner spine. Leg 5 (inserted drawing in Figure 3A) represented by four small, plumose setae on a protuberance located on posterolateral margin of genital complex.

Remarks

Since this species has been reported to occur on the stingrays in India and Japan, it would be expected to be found on the stingray from Taiwan. While the specimen from Taiwan is unquestionably identical with those reported by Rangnekar (1957) from India and Shiino (1960) from Japan, it is noticeably different from that reported by Pillai (1968) from India. The main differences are found in Pillai's (1968) specimens with (1) the abdomen distinctly longer than the genital complex in the female; (2) the antenna bearing forked (instead of simple) terminal claw in the male; (3) the maxilliped equipped with a robust (instead of slender) corpus in both sexes; and (4) leg 4 tipped with three subequal (instead of distinctly unequal) spines in both sexes. Also, Pillai's (1968) specimens were obtained from the sawfish (*Pristis*) and not the stingray (*Dasyatis*). Thus, Pillai's (1968) "*Caligus dasyaticus*" very likely represents a different species. However, without the chance of examining the specimen, we shall refrain from making a formal proposal on the change of the scientific name.

Caligus dactylus n. sp. (Figures 5–7)

Material examined

Fifty-one ♀♀, 18 ♂♂ and two larvae on gill filaments of 23 starry flying gurnard, *Dactyloptena petersenii* (Nyström), collected on 28 May 2004 at Da-hsi Fishing Port of I-Lan County. Holotype female (USNM 1086716), allotype male (USNM 1086717), and 30 paratypes (USNM 1086718, 1086719; 20 ♀♀, 10 ♂♂) have been deposited in the US National Museum of Natural History, Smithsonian Institution, Washington, DC and the remaining paratypes and other specimens kept in the author's (CLL) collection.

Female

Body (Figure 5A) 2.55 (2.38–2.76) long, excluding setae on caudal ramus. Cephalothoracic shield subtriangular, 1.19 (1.08–1.30) × 1.15 (1.08–1.20), excluding

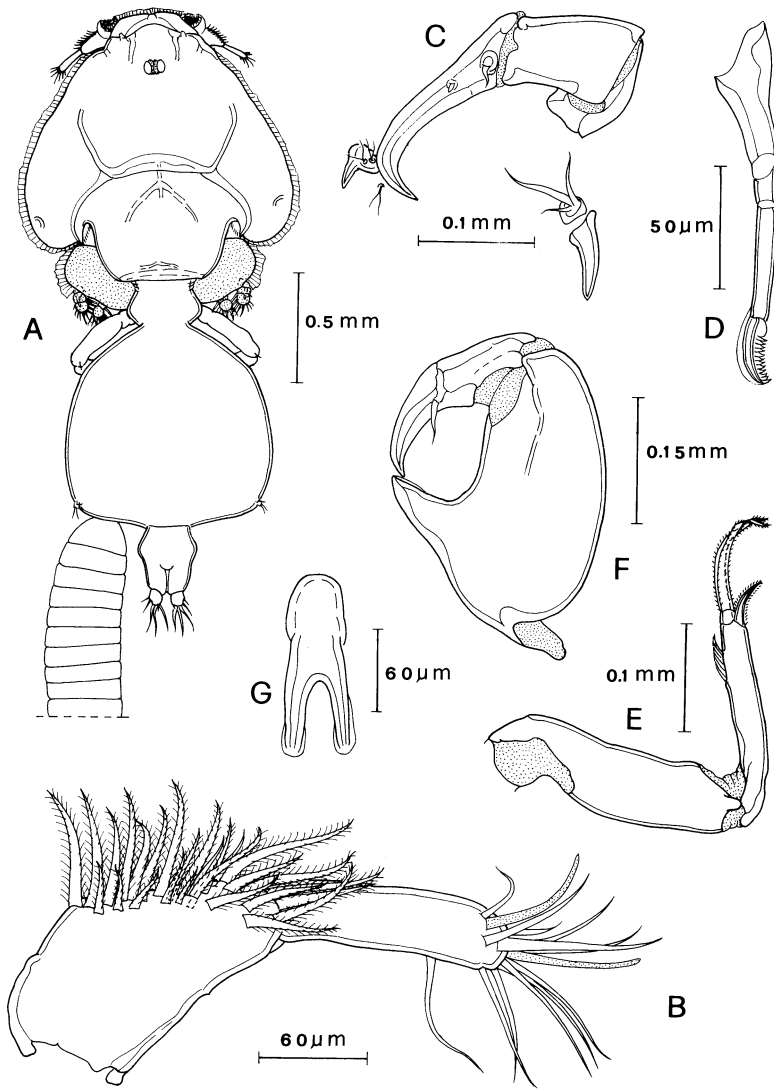


Figure 5. *Caligus dactylus* n. sp., adult female. (A) Habitus, dorsal; (B) antennule; (C) antenna, postantennal process, and maxillule; (D) mandible; (E) maxilla; (F) maxilliped; (G) sternal furca.

lateral hyaline membrane. Fourth pediger distinctly wider than long, $0.18 (0.15\text{--}0.22) \times 0.34 (0.30\text{--}0.36)$. Genital complex subsquare, $0.84 (0.78\text{--}0.90) \times 0.85 (0.76\text{--}0.90)$, with small knob in egg sac attachment area (Figure 7A). Abdomen (Figure 7A) one-segmented, with lateral bulge, $0.30 (0.25\text{--}0.34) \times 0.26 (0.24\text{--}0.28)$. Caudal ramus (Figure 7A) longer than wide, $70 (61\text{--}81) \times 55 (49\text{--}65) \mu\text{m}$, armed with usual three short and three long setae. Egg sac 2.45 long and containing 23 eggs.

Antennule (Figure 5B) two-segmented; both proximal and distal segments armed as in *C. arii*; distal segment long, about 3.75 times as long as wide. Antenna (Figure 5C) three-segmented; proximal segment smallest, unarmed; middle segment subrectangular and

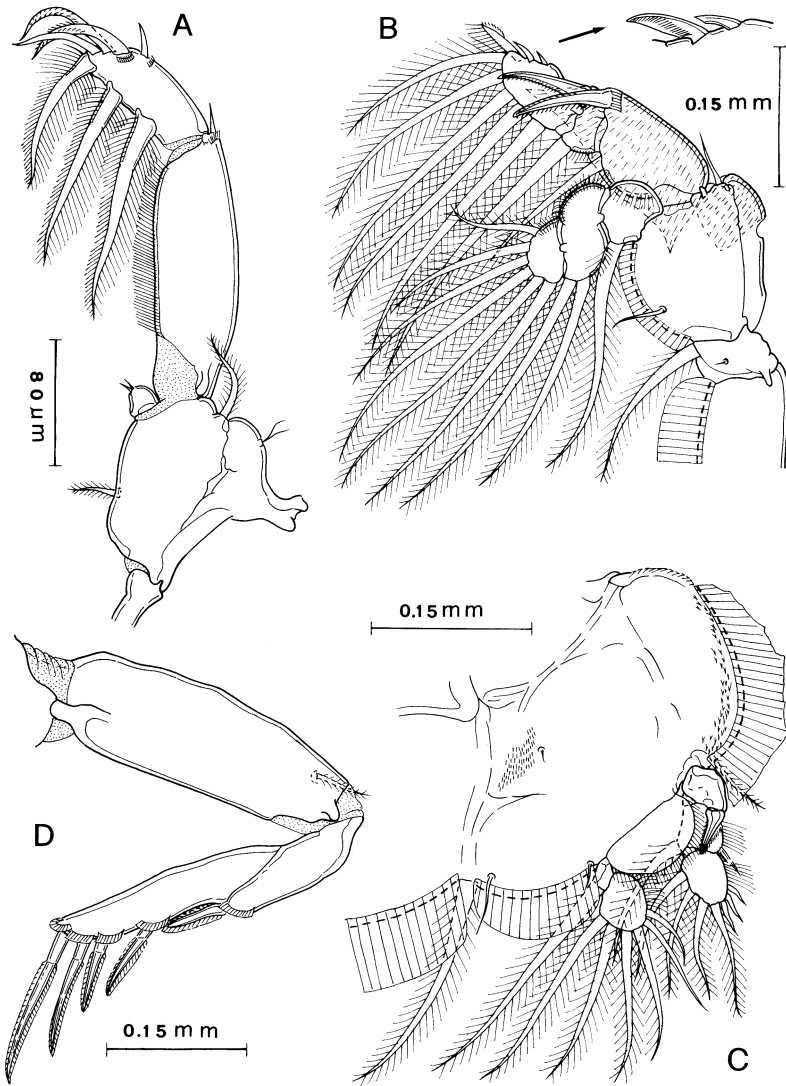


Figure 6. *Caligus dactylus* n. sp., adult female. (A) Leg 1; (B) leg 2; (C) leg 3; (D) leg 4.

unarmed; distal segment a claw strongly bent at tip and carrying two setae in basal region. Postantennal process (Figure 5C) small spine with two papillae in basal region bearing two setules, another similar setule-bearing papilla nearby on cephalon. Mandible (Figure 5D) as in *C. arii*. Maxillule (Figure 5C) comprising short, bluntly pointed digitiform process and papilla bearing three unequal setae. Maxilla (Figure 5E) generally constructed as in *C. arii*, except brachium (distal segment) being shorter than lacertus (proximal segment).

Maxilliped (Figure 5F) three-segmented; proximal segment (corpus) robust, produced on basal, medial surface (myxal area) into large pointed tooth-like process with distal trough; middle segment (shaft) as long as terminal claw, bearing medial seta at its tip; in

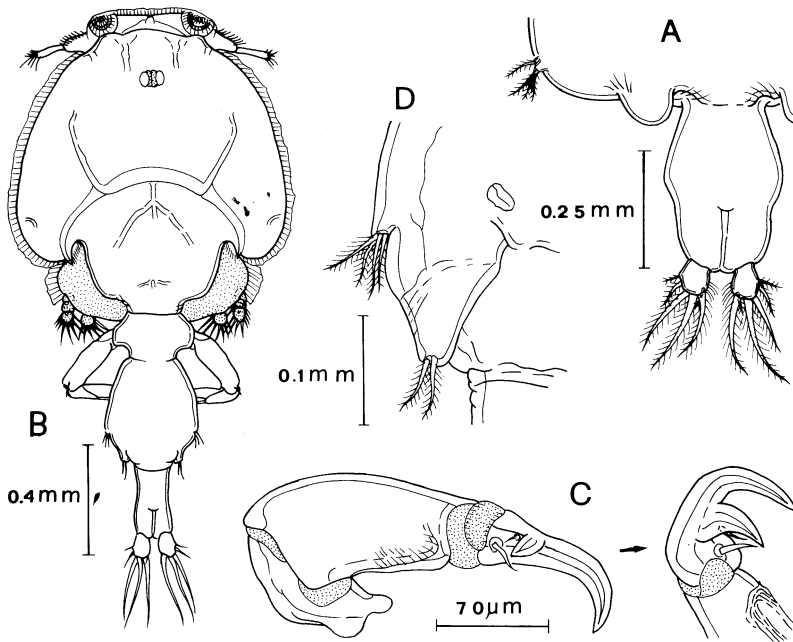


Figure 7. *Caligus dactylus* n. sp., adult female. (A) Posterior part of body showing part of posterolateral region of genital complex, abdomen, and caudal rami, ventral. Adult male: (B) habitus, dorsal; (C) antenna; (D) posterolateral region of genital complex, ventral.

closing, claw tip inserted into trough on tip of myxal process. Box of sternal furca (Figure 5G) subsquare, carrying two parallel tines with truncate tip.

Armature on rami of legs 1–4 as follows (Roman numerals indicating spines and Arabic numerals, setae):

	Exopod	Endopod
Leg 1	1-0; I,II,I,3	(Vestigial)
Leg 2	I-1; I-1; II,I,5	0-1; 0-2; 6
Leg 3	I-0; I-1; III,4	0-1; 6
Leg 4	I-0; I,III	(Absent)

Leg 1 (Figure 6A) protopod with plumose, outer seta and another small, plumose, inner seta in addition to a papilla bearing two setules; vestigial endopod small, tipped with two setules; first segment of exopod with row of setules on posterior edge and pecten near base of outer spiniform seta; middle two of terminal four elements with twisting rows of setules but no accessory process; pecten near base of two outer, terminal elements. Leg 2 (Figure 6B) coxa small, with large plumose inner seta on posterior edge and small setule-bearing papilla on ventral surface; basis with simple, outer seta and medial papilla bearing long setule; both outer and medial edges of protopod fringed with large marginal membrane; similar membrane on outer margin of elongated, proximal segment of exopod; outer spines on basal two segments of exopod long. Leg 3 (Figure 6C) protopod (apron) with short, outer and long, inner seta; large marginal membrane on outer edge following

serrated margin and another marginal membrane on posterior edge of basis inner to velum; setule-bearing papilla on basis near both ends of this posterior membrane; and rows of denticles on lateral edge, another patch of spinules and setule-bearing papilla on ventral surface of protopod. Leg 4 (Figure 6D) protopod with small, plumose, outer seta; pectens on two exopodal segments at insertion of each of five outer spines. Leg 5 (Figure 7A) represented by two papillae on posterolateral margin of genital complex, with one bearing one small, plumose setae and another bearing three similar setae.

Male

Body (Figure 7B) 1.92 (1.78–2.00) long, excluding setae on caudal rami. Cephalothoracic shield suborbicular, 1.04 (1.00–1.08) × 0.95 (0.90–0.98), excluding lateral marginal membranes. Fourth pediger distinctly wider than long, 0.16 (0.14–0.18) × 0.30 (0.30–0.32). Genital complex much smaller than cephalothoracic shield, 0.40 (0.38–0.42) × 0.34 (0.32–0.35). Abdomen slender and one-segmented, 0.25 (0.22–0.27) × 0.13 (0.13–0.14). Caudal ramus longer than wide, 89 (81–97) × 66 (65–69) μm.

Antenna (Figure 7C) three-segmented; proximal segment smallest and unarmed; middle segment largest, without armature except light corrugation on medial surface; terminal segment a sharp claw armed with two basal inner setae and a large, basal tooth. Leg 5 (Figure 7D) constructed as in female but located differently from female, close to midway along lateral margin of genital complex. Leg 6 (Figure 7D) represented by a lobe tipped with two plumose setae located on posterolateral corner of genital complex.

Etymology

The specific name *dactylus* is Greek (= a finger or toe), and refers to the thumb-like myxal process on the corpus of the maxilliped.

Remarks

This new species is characteristic in having the following features in the female: (1) the length of abdomen is less than one-half that of genital complex; (2) the genital complex is wider than long; (3) the corpus of the maxilliped is equipped with a large myxal process; (4) tines on the sternal furca are parallel and truncate at tip; (5) the middle two of the terminal four elements on the exopod of leg 1 have no accessory process; and (6) the armature formula of leg 4 is I-0; I,III. Checking the known species of *Caligus* revealed that the above combination of six characters is shared with only one species, namely *Caligus priacanthi* Pillai, 1961.

Caligus priacanthi is so far known only from India. Pillai (1961) reported the female only in his original description of the species, but description of the male was later provided by Prabha and Pillai (1986). Comparison with those two works showed that *C. dactylus* can not be identified with *C. priacanthi*. The differences seen in the female are the structures of the proximal segment on the antenna, calamus on the maxilla, tines on the sternal furca, outer spines on the proximal and middle segments of the exopod of leg 2; and in the male, the abdomen and the myxal process on the maxilliped. Besides, the hosts are different. The Indian *C. priacanthi* is a parasite of the moontail bullseye, *Priacanthus hamrur* (Forsskål).

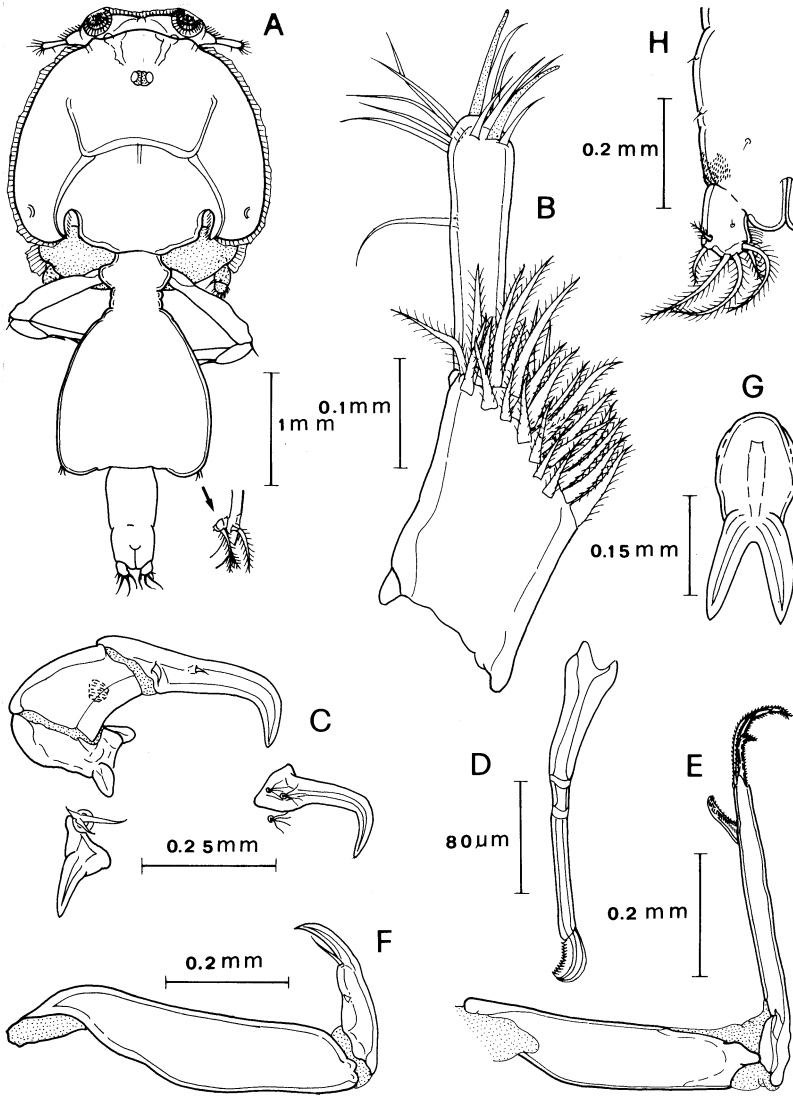


Figure 8. *Caligus lutjani* n. sp., adult female. (A) Habitus, dorsal; (B) antennule; (C) antenna, postantennal process, and maxillule; (D) mandible; (E) maxilla; (F) maxilliped; (G) sternal furca; (H) right half of anal somite, ventral.

***Caligus lutjani* n. sp.**
(Figures 8–10)

Material examined

Two ♀♀ on gills of two-spot red snapper, *Lutjanus bohar* (Forsskål), collected on 21 July 2004 at Mi-tuo Fishing Harbor in Kaohsiung County, and 3 ♀♀ and 2 ♂♂ in gill cavity of mangrove red snapper, *Lutjanus argentimaculatus* (Forsskål), collected on 10 November 2004 off Ken-Ding in PingDong County. Holotype female (USNM 1086713), allotype

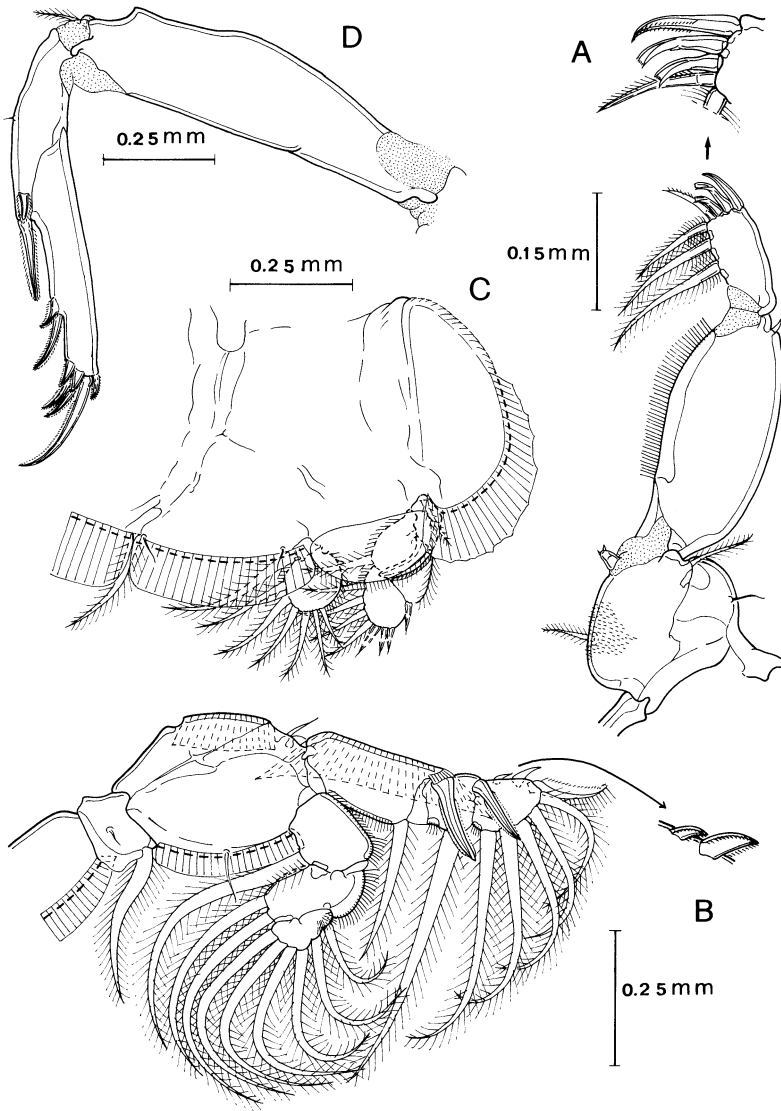


Figure 9. *Caligus lutjani* n. sp., adult female. (A) Leg 1; (B) leg 2; (C) leg 3; (D) leg 4.

male (USNM 1086714), and two female paratypes (USNM 1086715) have been deposited in the US National Museum of Natural History, Smithsonian Institution, Washington, DC and the remaining paratypes and other specimens kept in the author's (CLL) collection.

Female

Body (Figure 8A) 5.15 (4.68–5.62) long, excluding setae on caudal ramus. Cephalothoracic shield subcircular, 2.12 (2.00–2.24) × 2.20 (2.04–2.36), excluding lateral hyaline membrane. Fourth pediger distinctly wider than long, 0.32 (0.28–0.36) × 0.61 (0.56–0.66). Genital complex bottle-shaped, 1.65 (1.50–1.80) × 1.33 (1.32–1.34), with slightly protruded posterolateral

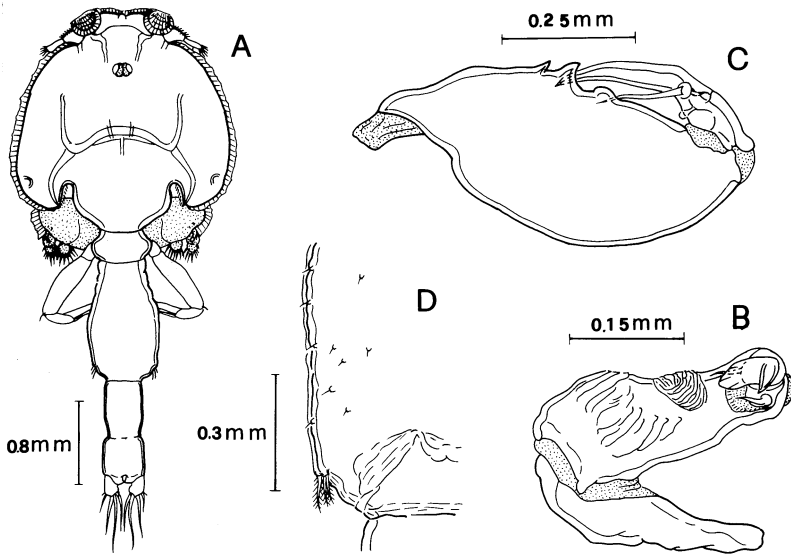


Figure 10. *Caligus lutjani* n. sp., adult male. (A) Habitus dorsal; (B) antenna; (C) maxilliped; (D) right half of genital complex, ventral.

corners. Abdomen appearing two-segmented, proximal segment $0.57 (0.50-0.64) \times 0.46 (0.42-0.50)$ and anal segment $0.46 (0.36-0.56) \times 0.44 (0.40-0.48)$; anal segment ornamented on ventral surface with setule-bearing papillae and patch of denticles as shown in Figure 8H. Caudal ramus (Figure 8H) longer than wide, $162 (146-178) \times 1.06 (97-113) \mu\text{m}$. Egg sac not seen.

Antennule (Figure 8B) two-segmented; both proximal and distal segments armed as in *C. arii*; distal segment long, about 3.73 times as long as wide. Antenna (Figure 8C) three-segmented; proximal segment smallest, armed with bluntly pointed process on posteromedial corner; middle segment subrectangular and bearing small adhesion pad on ventral surface; distal segment a claw strongly bent at tip and carrying two setae in basal region. Postantennal process (Figure 8C) a small, bent claw bearing two papillae in basal region, each tipped with four setules, another similar setule-bearing papilla nearby on cephalon. Mandible (Figure 8D) as in *C. arii*. Maxillule (Figure 8C) comprising short, bluntly pointed digitiform process and papilla bearing three unequal setae. Maxilla (Figure 8E) generally constructed as in *C. arii*, except subterminal hyaline membrane on brachium (distal segment) becoming a spiniform process. Maxilliped (Figure 8F) three-segmented and constructed as in *C. arii*, except having a simple (instead of pinnate), distal seta on shaft. Box of sternal furca (Figure 8G) oblong, carrying two diverging tines with sharp tips.

Armature of rami on legs 1–4 as in *C. dactylus*. Leg 1 (Figure 9A) protopod with plumose, outer seta and another plumose, inner seta in addition to a setule-bearing papilla on outer margin and a patch of spinules on ventral surface; vestigial endopod small, tipped with two setules; first segment of exopod with row of setules on posterior edge; middle two of terminal four elements with accessory process connected to spine proper by hyaline membrane. Leg 2 (Figure 9B) constructed essentially as that in *C. dactylus*. Leg 3 (Figure 9C) protopod (apron) with short, outer and long, inner, plumose seta; large marginal membrane on outer edge following serrated margin and another marginal membrane on posterior edge of basis inner to velum; setule-bearing papilla on basis near both ends of this posterior membrane. Leg 4 (Figure 9D) protopod produced

subterminally on outer margin before insertion of plumose, outer seta; exopod two-segmented; proximal segment with setule-bearing papilla on outer margin; short, bipectinate, spiniform process on both exopodal segments at insertion of each five outer spines. Leg 5 (inserted drawing in Figure 8A) represented by two papillae on posterolateral margin of genital complex, with one bearing one small, plumose setae and another with two similar setae.

Male

Body (Figure 10A) 4.86 (4.74–4.98) long, excluding setae on caudal rami. Cephalothoracic shield subcircular, 2.21 (2.12–2.30) × 2.17 (2.08–2.26), excluding lateral marginal membranes. Fourth pediger distinctly wider than long, 0.28 (0.28–0.28) × 0.58 (0.56–0.60). Genital complex long, 1.22 (1.20–1.24) × 0.68 (0.66–0.70), bearing setule-bearing papillae on ventral surface and lateral margin (Figure 10D). Abdomen two-segmented, proximal segment longer than wide, 0.56 (0.56–0.56) × 0.37 (0.36–0.38), but anal segment subsquare, 0.45 (0.42–0.48) × 0.42 (0.40–0.44). Caudal ramus longer than wide, 215 (211–219) × 146 (138–154) μm.

Antenna (Figure 10B) three-segmented; proximal segment unarmed; middle segment largest, with two unequal corrugated pads on medial surface; terminal segment produced into a small plate with short, sharp claw and two basal setae. Corpus of maxilliped (Figure 10C) robust, with three (two sharp and one blunt) processes in myxal area; in closing, tip of claw inserting into trough in largest, middle process. Leg 5 (Figure 10D) constructed as in female. Leg 6 not seen.

Etymology

The new species is named after its host—the fishes of the genus *Lujanus*.

Remarks

Caligus lutjani is characterized by a combination of the following four features: (1) the two-segmented abdomen is about one-half the length of the genital complex; (2) sternal furca has a pair of diverged, sharply pointed tines; (3) middle two of the terminal four elements on the exopod of leg 1 are armed with accessory process; and (4) leg 4 has a formula of I-0; I,III. This combination of morphological features is shared with only one of more than 250 congeners—*Caligus novocaledonicus* Kabata, 1968. However, close comparison with the latter showed that the specimens from Taiwan belong to a different species. The differences found in *C. lutjani* are: (1) the lack of a conical projection at the base of the postantennal process; (2) presence of a bipectinate, spiniform process on the exopod of leg 4 near the insertion of each of the five outer spines (see Figure 9D); and (3) a long (versus broad) caudal ramus. The host of *C. novocaledonicus* is *Lethrinus miniatus* Forster, caught in New Caledonia. The parasite has not been reported again since the publication of its original description by Kabata (1968).

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